

**‘Specialization in ICTs and Special Education: Psychopedagogy
of Integration’ Postgraduate Program**
**DEMOCRITUS UNIVERSITY OF THRACE Department of Greek
Philology in collaboration with**
**NCSR DEMOKRITOS Informatics and Telecommunications
Institute**

EMOTIONAL INTELLIGENCE IN AUTISM SPECTRUM DISORDER

GRATSANI EKATERINI

**POSTGRADUATE
THESIS**

Athens
2022

ABSTRACT

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by deficits in communication and social interaction and limited, repetitive patterns in behaviors, interests, and activities. Symptoms appear early in development and affect the daily functioning of people with autism. The term "spectrum" is used because of the heterogeneity in the presentation and severity of autism symptoms, as well as in the skills and level of functioning of individuals with this disorder. Emotional intelligence or heart intelligence refers to a variety of skills, such as being able to find motivation for yourself and withstand frustrations, to control and regulate your mood properly and to have empathy and hope. Unlike Emotional Intelligence (IQ), which has been studied by hundreds of thousands of people for many years, Emotional Intelligence (EI) is a new concept. No one can yet say exactly to what extent he is responsible for the differences in people in their lives. From the data it seems that it can be just as and sometimes more powerful than IQ. Although there are those who claim that IQ cannot be significantly altered by experience or education, it turns out that key emotional skills can be altered and improved in children with autism if we take the trouble to teach them. The present study is a literature review that focuses on emotional intelligence in autism spectrum disorder, focusing on the use of Information and Communication Technologies (ICT) and Robotics. The results showed that the application of appropriate methods can effectively improve the onset of basic symptoms of autism, such as social interaction, eye contact, behavioral problems, social skills, improved self-esteem and better understanding of emotions in persons applied. Therefore, we conclude that emotional intelligence can develop in Diffuse Developmental Disorders (autism).

KEY WORDS: Diffuse Developmental Disorders, Autism, Emotional Intelligence, DSM-5, Social Deficits, Neurodevelopmental Disorders

References

- Alves, S., Marques, A., Queirós, C., & Orvalho, V. (2013). LIFEisGAME prototype: A serious game about emotions for children with autism spectrum disorders. *PsychNology Journal*, 11(3).
- American Psychiatric Association. (2000). Diagnostic and statistical manual of mental disorders (4th, text revision ed.). Washington, DC: American Psychiatric Association.
- American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th, text revision ed.). Washington, DC: American Psychiatric Association.
- Bakola, L., & Drigas, A. (2020). Technological Development Process of Emotional Intelligence as a Therapeutic Recovery Implement in Children with ADHD and ASD Comorbidity. <https://doi.org/10.3991/ijoe.v16i03.12877>
- Baron, R. (1997). The BarOn emotional quotient inventory (BarOn EQ-i). *Toronto, ON: Multi-Health Systems Inc.*
- Bar-On, R. (2000). Emotional and Social Intelligence: Insights from the Emotional Quotient Inventory. In R. Bar-On, and J.D.A. Parker, (Eds.), *The Handbook of Emotional Intelligence* 17, pp. 363-388. Jossey-Bass, San Francisco.
- Bar-On, R. (2004). The Bar-On Emotional Quotient Inventory (EQ-i): Rationale, description and summary of psychometric properties. In G. Geher (Ed.), *Measuring emotional intelligence: Common ground and controversy* (p. 115–145). Nova Science Publishers.
- Bar-On, R. (2006). The Bar-On model of emotional-social intelligence (ESI) 1. *Psicothema*,

13-25. <https://reunido.uniovi.es/index.php/PST/article/view/8415>

Bar-On, R., & Handley, R. (2003). The Bar-On EQ-360. *Toronto, Canada: Multi-Health Systems.*

Bar-On, R., & Handley, R. (2003). The Bar-On EQ-Interview. *Toronto, Canada: Multi-Health Systems.*

Bartneck, C., & Forlizzi, J. (2004, September). A design-centred framework for social human-robot interaction. In *RO-MAN 2004. 13th IEEE international workshop on robot and human interactive communication (IEEE Catalog No. 04TH8759)* (pp. 591-594). IEEE. <https://doi.org/10.1109/roman.2004.1374827>

