

Agnieszka Rynkiewicz

Autism Society of Washington
USA

Department of Developmental, Psychotic and Geriatric Psychiatry, Child and Adolescent Unit
Medical University of Gdansk
Poland

The use of computer technology and the internet in teaching and therapy of individuals with Autism Spectrum Disorders (ASD)¹

Across the world there is a passionate love affair between children and computers.... and more than wanting it [computer technology], they seem to know that in a deep way it already belongs to them. They know they can master it more easily and naturally than their parents. They know they are the computer generation.

Seymour Papert

The Connected Family, 1996.

Diagnosis and sensory profile in ASD in the contest of computer-mediated-communication (CMC)

Many individuals with autism spectrum disorders (ASD) have limited verbal skills but are extremely proficient in skills related to technology and written communication (Ward and Meyer, 1999). They have a 'natural' affinity with computers (Prior et al., 1998). According to Goldsmith and LeBlanc (2004), parents and clinicians regularly report that children with autism are drawn to technological devices, and researchers have noted the importance of devising treatments that take advantage of this fascination. Evidence-based multimedia programs demonstrate significant improvements in social and academic skills of ASD individuals (Bernard-Opitz et al., 1999; Bosseler and Masaro, 2003; Gray, Creighton, McMahon, and Cunningham, 1991; Heimann et al., 1995; Kinney et al., 2003; Hetzroni and Tannous, 2004; Mangan, 2008). Also recent studies using the computer as a vehicle for communication (Brownlow and O'Dell, 2006; Rejendran and Mitchell, 2000; Scott, 2008) prove that people who are on the autism spectrum communicate more easily using computer-mediated communication (CMC) such as: instant messages (IMs), emails, chat rooms, text messaging, virtual worlds or blogging. Brownlow and O'Dell (2006) have demonstrated that in chat rooms ASD individuals are finding a voice in an online environment and the Internet is a powerful tool in enabling this voice to be heard (p. 315). As described by Ward and Meyer (1999), many able individuals with ASD find a group identity in the Electronic Age (p. 136).

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Currently, professionals think of autism as a 'spectrum' disorder, meaning a group of disorders with similar features. The spectrum ranges from a severely affected, mentally retarded individual who may need to be institutionalized, to a brilliant individual who is very well adjusted but exhibits barely visible autistic behaviours in social and communication areas. Publication of the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) in May 2013 will mark one of the most anticipated events in the field of mental health (APA, 2010). One of the reasons for this is that the American Psychiatric Association (APA) will recommend a new name for the category of autism spectrum disorder (ASD), which currently includes autistic disorder (commonly called as autism), Asperger's disorder, childhood disintegrative disorder, and pervasive developmental disorder not otherwise specified (PDD-NOS). According to APA's work group, this single category (ASD) will better reflect the state of knowledge about its pathology and clinical presentation, as the previous criteria were equivalent to trying to "cleave meatloaf at the joints" (APA, 2010). Many individuals with Asperger's syndrome are usually of average or above-average intelligence and are often able to mask or accommodate their differences. According to Mayor (2008), many of them make it well into middle age or live their whole lives without being formally diagnosed (p. 24). Diagnostic criteria in regards to high-functioning individuals on the autism spectrum, for example people with Asperger's syndrome, are controversial and professionals are still in disagreement. According to Harvey and Latica (2002), Asperger's syndrome is a neurological difference that has been socially constructed as a disorder (p. 659). Levin and Schlozman (2006) challenge the paradigm of how we distinguish between mental illness and the spectrum of normal behaviour in regards to Asperger's syndrome and high functioning autism (p. 430). Baron-Cohen (2002) describes Asperger's Syndrome not as a disability but simply as a different cognitive style (p. 186). Harvey and Latica (2002) state that Asperger's syndrome is an inborn neurological difference accompanied by a range of behaviour patterns that would count as normal, though eccentric.

Individuals with autism spectrum disorders (ASD) share common deficits that may be present from early childhood, like social impairments, narrow interests and repetitive adherence for introducing routines. These people (ASD) sometimes have problems as a result of social constraints and stigma. Many tend to experience isolation and a lack of understanding in their everyday lives. Many are often misunderstood and rejected, often resulting in frustration, anger, depression and lack of self-esteem. They struggle to effectively communicate their needs, thoughts and emotions in face-to-face situations. What comes 'naturally' to most people does not come 'naturally' to ASD people and according to Rynkiewicz (2009), this social awkwardness of ASD individuals, although physically invisible, can be highly disabling (e.g., colour blindness) (p. 26). Cumine et al. (1998) states that children with Asperger's syndrome do not pick up social skills incidentally; they need to be specifically taught (p. 39).

