P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2019.25.01.013

Interaction with Social Robots: Social Skill Development in Children - An Atypical Study

Dr. Jagvinder Singh
[1]Guru Kashi University, Talwando Sabo

ABSTRACT:

Chetah's footsteps are being followed by technology, which is speeding forward into the era of Artificial Intelligence, where robots have become an integral part of many of our daily activities, acting as peers, facilitators, and assistants. The days when the name 'ROBOT' was only used to refer to machines used for industrial purposes are long gone, and the time has come for humanoids to become more like friends. Almost every domain has been invaded by robots. As it is thought that robots are capable of completing jobs that are beyond human conception, they are being deployed in the realms of medical care and child care rather than managing dangerous equipment.

INTRODUCTION:

The term "autism spectrum disorder" refers to a group of neurological conditions. These disorders are characterised by problems with communication and social interaction. People with ASD frequently have restricted, repetitive, and stereotyped interests or patterns of behaviour. The Diagnostic and Statistical Manual of Mental Diseases (DSM) is published by the American Mental Association (APA) and is used globally to diagnose and categorise psychiatric diseases. The DSM-5 now recognises five distinct ASD subgroups or specifiers. They are;

1. With or Without accompanying intellectual impairment
2. With or Without accompanying language impairment
3. Associated with a known medical or genetic condition or environmental factor
4. Associated with another neuro developmental, mental or behavioral condition
5. With catatoria

One or more specifiers can be found in a person. Autism affects children's ability to communicate. This makes it difficult for individuals to communicate their feelings through words, gestures, facial expressions, and touch. This is where social Robots would come in handy and make their lives easier.

THE CLINICAL PICTURE OF AUTISM DISORDER:

Autistic children have a wide range of talents and disabilities. Even in the earliest stages of infancy, a kid may appear separate or distant from others, which is a key symptom. Mothers

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2019.25.01.013

frequently recall their kids as never being cuddly, never reaching out when being brought up, never smiling or gazing at them when being fed, and never seeming to notice other people's motions.

Fig.1: Representative Image of an Autistic Child [source: nature.com]

1. A SOCIAL DEFICIT:

Autistic children frequently have little desire for love or touch with others, and they don't seem to know or care who their parents are. The autistic youngster is said to suffer from "Mind Blindness," or an inability to adopt other people's perspectives or "see things as they do." Autistic children also have difficulties paying attention and detecting and orienting to noises in their environment. Autistic children's lack of social engagement has been thoroughly documented. Lord and Magilt Evans (1995) found that autistic children had less social contacts than regular children in a behavioural observation study. Ecopresis is a regular occurrence. Failure to participate in toilet training is a typical problem, according to Radford and Anderson (2003), and one that causes additional hardship for parents of autistic children. Additionally, these children with Autism Disorder have a significant frequency of sleep issues.

2. AN ABSENCE OF SPEECH:

Autistic children are thought to have an imitative deficiency and are unable to learn successfully through imitation. This disorder might explain their unusual lack of or severely limited use of speech. If speech is available, it is practically never utilised to communicate except in the most basic of ways, such as saying "yes" in response to a query or repeating a few syllables like a parrot.

3. SELF STIMULATION:

Self-stimulation is a common trait among autistic children. It frequently takes the form of repeated motions such as head pounding, spinning, and rocking, which can last for an hour or more. Autistic children frequently exhibit an active aversion to auditory stimulation, sobbing even when they hear their parents speak. The pattern is not always consistent, but autistic youngsters may be greatly upset or scared by a very mild sound one minute and completely unaffected by loud noise the next.

4. INTELLECTUAL ABILITY:

Autistic children frequently demonstrate concealed deficits on cognitive or intellectual tests when compared to the development of other groups of children. These children have a specific weakness in expressing mental states, i.e., they appear to have a social reasoning handicap yet are able to operate things. Some youngsters are quite good at putting things together, therefore their performance on puzzles or form boards may be above normal. Even in the manipulation of items, meaning is visible, however difficult it may be.

5. MAINTAINING SAMENESS:

Many autistic youngsters are fascinated with and develop strong ties to strange things like pebbles, light switches, film negatives, or keys. In other cases, the object is so enormous or strange that simply carrying it about causes other activities to be disrupted. When their preoccupation with the object is disrupted – for example, by its removal or attempts to replace it, or when anything familiar in the

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2019.25.01.013

environment is even slightly altered – these children will have violent temper tantrums or a crying spell that lasts until the familiar situation is restored.