Billard, A., Robins, B., Nadel, J., & Dautenhahn, K. (2007). Building Robota, a mini-humanoid robot for the rehabilitation of children with autism. *Assistive Technology, 19*(1), 37-49. <https://doi.org/10.1080/10400435.2007.10131864>

Black, M. H., Chen, N. T., Iyer, K. K., Lipp, O. V., Bölte, S., Falkmer, M., ... & Girdler, S. (2017). Mechanisms of facial emotion recognition in autism spectrum disorders: Insights from eye tracking and electroencephalography. *Neuroscience & Biobehavioral Reviews, 80*, 488-515. <https://doi.org/10.1016/j.neubiorev.2017.06.016>

Boily, R., Kingston, S. E., & Montgomery, J. M. (2017). Trait and ability emotional intelligence in adolescents with and without autism spectrum disorder. *Canadian Journal of School Psychology, 32*(3-4), 282-298. <https://doi.org/10.1177/0829573517717160>

Boyatzis, R.E., Goleman, D., & Rhee, K. (1999). Clustering competence in emotional intelligence: Insights from the Emotional Competence Inventory (ECI). In R. Bar-

On, & J. D. A. Parker (Eds.), *Handbook of Emotional Intelligence* (pp. 343-362).
Jossey-Bass.

Brady, D. I., Saklofske, D. H., Schwean, V. L., Montgomery, J. M., McCrimmon, A. W., & Thorne, K. J. (2014). Cognitive and emotional intelligence in young adults with Autism Spectrum Disorder without an accompanying intellectual or language disorder. *Research in Autism Spectrum Disorders, 8*(9), 1016-1023. <https://doi.org/10.1016/j.rasd.2014.05.009>

Canitano, R. (2007). Epilepsy in autism spectrum disorders. *European child & adolescent psychiatry, 16*(1), 61-66. <https://doi.org/10.1007/s00787-006-0563-2>

Carvalho, V. H., Brandão, J., Cunha, P., Vasconcelos, J., & Soares, F. (2015). Tobias in the Zoo--A Serious Game for Children with Autism Spectrum Disorders. *International Journal of Advanced Corporate Learning, 8*(3). <https://doi.org/10.3390/s18082486>

Chaidi, I. & Drigas, A. (2020). Autism, Expression, and Understanding of Emotions: Literature Review. *International Association of Online Engineering* <https://doi.org/10.3991/ijoe.v16i02.11991>

Charitaki, G. (2015). The effect of ict on emotional education and development of young children with autism spectrum disorder. *Procedia Computer Science, 65*, 285-293. <https://doi.org/10.1016/j.procs.2015.09.081>

Chen, C. H., Lee, I. J., & Lin, L. Y. (2015). Augmented reality-based self-facial modeling to promote the emotional expression and social skills of adolescents with autism spectrum disorders. *Research in developmental disabilities, 36*, 396-403. <https://doi.org/10.1016/j.ridd.2014.10.015>

- Cheng, Y., Chiang, H. C., Ye, J., & Cheng, L. H. (2010). Enhancing empathy instruction using a collaborative virtual learning environment for children with autistic spectrum conditions. *Computers & Education*, 55(4), 1449-1458. <https://doi.org/10.1016/j.compedu.2010.06.008>
- Cho, S. J., & Ahn, D. H. (2016). Socially assistive robotics in autism spectrum disorder. *Hanyang Medical Reviews*, 36(1), 17-26. <http://dx.doi.org/10.7599/hmr.2016.36.1.17>
- Darling, K. (2016). "Extending legal protection to social robots: The effects of anthropomorphism, empathy, and violent behavior towards robotic objects". In *Robot Law*. Cheltenham, UK: Edward Elgar Publishing. doi: <https://doi.org/10.4337/9781783476732.00017>
- Dautenhahn, K., & Werry, I. (2004). Towards interactive robots in autism therapy: Background, motivation and challenges. *Pragmatics & Cognition*, 12(1), 1-35. <https://doi.org/10.1075/pc.12.1.03dau>
- Didehbani, N., Allen, T., Kandalaf, M., Krawczyk, D. and Chapman, S. (2016) Virtual Reality Social Cognition Training for Children with High Functioning Autism. *Computers in Human Behavior*, 62, 703-711. <https://doi.org/10.1016/j.chb.2016.04.033>
- Drigas, A. S., & Ioannidou, R. E. (2013). Special Education and ICTs. *International Journal of Emerging Technologies in Learning*, 8(2). <http://dx.doi.org/10.3991/ijet.v8i2.2514>
- Drigas, A. S., & Karyotaki, M. (2019). " A Layered Model of Human Consciousness". *Int. J. Recent Contributions Eng. Sci. IT*, 7(3), 41-50. <https://doi.org/10.3991/ijes.v8i1.12503>