Individuals with ASD have a unique sensory profile that often causes a sensory overload. They have difficulties with multichannel receptivity and processing, and possess a range of abnormalities, including hyper- and hypo-sensitivity, sensory distortion of sound, vision, touch, taste, and smell (O'Neill and Jones, 1997). Typically

ASD people need longer time to process the information and respond to different sensations and situations. Thus, computers allow ASD individuals not only to work at their own speed, but they (computers) minimize competing sensational information in the environment that might cause distractions. They (computers) help reduce social anxiety experiences during face-to-face interactions and accommodate the autistic need for sameness, control and predictability. Computers provide a controlled, structured, and interactive environment. As Attwood (2007) states, the computers are logical, predictable and not prone to moods. According to Schultz et al. (2000) and Klin et al. (2002), problems with noticing and perceiving many nuances of social interactions in face-to-face situations may be due to reduced eye region fixation time that ASD individuals have. Schultz et al. (2000) and Klin et al. (2002) conducted experiments where ASD individuals viewed social scenes while eye-tracking technology simultaneously measured their visual fixations. The study revealed that people who were on the autism spectrum fixated more on mouths and objects, but not on eyes. 'Reading' speakers' facial expressions is crucial, as humans do not develop language skills solely by hearing spoken words. Some educational software such as *Mind Reading* (Baron-Cohen, Wheelwright, Hill, Raste and Plumb, 2001) or the children's animated series *The Transporters*, has been developed by professionals from the Autism Research Centre at the University of Cambridge to teach the skill of recognising emotion expressed on faces. More details about this software and animation series are included later in this paper.

The Internet could change the lives of average citizens as much as the telephone did in the early part of the 20th century and television in the 1950s and 1960s (Kraut et al., 1998, p.1017). Shields and Behrman (2000) have noted that, "Computer technology has transformed society in profound ways. For better or worse, the increasing pervasiveness of computer technology is a reality no one can ignore." (p. 4). Effective communication is critical. Like Shklovski, Kraut and Rainie (2004) noted, communication is the mechanism people use to develop and maintain the social relationships that are so valuable to their physical and mental health. The Internet leads to more and better social relationships by freeing people from the constraints of geography or isolation brought on by stigma, illness, or schedule (Kraut et al., 1998, p. 1017). ASD individuals struggle in face-to-face interactions. However as Brownlow and O'Dell (2006) noted, poor communication patterns of ASD individuals in face-to-face communication situations are not reflective of their communication abilities as a whole (p. 315). The Internet helps to rehabilitate or 'normalize' communication deficits in high functioning ASD individuals.

ASD people find the Internet very attractive as it offers computer-mediated-communication (CMC), such as email, blogging, instant messaging (IM), etc. Email is probably one of the most popular options of CMC (Burnett and Wilkinson, 2005; Lenhart, Rainie, and Lewis, 2001; Livingstone, 2003; Madell and Muncer, 2004; Quigley and Blashki, 2003; Sun et al., 2005). Bryant, Sanders-Jackson, and Smallwood (2006) noted that computer-mediated-communication (CMC) is more frequently used by socially isolated adolescents. Since many ASD people suffer from anxiety or even panic attacks during social encounters, CMC provides a safe mode of communication for them. It facilitates communication more easily in this population (Brownlow and O'Dell, 2006; Rajendran and Mitchell, 2000; 2006; Scott, 2008).

Our today's society is in a *digital revolution*, and the Internet facilitates communication in fundamentally different ways from other semiotic situations. According to Baron (2005), CMC provides young users the opportunity for social affinity and control over when and with whom to interact (p. 29). ASD people prefer CMC to conversing, as it is different from other forms of communication, such as face-to-face interaction, traditional writing, and phone conversation. ASD individuals struggle in face-to-face and phone conversations due to their weaknesses in auditory and verbal processing (Cohen and Sloan, 2007). They also process different stimuli and events with delay (Rynkiewicz, 2009). The phone conversation has all the immediacy of face-to-face communication and requires use of spoken language and the need to generate quick, novel responses, whereas emailing or phone texting requires graphic symbols and has a slower pace. A slower pace due to this delay in processing is something that ASD individuals need as an executive or temporal buffer. They (ASD individuals) need more time to sort out complicated social events and exchanges, organize thinking and connect the emotions to thoughts. The lack of nonverbal cues in emailing, text-messaging, or blogging etc. is actually an advantage for ASD writers as it allows them to plan, compose, edit, and deliver their written messages, something face-to-face or phone conversations do not allow. The gender difference in regards to the Internet usage by ASD people should be noted as well. ASD men are more likely than ASD women to use the Internet for purposes related to entertainment and leisure. ASD men more frequently play games or create their own websites, whereas females use the Internet primarily for interpersonal communication, emotional support and educational assistance. ASD females more frequently use chat rooms, emails, instant messaging, and join various discussion groups and clubs. Both sexes of the ASD population, however, are task-, information-, and content-oriented. They browse the Internet with passion for information related to their special interests.