ROBOTIC ASSISTANCE FOR CHILDREN WITH AUTISM:

Since there is no cure for autism, many scientific studies suggest that intensive therapies at an early stage of a child‟s development results in long lasting and meaningful improvementsto the child‟s ability to adapt and thrive in social situations. Here is where a robot comes into picture. The International Standard of organization defines a robot as ,,A reprogrammable, multifunctional manipulator designed to move materials, parts or tools or specialized devices through variable programmed motions for performance of variety of tasks‟.

A SOCIAL ROBOT:

The social robot that is identified as an artificial intelligence (AI) system is an autonomous object which interacts with man/machine, ie; other autonomous physical agents. It is capable of communicating with the outer world by following social behaviors that are attached to its role. These social robots could often be referred to as intelligent/ smart robots that could be much of a friend than a foe or a monster as portrayed in many movies. These robots are capable of performing social interactions ranging from simple supportive tasks like assisting people at work in industries to collaborating and communicating with autistic children or being assistive in healthcare.

Fig.2: Social Robot interacting with an Autistic Child [source: frontporchne.com]

The robots in general are capable of performing multifaceted tasks, they can assist people in trivial tasks such as passing a tool, they can help a baker to knead dough for bread and pipe frosting on sugar cookies, tackle those potentially hazardous tasks that are often far from human. Now the present generation social robots have gone levels ahead overcoming the barriers by being able to interact with people at home, schools, hospitals and workplaces which was considered to be a serious scientific challenge. These robots were designed by being drawn from psychological research areas such as emotional/social intelligence, perception, communication and theory of mind. The social robots that are used in healthcare such as working with dementia patients/ those handling autistic children require for people trust and engage with them. These socially interactive robots are dedicated to operate as partners, peers or assistants, for their sole task is to engage people in social interactions.

Fig.3: Robots in Interactive patient care [source: Interaction Design Foundation – 2016]

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2019.25.01.013

This paper addresses in particular all the aspects connected to social robots exclusively designed to communicate with autistic children. This paper at first discusses in detail about autism spectrum disorder (ASD), the causes, symptoms, types etc. Therefore this work falls under the category of Engineering psychology or Ergonomics at large.

WHAT IS WHAT ABOUT SOCIAL ROBOTS (the technology behind):

The social robot aims to help children/ students with autism spectral disorder (ASD) in ways humans can‟t for which they need to excel at reading our intentions so that they could adapt and respond to human behavior which is often unpredictable. Now the robot needs to figure out what exactly its partner wants or intends, it then needs to assume and take into account the inferences so as to adapt its own behavior and respond correctly. It is for this purpose that these smart robot‟s intelligence is based on the cognitive computing model to simulate human thought process. The cognitive computing system is the one which uses computerized models so as to simulate the cognition process in human, thereby finding solutions in complex situations, wherein often the answers are uncertain and ambiguous. These systems involve machine learning which in turn uses pattern recognition, data mining and natural language processing that mimic the way in which human brain works.

The basic machine learning algorithm receives the input data, performs statistical analysis on that to predict the output. It also updates the outputs as new data becomes available. Data mining and predictive modeling that are constituents of machine learning. It searches through a set of data and looks for patterns (pattern recognition) and accordingly adjusts program actions.

These social robots can serve both as a telepresence robot that is remotely controlled or an autonomous system supported with a local AI which could interact independently responding to cues from its human partner. The former finds its application in assistive healthcare as it is a remote controlled wheeled device with a wireless internet connectivity. The next section of this paper discusses in brief about one such social robot which is widely believed to be the future of socialization and education for learners with ASD.

CASE STUDIES ON SOCIAL ROBOTS EXCLUSIVELY DESIGNED FOR AUTISTIC CHILDREN:

This section of this research paper puts forth the inferences from two case studies about the social robots currently in use to serve as peers for children with Autism Spectrum Disorder.

1. **MILO – THE SOCIAL BOT:**

Robokind, a learning company whose products are Robots4Autism and Robots4STEM is said to aid children in realizing their full potential and also in pursuing their passion. As a benefaction to the ASD Community, Robokind has developed Milo – A Social Robot, which is socially advanced Robot which is proven to be over 80% more effective with learners with ASD in comparison with other conventional therapies.