- Drigas, A. S., & Papoutsi, C. (2018). A new layered model on emotional intelligence. *Behavioral Sciences*, 8(5), 45. <https://doi.org/10.3390/bs8050045>
- Drigas, A. S., & Pappas, M. A. (2017). The consciousness-intelligence-knowledge pyramid: an 8x8 layer model. *International Journal of Recent Contributions from Engineering, Science & IT (IJES)*, 5(3), 14-25. <https://doi.org/10.3991/ijes.v5i3.7680>
- Drigas, A., & Mitsea, E. (2020). The Triangle of Spiritual Intelligence, Metacognition and Consciousness. *Int. J. Recent Contributions Eng. Sci. IT*, 8(1), 4-23. <https://doi.org/10.3991/ijes.v8i1.12503>
- Drigas, A., & Mitsea, E. A Metacognition Based 8 Pillars Mindfulness Model and Training Strategies. <https://doi.org/10.3991/ijes.v8i4.17419>
- Drigas, A., & Mitsea, E. (2020). The 8 Pillars of Metacognition. *International Journal of Emerging Technologies in Learning (IJET)*, 15(21), 162-178. <https://doi.org/10.3991/ijet.v15i21.14907>
- Duncan, J., Seitz, R. J., Kolodny, J., Bor, D., Herzog, H., Ahmed, A., ... & Emslie, H. (2000). A neural basis for general intelligence. *Science*, 289(5478), 457-460. <https://science.sciencemag.org/content/289/5478/457.abstract>
- Farb, N. A., Chapman, H. A., & Anderson, A. K. (2013). Emotions: form follows function. *Current opinion in neurobiology*, 23(3), 393–398. <https://doi.org/10.1016/j.conb.2013.01.015>
- Flanagan, D. P., & Dixon, S. G. (2013). The Cattell-Horn-Carroll theory of cognitive abilities. *Encyclopedia of special education: A reference for the education of*

children, adolescents, and adults with disabilities and other exceptional individuals. <https://doi.org/10.1002/9781118660584.e5e0431>

Gardner H., (1983) *Frames of mind the theory of multiple intelligences*. New York: Basic Books

Gardner, H., & Hatch, T. (1989). Educational implications of the theory of multiple intelligences. *Educational researcher*, 18(8), 4-10. <http://www.jstor.org/stable/1176460>

Gay, V., Leijdekkers, P., Agcanas, J., Wong, F., & Wu, Q. (2013, June). CaptureMyEmotion: Helping Autistic Children Understand their Emotions Using Facial Expression Recognition and Mobile Technologies. In *Bled eConference* (p. 10).

Gökçen, E., Petrides, K. V., Hudry, K., Frederickson, N., & Smillie, L. D. (2014). Sub-threshold autism traits: The role of trait emotional intelligence and cognitive flexibility. *British Journal of Psychology*, 105(2), 187-199. <https://doi.org/10.1111/bjop.12033>

Goleman, D. (1995). *Emotional Intelligence: Why it can matter more than IQ* Bantam Books. New York, NY.

Goleman, D. (1998). *Working with emotional intelligence*. NY: Bantam.

Goleman, D. *Emotional intelligence: Issues in paradigm building In The Emotionally Intelligent Workplace: How to Select for, Measure, and Improve Emotional Intelligence in Individuals, Groups, and Organizations*. Jossey-Bass: San Francisco, CA, USA, 2001. Volume 13, p. 26.

Goodrich, M. A., & Schultz, A. C. (2008). *Human-robot interaction: a survey*. Now Publishers Inc.