Computer-mediated communication (CMC) has properties of both written and oral language and as Merchant (2003) noted, the medium of e-mail has plenty to offer to young writers (p. 110). Some ASD people can write beautifully, however the process of writing is typically slow and laborious (Rynkiewicz, 2009). A skilful teacher and mentor may use CMC to teach writing to ASD people. Online chats, emails and text-messaging give ASD individuals autonomy, creativity and a high level of interaction. According to Herring (2002), email allows users the time to carefully compose and edit their messages, which may be formal and linguistically complex. People with Asperger's syndrome and high functioning autism are afraid to make mistakes and misspellings. Unlike in traditional writing, however, misspellings online are taken as a sign of typing inaccuracy rather than lack of education (Scott, 2008). The Internet lexicon is the other reason why ASD people like CMC. It has various types of abbreviations, distinctive graphology, idiosyncratic spelling, and unique use of punctuation (Crystal, 2006). It allows ASD people to express their emotions and feelings during online conversations, something they struggle in during face-to-face interactions. They can capitalize a message, underscore, and italicize text, as well as place asterisks or brackets around words to add emphasis. They can use graphic symbols like emoticons too. ASD people have deficits in understanding complex emotions (Baron-Cohen, 1991), however, it is a myth that individuals from

the autism spectrum do not experience complex feelings and emotions. Computer-mediated-communication rehabilitates this impairment as they (ASD people) can express feelings and emotions in writing, for example in email. ASD individuals also express complex emotions in other forms of computer art, like in drawing or music, and computers facilitate this. Engagement in computer activity, which is a special interest for ASD individuals, provides a calming effect, relaxation, as well as pleasure.

The emergence of new kinds of relationships between writers and readers where the interaction is heavily screen-based has pedagogical implications as it suggests new kinds of relationships between students and teachers. Nowadays, the out-of-school practices of students are increasingly screen-based, which is opposite to school literacy curriculum that is dominated by practices based on print-based text (Holloway and Valentine, 2003). Email opens new possibilities for ASD writers and enriches the curricular emphasis on genres and forms. It also expands the horizons of writers as they write for new online audiences. According to Scott (2008), users of the Internet explore new ways of expressing ideas as well as feelings towards their correspondents, and this new creativeness actually promotes the culturally valued practices of reading and writing. Educators might rethink what literacy means in the current era, dominated by computer technology, and ensure that schooling is not so focused on controlling literacy, but empowering the young to explore its full potential. According to Baron (2005), CMC is unlikely to play a significant role in altering writing standards – unless we as parents and educators let it (p. 31).

Peer relationships are important, especially to adolescents. As Tennant (2008) reflects, “Making the world a better place alone is an oxymoron, because no place of solitude is a better place for human beings” (p. 4). Problems like rejection and lack of close friends are among the strongest predictors of depression and low-self esteem. ASD people do prefer solitude, but this does not mean that people with high functioning autism or Asperger’s syndrome do not look for friendships and social interactions. Typically ASD individuals find friendship among people who share the same special interests, hobbies, and passions. The flexible and potentially anonymous Internet environment allows some shy and anxious ASD adolescents to explore their identity; as Heisler and Crabill (2006) stated, CMC allows concealing or constructing identities related to gender, race, class, and religious affiliations. To ASD people, instant messages (IMs), another form of CMC, are like “hanging out” face-to-face and talking on the phone. The *digital revolution* allows ASD individuals to be digital citizens’ net generation. They belong to a large ‘virtual community’. However as suggested by Scott (2008), Internet usage can undermine or foster the well-being of ASD individuals, depending on whether it supplants or expands opportunities for meaningful, daily contact with close peers.

ASD people can create truly meaningful, close relationships with their friends online. Online communication has become increasingly popular among individuals with autism for self-advocacy and for meeting other individuals with autism (Robertson and Ne’eman, 2008). Like Brownlow and O’Dell (2006) have stated, the Internet enables ASD individuals to be heard (p. 315). Formal organizations create online communities to support ASD people, like OASIS@MAAP, Autism Society (former Autism Society of America), Autism Society of Washington, etc.,

erving as the primary recourses to teach, inform and advocate. Informal online communities such as WrongPlanet.com serve primarily as a network to meet and chat online with the other individuals from the autism spectrum. Often older, well-educated and accomplished ASD individuals serve as the online mentors to younger ASD individuals. It presents a natural predilection of people with ASD to form more and stronger relationships with individuals who are much older or younger than themselves (Attwood, 2007; Bauminger and Kasari, 2000; Jones and Meldal, 2001; Rynkiewicz, 2009). According to Kraut et al. (1998), generally, strong personal ties are supported by physical proximity. However, this may not be true with ASD individuals because of their sensory profile, as many ASD people find both physical touch and eye contact uncomfortable. Computer technology, therefore, provides a comfortable social and physical distance for children and adults with ASD. It also provides visual support.