- Groen, W., Teluij, M., Buitelaar, J., & Tendolkar, I. (2010). Amygdala and hippocampus enlargement during adolescence in autism. *Journal of the American Academy of Child & Adolescent Psychiatry*, 49(6), 552-560. <https://pubmed.ncbi.nlm.nih.gov/20494265/>
- Guilford, J. P. (1966). Intelligence: 1965 model. *American psychologist*, 21(1), 20. <https://doi.org/10.1037/h0023296>
- Harms, M. B., Martin, A., & Wallace, G. L. (2010). Facial emotion recognition in autism spectrum disorders: a review of behavioral and neuroimaging studies. *Neuropsychology review*, 20(3), 290-322. <https://doi.org/10.1007/s11065-010-9138-6>
- Hassan, A., Shafi, M., & Khattak, M. I. (2016). Multi-touch collaborative gesture recognition based user interfaces as behavioral interventions for children with Autistic spectrum disorder: A review. *Mehran University Research Journal of Engineering and Technology*, 35(4), 543-560. <https://doi.org/10.22581/muet1982.1604.06>
- Hazlett, H. C., Gu, H., Munsell, B. C., Kim, S. H., Styner, M., Wolff, J. J., ... & Piven, J. (2017). Early brain development in infants at high risk for autism spectrum disorder. *Nature*, 542(7641), 348-351. <https://www.nature.com/articles/nature21369>
- Horn, J. L. (2006). Understanding human intelligence: Where have we come since Spearman. *Factor analysis at*, 100, 230-255. <http://www.iapsych.com/articles/Horn2006b.pdf>
- Hranilovic, D., Bujas-Petkovic, Z., Vragovic, R., Vuk, T., Hock, K., & Jernej, B. (2007). Hyperserotonemia in adults with autistic disorder. *Journal of autism and*

developmental disorders, 37(10), 1934-1940.
<https://link.springer.com/article/10.1007/s10803-006-0324-6>

Ip, H.H., Wong, S.W., Chan, D.F., Byrne, J., Li, C., Yuan, V.S., Lau K.S.Y. and Wong, J.Y.W. (2018) Enhance Emotional and Social Adaptation Skills for Children with Autism Spectrum Disorder: A Virtual Reality Enabled Approach. *Computers & Education*, 117, 1-15. <https://doi.org/10.1016/j.compedu.2017.09.010>

Izard, C. E. (1993). Four systems for emotion activation: Cognitive and noncognitive processes. *Psychological review*, 100(1), 68. <https://doi.org/10.1037/0033-295X.100.1.68>

Jones, C. R., Pickles, A., Falcaro, M., Marsden, A. J., Happé, F., Scott, S. K., ... & Charman, T. (2011). A multimodal approach to emotion recognition ability in autism spectrum disorders. *Journal of Child Psychology and Psychiatry*, 52(3), 275-285. <https://doi.org/10.1111/j.1469-7610.2010.02328.x>

Jordan, C. J. (2010). Evolution of autism support and understanding via the World Wide Web. *Intellectual and developmental disabilities*, 48(3), 220-227. <https://doi.org/10.1352/1934-9556-48.3.220>

Joseph, R. (2013). *The naked neuron: Evolution and the languages of the body and brain*. Springer.

Kvist, A. V., & Gustafsson, J. E. (2008). The relation between fluid intelligence and the general factor as a function of cultural background: A test of Cattell's Investment theory. *Intelligence*, 36(5), 422-436. <https://doi.org/10.1016/j.intell.2007.08.004>

Ledoux, J. (1991). Emotion and the limbic system concept. *Concepts in neuroscience*, 2, 169-199.

LeDoux, J. E. (1992). Emotion and the amygdala.

LeDoux, J. E. (1993). Emotional memory systems in the brain. *Behavioural brain research*, 58(1-2), 69-79. [https://doi.org/10.1016/0166-4328\(93\)90091-4](https://doi.org/10.1016/0166-4328(93)90091-4)

LeDoux, J. E. (2000). Emotion circuits in the brain. *Annual review of neuroscience*, 23(1), 155-184. <https://doi.org/10.1146/annurev.neuro.23.1.155>

Leite, I., Castellano, G., Pereira, A., Martinho, C., & Paiva, A. (2012, March). Modelling empathic behaviour in a robotic game companion for children: an ethnographic study in real-world settings. In *Proceedings of the seventh annual ACM/IEEE international conference on Human-Robot Interaction* (pp. 367-374). <https://doi.org/10.1145/2157689.2157811>