ASD individuals are relatively skilled in responding to visual cues, such as pictures and animations (Bernard-Opitz, Sriram and Nakhoda-Sapuan, 2001). The effective treatment for students with ASD should include 'visualized' procedures because children with ASD have 'strength' in visual thinking (Yamamoto, 2007). Also, individuals on the autism spectrum appear to favour visuospatial over linguistic mediation (Sahyoun et al., 2009). Vision dominates our perception of space, not because of any inherent physiological advantage of visual over other sensory connections in the brain, but because visual information tends to be more reliable than other sources of spatial information; and the central nervous system integrates information in a statistically optimal fashion (Witten, 2005, p. 489). Visual spatial information is exceptionally reliable and precise while the same information in other sensory systems can be easily distorted. For example, acoustic cues change gradually with stimulus location, compared with the resolution of optical signals, and the cues are easily distorted by echoes caused by objects in the environment or changes in the shapes of the ears (Witten, 2005, p. 490). Individuals with autism spectrum disorders (ASD) report a propensity for visual rather than verbal modes of thinking. Children with ASD use inner speech or visual imagery to support recall from short-term memory (Williams et al., 2008, p. 51). The study of Grinter et al. (2009) supports the superiority of visuospatial analysis in students that score high on the Autism-spectrum Quotient (AQ). These students are faster and more accurate on the Embedded Figures Test (EFT) and the Block Design subscale of the Wechsler Intelligence Scale III compared to those that score low on the AQ. Many students on the autism spectrum see in pictures. Like Dr. Grandin said, "My mind is similar to an Internet search engine that searches for photographs." (Grandin, 2009, p. 1437).

Berube (2007) argues that since autistic children possess special gifts in visual/spatial areas, we should support these abilities instead of "correcting" them into a more "normal" range (p. 5).

Selected computer programs and software used in teaching and therapy of individuals with ASD

TeachTown is a research-based computer-assisted therapy for children with autism spectrum disorders. The program uses practices from Applied Behaviour Analysis (ABA), education, speech and language, and developmental psychology.

Thanks to its online capacities, this computer program allows teachers, parents and clinicians to coordinate the child's education and therapy in multiply locations from where all the data is automatically synchronized via the Internet. A child can work on any computer that has the software installed and an Internet connection. The curriculum is designed for developmental ages two to seven. However, the creators of TeachTown are planning to design the curriculum for older children and teenagers in the near future (M. Vaupel, personal communication, November 20, 2009). TeachTown is a subscription service where the curriculum, lessons, reinforcers, and generalization activities for off computer learning are consistently updated. Off-computer generalization activities are written for non-experts so any family member can teach them to a child. This cost-effective tool is used to teach receptive language, cognitive/academic, social skills, and adaptive life skills (Whalen, 2009; Whalen, Moss, Ilan, Vaupel et al., 2010).

Transporters – is a 3D children's animation series created for both high-functioning ASD children who have developed age appropriate language and cognitive abilities and low-functioning ASD children who have significant learning difficulties. The animation has been designed to enhance understanding and recognition of emotions by children with autism spectrum disorders between the ages of three and eight. There are eight characters, vehicles with grafted real-life faces of actors who show emotions. The series consists of 15 five-minute episodes, each of which focuses on a key emotion or mental state. The 15 key emotions shown on the vehicles' faces are: happy, sad, angry, afraid, disgusted, surprised, excited, tired, unfriendly, kind, sorry, proud, jealous, joking and ashamed (Baron-Cohen, Golan, Chapman, Granader, 2007; Golan, Ashwin, Granader, et al., 2010).

The Virtual World is a therapeutic 3D program designed by researchers from The Virtual World Lab at the University of Texas in Dallas. The program uses a platform from Second Life, the popular virtual world (Mangan, 2008). The idea is that patients go to an "island" customized for therapeutic purposes to build social skills. Patients design their avatars which look nearly identical to themselves by choosing from programmed gestures, smiles, and shrugs. They can even express their reactions, like for example impatience, by tapping their feet. Patients experience encounters like in real life scenarios (e.g., in a restaurant, office, home, or park, etc.). These virtual encounters evoke responses and emotions. If behaviour during any encounter in the Virtual World is socially inappropriate, the Virtual World is put on pause and a clinician, together with the patient, discuss and consider how to better handle the situation. Patients with autism spectrum disorders who have been tested so far with this program have shown improvements in social skills. They are less likely, for instance, to make inappropriate jokes and they are better in reading people's body language (Mangan, 2008).

Mind Reading – *The Interactive Guide to Emotions* – is software created by researchers from the Autism Research Centre at Cambridge University to teach children and adults with Asperger's syndrome and high functioning autism to recognize emotions. It is an interactive guide to emotions and mental states. It is based on a taxonomic system of 412 emotions and mental states, grouped into 24 emotion groups and 6 developmental levels from age four to adulthood. There are three main sections: Emotions Library, Learning Centre and Game Zone. Emotion

Library presents different emotions as video clips with a definition and a story for each emotion. Learning Centre has lessons and quizzes about emotions while the Game Zone provides the games and informal, fun learning about emotions (Golan, Ashwin, Granader, et al., 2010; Golan and Baron-Cohen, 2006).

Bubble Dialogue – is a computer program for individuals with autism to help regulate interaction, such that the social impairment characteristics of Asperger's syndrome are less conspicuous. The program allows autistic individuals to analyze, repeat and finish a task at their own, typically slower speed. The program engages in role-play scenarios; participants can repeat a scene, analyze relevant cues many times without annoying or boring others. They (participants) report they can be relaxed, because they do not receive public criticism and there is also no heavy face-to-face interaction processing required while conversing (Gray, Creighton, McMahon, and Cunningham, 1991).

AViSSS – Animated Visual Supports for Social Skills program is an application designed by researchers from the University in Kansas. It is a three-dimensional (3D) virtual environment for children with Asperger's syndrome for teaching social skills. This 3D virtual environment has multiple scenarios with animations, characters and objects that present various situations and problems that a student needs to address. Each response that a student gives to AViSSS generates a result and explanation of their choice (Ehrlich and Miller, 2009).

The following two projects are worth mentioning in this article because of their potential for research in computer technology and ASD:

Collegium Futurum 21 (CF21) – is a middle and high school program in Poland where students use modern technology and multimedia tools. The program is designed to teach the general population of students, however, the educational environment is very well-suited for able students with Asperger's syndrome and high functioning autism. The program partners and is supported by the Autism Society of Washington. This educational program uses the essence of Web 2.0, blogs, webquests, YouTube, expert Internet portals, e-learning 2.0; it builds online communities for students' projects. The virtual campus has teachers and experts available online for students from Europe, Canada, and the USA as well. Students create online events, e-videos, market their own websites (banners, blogging, etc.), design projects using computer graphics, and learn about copyright laws and privacy policies. Modern teaching is offered, such as I-Search, Web Quest, RAFTT, etc. Classes are small, 5 to 10, students and each student has a mentor (Raczyńska, 2010).

MEDIATE – MultiSensory Environment Design for an Interface between Autistic and Typical Expressiveness. This is a European-funded project of full-body, non-invasive, interactive computer space that generates real-time stimuli (visual, aural and vibrotactile). The project is designed for low-functioning children with autism who have no verbal communication. It shows that children who need very rigid daily routines and who do not cope well with unknown places actually become curious enough to enter out of their own will and start to play (Parés et al., 2006).

Conclusion

The effectiveness of computers and the Internet in teaching and therapy of people with Autism Spectrum Disorders (ASD) has been demonstrated in a number of recent studies (Bernard-Opitz et al., 1999; Bernard-Opitz, Sriram, and Nakhoda-Sapuan, 2001; Bosseler and Masaro, 2003; Chen and Bernard-Opitz, 1993; Heimann et al., 1995; Hetzroni and Tannous, 2004; Kinney, Vedora, and Stromer, 2003; Lewis et al., 2005; Mangan, 2008; Moore and Calvert, 2000). Although more research is still needed, the results of studies that have been completed up to this point are highly promising and reveal that ASD individuals may benefit from a departure from traditional methodologies (Brownlow and O'Dell, 2006). Computer technology and the Internet unlock the potential and talents of ASD children and adults. As Cartwright stated, "Technology is what the gift of fire and light was to our forefathers." (N. C. Cartwright, personal communication, March 7, 2010).

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References

- American Psychiatric Association (2000). *Diagnostic and Statistical Manual of Mental Disorders, 4th edition*. Washington, DC: American Psychiatric Association.
- American Psychiatric Association 2010, DSM-5: The Future of Psychiatric Diagnosis. (n.d.). Proposed Draft Revisions to DSM Disorders and Criteria. Retrieved April 20, 2010, from <http://www.dsm5.org/Pages/Default.aspx>
- Attwood, T. (2007). *The Complete Guide to Asperger's Syndrome*. London: Jessica Kingsley Publishers.
- Baron, N. S. (2005). Instant messaging and the future of language. *Communications of the ACM*, 8 (7), 29–31.
- Baron-Cohen, S. (1991). Do people with autism understand what causes emotion? *Child Development*, 62(2), 385–395.
- Baron-Cohen, S. (2002). Is Asperger syndrome necessarily viewed as a disability? *Focus on Autism and Other Developmental Disabilities*, 17 (3), 186–191.
- Baron-Cohen, S. (2008). *The Facts. Autism and Asperger syndrome*. New York: Oxford University Press Inc.
- Baron-Cohen, S., Golan, O., Chapman, E., Granader, Y. (2007). Transported to a world of emotion. *The Psychologist*, 20 (2), 76–77.
- Baron-Cohen, S., Golan, O., Wheelwright, S., Hill, J. (2004). *Mind reading: The interactive guide to emotions*. London: Jessica Kingsley Limited (<http://www.jkp.com/catalogue/book/9781843105602>).
- Baron-Cohen S., Wheelwright S., Hill J., Raste Y., Plumb I. (2001). The "Reading the Mind in the Eyes" Test Revised Version: A Study with Normal Adults, and Adults with Asperger