Lorenzo, G., Lledó, A., Pomares, J. and Roig, R. (2016) Design and Application of an Immersive Virtual Reality System to Enhance Emotional Skills for Children with Autism Spectrum Disorders. *Computers & Education*, 98, 192-205. <https://doi.org/10.1016/j.compedu.2016.03.018>

MacCann, C., Jiang, Y., Brown, L. E., Double, K. S., Bucich, M., & Minbashian, A. (2020). Emotional intelligence predicts academic performance: A meta-analysis. *Psychological Bulletin*, 146(2), 150. <https://doi.org/10.1037/bul0000219>

Madsen, M., El Kaliouby, R., Goodwin, M., & Picard, R. (2008, October). Technology for just-in-time in-situ learning of facial affect for persons diagnosed with an autism spectrum disorder. In *Proceedings of the 10th international ACM SIGACCESS conference on Computers and accessibility* (pp. 19-26). <https://doi.org/10.1145/1414471.1414477>

Matsumoto, D., Keltner, D., Shiota, M.N., O'Sullivan, M., & Frank, M. (2008). Facial

expressions of emotion. In M. Lewis, J. M. Haviland-Jones, & L.F. Barrett (Eds.), *Handbook of Emotions* (pp. 211–234). Guilford.

Mayer, J. D. (2001). Emotion, intelligence, and emotional intelligence. In J. P. Forgas (Ed.), *Handbook of affect and social cognition* (p. 410–431). Lawrence Erlbaum Associates Publishers.

Mayer, J. D., & Salovey, P. (1993). The intelligence of emotional intelligence.

Mayer, J. D., Caruso, D. R., & Salovey, P. (1999). Emotional intelligence meets traditional standards for an intelligence. *Intelligence*, 27(4), 267-298. [https://doi.org/10.1016/S0160-2896\(99\)00016-1](https://doi.org/10.1016/S0160-2896(99)00016-1)

Mayer, J. D., Roberts, R. D., & Barsade, S. G. (2008). Human abilities: emotional intelligence. *Annual review of psychology*, 59, 507–536. <https://pubmed.ncbi.nlm.nih.gov/17937602/>

Mayer, J. D., Salovey, P., & Caruso, D. R. (2004). " Emotional intelligence: Theory, findings, and implications". *Psychological inquiry*, 15(3), 197-215. https://doi.org/10.1207/s15327965pli1503_02

Mayer, J. D., Salovey, P., & Caruso, D. R. (2008). Emotional intelligence: New ability or eclectic traits? *American Psychologist*, 63(6), 503–517. <https://doi.org/10.1037/0003-066X.63.6.503>

Mayer, J. D., Salovey, P., Caruso, D. R., & Sitarenios, G. (2001). Emotional intelligence as a standard intelligence. *Emotion (Washington, D.C.)*, 1(3), 232–242. <https://pubmed.ncbi.nlm.nih.gov/12934682/>

Mayer, J. D., Salovey, P., Caruso, D. R., & Sitarenios, G. (2003). Measuring emotional

intelligence with the MSCEIT V2.0. *Emotion (Washington, D.C.)*, 3(1), 97–105.
<https://pubmed.ncbi.nlm.nih.gov/12899321/>

Mayer, J., Salovey, P., & Caruso, R. (2002). *The Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT): User's manual*. Toronto: Multi-Health Systems.

Mazzei, D., Billeci, L., Armato, A., Lazzeri, N., Cisternino, A., Pioggia, G., ... & De Rossi, D. (2010, September). The face of autism. In *19th International Symposium in Robot and Human Interactive Communication* (pp. 791-796). IEEE.
<https://doi.org/10.1109/ROMAN.2010.5598683>

McCrimmon, A. W., Matchullis, R. L., & Altomare, A. A. (2016). Resilience and emotional intelligence in children with high-functioning autism spectrum disorder. *Developmental Neurorehabilitation*, 19(3), 154-161.
<https://doi.org/10.3109/17518423.2014.927017>

McGrew, K. S. (2009). CHC theory and the human cognitive abilities project: Standing on the shoulders of the giants of psychometric intelligence research.
<https://doi.org/10.1016/j.intell.2008.08.004>

Mead, R., Wade, E., Johnson, P., Clair, A. S., Chen, S., & Matarić, M. J. (2010, September). An architecture for rehabilitation task practice in socially assistive human-robot interaction. In *19th International Symposium in Robot and Human Interactive Communication* (pp. 404-409). IEEE.
<https://doi.org/10.1109/ROMAN.2010.5598666>

Morgan, H. (1996). An analysis of Gardner's theory of multiple intelligence. *Roeper Review*, 18(4), 263-269. <https://doi.org/10.1080/02783199609553756>

Muñoz, R., Barcelos, T., Noël, R., & Kreisel, S. (2012, November). Development of

software that supports the improvement of the empathy in children with autism spectrum disorder. In *2012 31st International Conference of the Chilean Computer Science Society* (pp. 223-228). IEEE.
<https://doi.org/10.1109/SCCC.2012.33>

Øhrstrøm, P. (2011). Helping autism-diagnosed teenagers navigate and develop socially using e-learning based on mobile persuasion. *The International Review of Research in Open and Distributed Learning*, 12(4), 54-71.
<https://doi.org/10.19173/irrodl.v12i4.878>

Papageorgiou, E. (2020). The Impact of Information and Communication Technologies on the Emotional Education of Children with Autism Spectrum Disorder. Views of Specialist Educators and Psychologists. *Open Access Library Journal*, 7(5), 1-24.
<https://doi.org/10.4236/oalib.1106248>

Papoutsis, C., Drigas, A., & Skianis, C. (2018). Mobile Applications to Improve Emotional Intelligence in Autism-A Review. *International Journal of Interactive Mobile Technologies*, 12(6). <https://doi.org/10.3991/ijim.v12i6.9073>

Petrides, K. V. (2009). Psychometric properties of the trait emotional intelligence questionnaire (TEIQue). In *Assessing emotional intelligence* (pp. 85-101). Springer, Boston, MA.

Petrides, K. V. (2009). Psychometric Properties of the Trait Emotional Intelligence Questionnaire (TEIQue). *The Springer Series on Human Exceptionality*, 85–101.
https://doi.org/10.1007/978-0-387-88370-0_5

Petrides, K. V. (2010). Trait emotional intelligence theory. *Industrial and Organizational Psychology*, 3(2), 136-139. <https://doi.org/10.1111/j.1754-9434.2010.01213.x>

- Petrides, K. V., & Furnham, A. (2001). Trait emotional intelligence: psychometric investigation with reference to established trait taxonomies. *European Journal of Personality*, 15(6), 425–448. <https://doi.org/10.1002/per.416>
- Petrides, K. V., Pita, R., & Kokkinaki, F. (2007). The location of trait emotional intelligence in personality factor space. *British journal of psychology (London, England: 1953)*, 98(Pt 2), 273–289. <https://pubmed.ncbi.nlm.nih.gov/17456273/>
- Phelps, E. A. (2004). Human emotion and memory: interactions of the amygdala and hippocampal complex. *Current opinion in neurobiology*, 14(2), 198-202. <https://doi.org/10.1016/j.conb.2004.03.015>
- Rázuri, J. G., Sundgren, D., Rahmani, R., Moran, A., Bonet, I., & Larsson, A. (2015). Speech emotion recognition in emotional feedback for human-robot interaction. *International Journal of Advanced Research in Artificial Intelligence (IJARAI)*, 4(2), 20-27. <https://doi.org/10.14569/IJARAI.2015.040204>
- Reynolds, J. L., Lincoln, A. J., Irvani, R., Toma, V., & Brown, S. (2018). The relationship between executive functioning and emotional intelligence in children with autism spectrum disorder. *Open Journal of Psychiatry*, 8(3), 253-262. <https://doi.org/10.4236/ojpsych.2018.83022>
- Richards, R. (2001). Millennium as opportunity: Chaos, creativity, and Guilford's Structure of Intellect Model. *Creativity Research Journal*, 13(3-4), 249-265. https://doi.org/10.1207/S15326934CRJ1334_03
- Richter-Levin, G. (2004). The amygdala, the hippocampus, and emotional modulation of memory. *The Neuroscientist*, 10(1), 31-39. <https://doi.org/10.1177/1073858403259955>