- Syndrome or High-functioning Autism. *Journal of Child Psychology and Psychiatry* 42, (2), 241–251.
- Bauminger, N., Kasari, C. (2000). Loneliness and friendship in high-functioning children with autism. *Child Development*, 71(2), 447–456.
- Bernard-Opitz, V., Sriram, N., Sapuan, S. (1999). Enhancing vocal imitations in children with autism using IBM SpeechViewer. *Autism: The International Journal of Research & Practice*, 3 (2), 131–148.
- Bernard-Opitz, V., Sriram, N., Nakhoda-Sapuan, S. (2001). Enhancing Social Problem Solving in Children with Autism and Normal Children Through Computer-Assisted Instruction. *Journal of Autism & Developmental Disorders*, 31 (4), 377–385.
- Berube, C. (2007). What's in TECPlus? *Teaching Exceptional Children*, 39 (6), 5–5.
- Bosseler, A., Massaro, D. W. (2003). Development and Evaluation of a Computer-Animated Tutor for Vocabulary and Language Learning in Children with Autism. *Journal of Autism & Developmental Disorders*, 33(6), 653–672.
- Brownlow, C., O'Dell, L. (2006). Constructing an autistic identity: AS voices online. *Mental Retardation*, 44 (5), 315–321.
- Bryant, A. J., Sanders-Jackson, A., Smallwood, A. M. K. (2006). IMing, text messaging and adolescent social networks. *Journal of Computer-Mediated Communication*, 11 (2), 577–592.
- Burnett, C., Wilkinson, J. (2005). Holy lemons! Learning from children's uses of the Internet in out-of-school contexts. *Literacy*, 11, 158–165.
- Chen, S. H., Bernard-Opitz, V. (1993). Comparison of personal and computer-assisted instruction for children with autism. *Mental Retardation* 31, (6), 368–376.
- Cohen, M. J., Sloan, D. (2007). *Visual Supports for People with Autism: A Guide for Parents and Professionals*. Woodbine House, Inc.
- Crystal, D. (2006). *Language and the Internet* (2nd ed.). Cambridge: Cambridge University Press.
- Cumine, V., Leach, J., Stevenson, G. (1998). *Asperger syndrome: a practical guide for teachers*. London: David Fulton Publishers.
- Ehrlich, J. A., Miller, J. R. (2009). A Virtual Environment for Teaching Social Skills: AViSS. *IEEE Computer Graphics & Applications*, 29 (4), 10–16.
- Golan, O., Ashwin, E., Granader, Y., et al. (2010). Enhancing emotion recognition in children with autism spectrum conditions: An intervention using animated vehicles with real emotional faces. *Journal of Autism and Developmental Disorders*, 40 (3), 269–279.
- Golan, O., Baron-Cohen, S. (2006). Systemizing empathy: Teaching adults with Asperger syndrome or high-functioning autism to recognize complex emotions using interactive multimedia. *Development and Psychopathology*, 18 (2), 591–617.
- Goldsmith, T. R., LeBlanc, L. A. (2004). Use of Technology in Interventions for Children with Autism. *Journal of Early and Intensive Behavior Intervention*, 1 (2), 166–178.
- Grandin, T. (2009). How does visual thinking work in the mind of a person with autism? A personal account. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 5 (364), 1437–1442.
- Gray, B., Creighton, N., McMahon, M., Cunningham, D. (1991). *Getting started with Bubble Dialogue, Language Development and Hypermedia Research Group Internal Report*, University of Ulster at Coleraine, Ulster.
- Grinter, E. J., Maybery, M. T., Van Beek, P. L., Pellicano, E., Badcock, J., Badcock, D. (2009). Global Visual Processing and Self-Rated Autistic-like Traits. *Journal of Autism & Developmental Disorders* 39 (9), 1278–1290.

- Harvey, M., Latica, V. (2002). The Social Construction of Asperger Syndrome: the pathologising of difference? *Disability & Society*, 17 (6), 659–669.
- Heimann, M., Neslon, K. E., Tjus, T., Gillberg, C. (1995). Increasing reading and communication skills in children with autism through and interactive multimedia computer program. *Journal of Autism and Developmental Disorders*, 10 (25), 459–480.
- Herring, S. C. (2002). Computer-mediated communication on the Internet. *Annual Review of Information Science and Technology*, 36, 109–168.
- Hetzroni, O. E., Tannous, J. (2004). Effects of a Computer-Based Intervention Program on the Communicative Functions of Children with Autism. *Journal of Autism & Developmental Disorders*, 34 (2), 95–113.
- Holloway, S. and Valentine, G. (2003) *Cyberkids – Children in the New Information Age*. London: Routledge.
- Jones, R. S. P., Meldal, T. O. (2001). Social relationships and Asperger's syndrome: A qualitative analysis of first-hand accounts. *Journal of Learning Disabilities*, 5 (1), 35–41.
- Kinney, E. M., Vedora, J., Stromer, R. (2003). Computer-Presented Video Models to Teach Generative Spelling to a Child with an Autism Spectrum Disorder. *Journal of Positive Behavior Interventions*, 5 (1), 22–30.
- Klin, A. et al. (2002). Visual fixation patterns during viewing of naturalistic social situations as predictors of social competence in individuals with autism. *Archives of General Psychiatry*, 59 (9), 809–816.
- Kraut, R., Patterson, M. (1998). Internet paradox a social technology that reduces social involvement and psychological well-being. *American Psychologist*, 53 (9), 1017–1031.
- Lewis, L., Trushell, J., Woods, P. (2005). Effects of ICT group work on interactions and social acceptance of a primary pupil with Asperger's Syndrome. *British Journal of Educational Technology*, 36 (5), 739–755.
- Levin, H., Schlozman, S. (2006). Napoleon Dynamite: Asperger's disorder or Geek NOS? *The Journal Of The American Association Of Directors Of Psychiatric Residency Training And The Association For Academic Psychiatry*, 30 (5), 430–435.
- Livingstone, S. (2003). Children's use of the internet: Reflections on the emerging research agenda. *New Media & Society*, 5(2), 147–166.
- Madell, D., Muncer, S. (2004). Back from the beach but hanging on the telephone? English adolescents' attitudes and experiences of mobile phones and the internet. *Cyber Psychology & Behavior*, 7 (3), 359–367.
- Mangan, K. (2008). Virtual Worlds Turn Therapeutic for Autistic Disorders. *Chronicle of Higher Education*, 54 (18), A26 –A26.
- Mayor, T. (2008a). IT'S Open Secret. *Computerworld*, 42 (19), 22–27.
- Mayor, T. (2008b). The Asperger's Guessing Game. *Computerworld*, 42 (19), 24–24.
- Merchant, G. (2005). Digikids: Cool dudes and the new writing. *E-Learning and Digital Media*, 2 (1), 50–60.
- Moore, M., Calvert, S. (2000). Brief Report: Vocabulary Acquisition for Children with Autism: Teacher or Computer Instruction. *Journal of Autism & Developmental Disorders* 30, (4), 359–363.
- O'Neill, M., Jones, R. S. P. (1997). Sensory-perceptual abnormalities in Autism: A case for more research? *Journal of Autism and Developmental Disorders*, 27 (3), 283–293.
- Ornitz E. M.; Guthrie D.; Farley A. H. (1977). The early development of autistic children. *Journal of Autism and Childhood Schizophrenia*, 7 (3), 207–229.
- Papert, S. (1996). *The Connected Family: Bridging the Digital Generation Gap*. Longstreet Press.

- Parés, N., Carreras, A., Durany, J., Ferrer, J., et al. (2006). Starting Research in Interaction Design with Visuals for Low-Functioning Children in the Autistic Spectrum: A Protocol. *Cyber Psychology & Behavior*, 9 (2), 218–223.
- Prior, M., Eisenmajer, R., Leekam, S., Wing, L., Gould, G., Ong, B., Dowe, D. (1998). Are there subgroups within the autistic spectrum? A cluster analysis of a group of children with autistic spectrum disorders. *Journal of Child Psychology and Psychiatry*, 39 (6), 893–902.
- O'Neill M.; Jones R. S. P. (1997). Sensory – perceptual abnormalities in autism: A case for more research? *Journal of Autism and Developmental Disorders*, 27 (3), 279–287.
- Quigley, M., Blashki, K. (2003). Beyond the boundaries of the sacred garden: Children and the Internet. *Educational Technology Review*, 11, 70–77.
- Raczyńska, A. (2010). Collegium Futurum – wyzwaniem dla tradycyjnej szkoły. *Edukacja i Dialog*, 216/217, (3/4).
- Rajendran, G., Mitchell, P. (2000). Computer mediated interaction in Asperger's syndrome: The Bubble Dialogue Program. *Computers & Education*, 35, 189–207.
- Rajendran, G., Mitchell, P. (2006). Text chat as a tool for referential questioning in Asperger syndrome. *Journal of Speech, Language, and Hearing Research*, 49 (1), 2–11.
- Robertson, M. S., Ne'eman, D. A. (2008). Disability Studies Quarterly 28 (4), Retrieved March 12, 2010, from: <http://www.dsq-sds.org/article/view/146/146>
- Rynkiewicz, A. (2009). *Zespół Aspergera. Inny mózg. Inny umysł*. Gdańsk: Harmonia.
- Sahyoun, C., Soulieres, I., Belliveau, J., Mottron, L., Mody, M. (2009). Cognitive Differences in Pictorial Reasoning between High-Functioning Autism and Asperger's Syndrome. *Journal of Autism and Developmental Disorders*, 39 (7), 1014–1023.
- Shklovski, I., Kraut, R., Rainie, L. (2004). The Internet and social participation: Contrasting cross-sectional and longitudinal analyses. *Journal of Computer-Mediated Communication*, 10 (1), Retrieved March 18, 2010, from <http://jcmc.indiana.edu/vol10/issue1/shklovskikraut.html>
- Shields, M. K., Behrman, E. (2000). Children and Computer Technology: Analysis and Recommendations. *Future of Children*, 10, (2), p.4–30.
- Schultz, R. T., Gauthier, I., Klin, A., Fulbright, R. K. et al. (2000). Abnormal ventral temporal cortical activity during face discrimination among individuals with autism and Asperger. *Archives of General Psychiatry*, 57 (4), 331–340.
- Scott, L. J. (2008). The usage patterns of communication via email in adolescents with Asperger Syndrome (Doctoral dissertation, University of Louisiana at Lafayette, 2008). *Dissertation Abstracts International: Section B: The Sciences and Engineering*, 69 (5–B), 2957.
- Sun, P., Unger, J. B., Palmer, P. H., Gallaher, P., Chou, C., Baezconde-Garbanati, L., et al. (2005). Internet accessibility and usage among urban adolescents in southern California: Implications for web-based health research. *Cyber Psychology & Behavior*, 8(5), 441–453.
- Tennant, D. (2008). Asperger's Oxymoron. *Computerworld*, 42 (40), 4.
- Ward, M. J., Meyer, R. N. (1999). Self-determination for people with developmental disabilities and autism: Two self-advocates' perspectives. *Focus on Autism and Other Developmental Disabilities*, 14, 133–140.
- Whalen, C. (2009). *Real Life, Real Progress for Children with Autism Spectrum Disorders*. Baltimore: Paul H. Brookes Publishing Co., Inc.
- Whalen, C., Moss, D., Ilan, A., B., Vaupel, M., et al. (2010). Efficacy of TeachTown: Basics computer-assisted intervention for the Intensive Comprehensive Autism Program in Los Angeles Unified School District. *Autism*, 14 (3), 179–197.