- Riek, L. D., Paul, P. C., & Robinson, P. (2010). When my robot smiles at me: Enabling human-robot rapport via real-time head gesture mimicry. *Journal on Multimodal User Interfaces*, 3(1), 99-108. <https://doi.org/10.1007/s12193-009-0028-2>
- Robins, B. & Dautenhahn, K. (2018). Kaspar, the social robot and ways it may help children with autism – an overview. *Enfance*, 1(1), 91-102. <https://doi.org/10.3917/enf2.181.0091>
- Robinson, E., Hull, L., & Petrides, K. V. (2020). Big Five model and trait emotional intelligence in camouflaging behaviours in autism. *Personality and Individual Differences*, 152, 109565. <https://doi.org/10.1016/j.paid.2019.109565>
- Royce, J. R. (1968). *The Nature of Human Intelligence*. JP Guilford. McGraw-Hill, New York, 1967. xiv+ 538 pp. 10.1126/science. <https://doi.org/162.3857.990-a>
- Saldien, J., Goris, K., Vanderborght, B., Vanderfaeillie, J., & Lefeber, D. (2010). Expressing emotions with the social robot probio. *International Journal of Social Robotics*, 2(4), 377-389.. <https://doi.org/10.1007/s12369-010-0067-6>
- Shen, M. D., & Piven, J. (2017). Brain and behavior development in autism from birth through infancy. *Dialogues in clinical neuroscience*, 19(4), 325. <https://pubmed.ncbi.nlm.nih.gov/29398928/>
- Sheridan, T. B. (2016). Human–robot interaction: status and challenges. *Human factors*, 58(4), 525-532. <https://doi.org/10.1177/0018720816644364>
- Spearman, C. (1904). "General Intelligence," Objectively Determined and Measured. *The American Journal of Psychology*, 15(2), 201-292. <https://doi.org/10.1037/11491-006>

Spearman, C. (1914). *The theory of two factors*. *Psychological Review*, 21(2), 101–115.
<https://doi.org/10.1037/h0070799>

Spearman, C. (1927). The measurement of intelligence. *Nature*, 120(3025), 577-578.
<https://www.nature.com/articles/120577a0>

Sternberg, R. J. (1985). *Beyond IQ: A triarchic theory of human intelligence*. CUP Archive.

Sternberg, R. J. (2000). The theory of successful intelligence. *Gifted education international*, 15(1), 4-21. <https://doi.org/10.1177/026142940001500103>

Sternberg, R. J. (2005). The theory of successful intelligence. *Revista Interamericana de Psicología/Interamerican Journal of Psychology*, 39(2), 189-202.
<https://www.redalyc.org/pdf/284/28439202.pdf>

Tan, C. T., Harrold, N., & Rosser, D. (2013, November). Can you CopyMe? an expression mimicking serious game. In *SIGGRAPH Asia 2013 symposium on mobile graphics and interactive applications* (pp. 1-4). <https://doi.org/10.1145/2543651.2543657>

Tanaka, J. W., Wolf, J. M., Klaiman, C., Koenig, K., Cockburn, J., Herlihy, L., ... & Schultz, R. T. (2012). The perception and identification of facial emotions in individuals with autism spectrum disorders using the Let's Face It! Emotion Skills Battery. *Journal of Child Psychology and Psychiatry*, 53(12), 1259-1267.
<https://doi.org/10.1111/j.1469-7610.2012.02571.x>

Thorndike, E. L. (1920). Intelligence and its uses. *Harper's magazine*.

Thurstone, L. L. (1931). Multiple factor analysis. *Psychological review*, 38(5), 406. <https://doi.org/10.1037/h0069792>