- Williams, D., Happé F., Jarrold, C. (2008). Intact inner speech use in autism spectrum disorder: evidence from a short-term memory task. *Journal of Child Psychology & Psychiatry*, 1 (49), 51–58.
- Witten, I. B., Knudsen, E. I. (2005). Why seeing is believing: merging auditory and visual worlds. *Neuron*, 3 (48), 489–496.
- Yamamoto, J., Kusumoto, C. (2007). Development and support for children with autistic spectrum disorders. *Cognitive Studies*, 14 (4), 621–639.

Use of computer technology and the internet in teaching and therapy of individuals with Autism Spectrum Disorders (ASD)

Abstract

Use of computer programs and software in teaching and therapy of individuals with ASD is a relatively new field of research, but it shows very promising results. The use of computer technology and the Internet in ASD has demonstrated effectiveness in a number of recent studies. Virtual reality is also gaining traction as a form of psychotherapy at some academic medical centres. Many individuals with ASD have unique talents and are skilled in responding to visual cues, such as pictures and animations. Computers not only unlock many unique talents that individuals with ASD possess, but also facilitate the development of social skills that are crucial for functioning in society. In addition to selected computer programs and software, the article also presents some important facts about the diagnosis and sensory profile in ASD and connects these facts with the discussion about computer-mediated-communication, CMC, which is used by individuals with ASD. The article is primarily focused on individuals with Asperger's syndrome and high-functioning autism.

Wykorzystanie techniki komputerowej i internetu w nauczaniu oraz terapii osób dorosłych z ASD

Streszczenie

Wykorzystanie programów i oprogramowania komputerowego w nauczaniu oraz terapii osób z ASD stanowi stosunkowo nową dziedzinę badawczą, aczkolwiek przedstawia bardzo obiecujące wyniki. W kilku najnowszych badaniach, stosowanie techniki komputerowej oraz internetu u osób z ASD okazało się efektywne. Rzeczywistość wirtualna jako forma psychoterapii zyskuje także szansę na realizację w niektórych akademickich ośrodkach medycznych. Wiele osób z ASD posiada unikalne zdolności i obdarzonych jest umiejętnością reagowania na bodźce wizualne, takie jak obrazki czy animacje. Komputery nie tylko wyzwalają wiele niezwykłych talentów, które posiadają osoby z ASD, lecz także ułatwiają rozwój umiejętności społecznych, niezbędnych dla funkcjonowania w społeczeństwie. Oprócz wybranych programów i oprogramowania komputerowego, artykuł ten przedstawia również pewne znaczące fakty dotyczące diagnozy i profilu sensorycznego w ASD oraz łączy te fakty z dyskusją na temat komunikacji zapośredniczonej komputerowo (ang. *computer-mediated-communication* – CMC), która jest stosowana przez osoby z ASD. Artykuł zasadniczo skupia się na osobach z zespołem Aspergera oraz autyzmem wysokofunkcjonującym.

Address for correspondence:

AgnesR@autismsocietyofwa.org