- Thurstone, L. L. (1934). The vectors of mind. *Psychological Review*, 41(1), 1–32.
<https://doi.org/10.1037/h0075959>
- Thurstone, L. L., & Thurstone, T. G. (1938). *Primary mental abilities* (Vol. 119). Chicago: University of Chicago Press.
- Torrado, J. C., Gomez, J., & Montoro, G. (2017). Emotional self-regulation of individuals with autism spectrum disorders: smartwatches for monitoring and interaction. *Sensors*, 17(6), 1359. <https://doi.org/10.3390/s17061359>
- Turkle, S., Breazeal, C., Dasté, O., & Scassellati, B. (2006). Encounters with kismet and cog: Children respond to relational artifacts. *Digital media: Transformations in human communication*, 120.
- Uljarevic, M., & Hamilton, A. (2013). Recognition of emotions in autism: a formal meta-analysis. *Journal of autism and developmental disorders*, 43(7), 1517-1526. <https://doi.org/10.1007/s10803-012-1695-5>
- Vanderborght, B., Simut, R., Saldien, J., Pop, C., Rusu, A. S., Pinteá, S., ... & David, D. O. (2012). Using the social robot probo as a social story telling agent for children with ASD. *Interaction Studies*, 13(3), 348-372.
<https://doi.org/10.1075/is.13.3.02van>
- Vannetzel, L., Chaby, L., Cautru, F., Cohen, D., & Plaza, M. (2011). Neutral versus emotional human stimuli processing in children with pervasive developmental disorders not otherwise specified. *Research in Autism Spectrum Disorders*, 5(2), 775-783. <https://doi.org/10.1016/j.rasd.2010.09.005>
- Vélez, P., & Ferreiro, A. (2014). Social robotic in therapies to improve children's attentional capacities. *Review of the Air Force Academy*, (2), 101.

<https://pdfs.semanticscholar.org/6538/4e96aa01fa48ce657438049285fbf0125311.pdf>

Walker, R. E., & Foley, J. M. (1973). Social intelligence: Its history and measurement. *Psychological Reports*, 33(3), 839-864.
<https://doi.org/10.2466/pr0.1973.33.3.839>

Walsh, C. A., Morrow, E. M., & Rubenstein, J. L. (2008). Autism and brain development. *Cell*, 135(3), 396-400. <https://pubmed.ncbi.nlm.nih.gov/18984148/>

Wassink, T. H., Hazlett, H. C., Epping, E. A., Arndt, S., Dager, S. R., Schellenberg, G. D., ... & Piven, J. (2007). Cerebral cortical gray matter overgrowth and functional variation of the serotonin transporter gene in autism. *Archives of general psychiatry*, 64(6), 709-717. <https://doi.org/10.1001/archpsyc.64.6.709>

Welch, K. C., Lahiri, U., Warren, Z., & Sarkar, N. (2010). An approach to the design of socially acceptable robots for children with autism spectrum disorders. *International journal of social robotics*, 2(4), 391-403.
<https://doi.org/10.1007/s12369-010-0063-x>

Whitaker-Azmitia, P. M. (2005). Behavioral and cellular consequences of increasing serotonergic activity during brain development: a role in autism? *International Journal of Developmental Neuroscience*, 23(1), 75-83
<https://doi.org/10.1016/j.ijdevneu.2004.07.022>

Xavier, J., Vignaud, V., Ruggiero, R., Bodeau, N., Cohen, D., & Chaby, L. (2015). A multidimensional approach to the study of emotion recognition in autism spectrum disorders. *Frontiers in psychology*, 6, 1954.
<https://doi.org/10.3389/fpsyg.2015.01954>

Xu, Q., Zuo, C., Liao, S., Long, Y., & Wang, Y. (2020). Abnormal development pattern of the amygdala and hippocampus from childhood to adulthood with autism. *Journal of Clinical Neuroscience*, 78, 327-332. <https://pubmed.ncbi.nlm.nih.gov/32593622/>

Yousif, J. H., Kazem, H. A., & Chaichan, M. T. (2019). Evaluation Implementation of Humanoid Robot for Autistic Children: A Review. *International Journal of Computation and Applied Sciences*, 6(1), 412-420. https://www.researchgate.net/publication/331162555_Evaluation_Implementation_Of_Humanoid_Robot_For_Autistic_Children_A_Review

Ziouzios, D., Ioannou, M., Ioanna, T., Bratitsis, T., & Dasygenis, M. (2020). Emotional Intelligence and Educational Robotics: The Development of the EI-EDUROBOT. *European Journal of Engineering Research and Science*. <https://doi.org/10.24018/ejers.2020.0.CIE.2307>

Zoerner, D., Schütze, J., Kirst, S., Dziobek, I., & Lucke, U. (2016, July). Zirkus Empathico: Mobile training of socio-emotional competences for children with Autism. In *2016 IEEE 16th International Conference on Advanced Learning Technologies (ICALT)* (pp. 448-452). IEEE. <https://doi.org/10.1109/ICALT.2016.146>

Ιστοσελίδες

<https://automateintellect.com/artificial-emotional-intelligence/>

<https://www.herts.ac.uk/kaspar>