The robots4autism program is said to offer a non threatening approach helping these children practice their communication skills and social skills. The lessons framed by this program are in such a way that they teach emotional identification and social behaviors to those within the age limit of 5-17 years who meet their prescribed set of prerequisite skills mentioned below;

- Put forth requests by means of words or gestures
- Manifest their ability to understand the vocal/non vocal language spoken
- Observe the actions of the care giver
- Predict the upcoming event during interactions

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2019.25.01.013

- Commenting/ responding to comments regarding what is displayed/ shown
- Answering yes/no questions
- Have fine motor abilities to handle gadget that the child currently interacts with Thus this program at large offers the following outcomes. The child hereby is able to,
- Express empathy
- Act appropriately to social situations
- Tune in on emotions
- Get self motivated
- Generalize in the population

How Milo works:

Learners with ASD often encounter a kind of fear and hesitation towards interacting with the outer world and therefore confine themselves into a virtual shell as like a snail. The friendly demeanor and patience is said to encourage children with ASD to step out of this shell thereby giving them the courage to interact with the outer world.

Milo can model human facial expressions, walk and talk. A robot is said to be emotionally intelligent if and only if it exhibits a two fold capability ie; its ability to understand and interpret human emotions as well as display those of its own by means of facial expressions, that initiate human facial expressions. These facial expressions include a lot of information regarding human emotion. It is capable of providing meaningful as well as sensitive cues about emotional response [7].

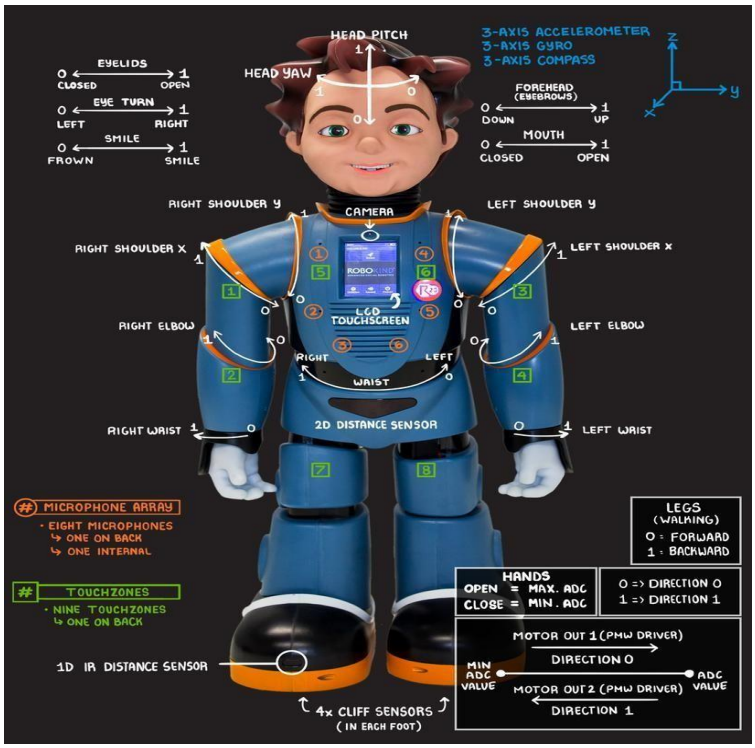

Fig.4: Milo – The social Robot [source: robots4autism.com]

Few years ago the expressive behavior of robotic faces extensively relied on mechatronic design and control, however this had its own limitations as they were not life like. This could be depicted in the complex design of robotic face ROMAN [ ]. But by the inception of humanoid robots, they mimic real human beings with their realistic skin and expressive face. Han is a humanoid robot created by

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2019.25.01.013

Hanson Robotics in the United States. His skin is constructed of Frubber, an elastic polymer that is a patented substance that mimics human skin. The frubber is equipped with around 40 motors on the robot's face, allowing for the development of a variety of faces . Milo, on the other hand, has a toy-like form that is more child-friendly than a humanoid.

***2.* QTROBOT**:

QTROBOT is a semi-humanoid social robot designed to improve autism therapy effectiveness by grabbing children's attention and teaching them new life skills. QTrobot is the first social robot to be scientifically and empirically validated to increase the learning opportunities of children with autism in social and communication skills. In Fig.5: QTrobot [source: luxai.com]

Fig.5

programming, QTrobot addresses the issue of IT professional support, since QTrobot might be readily programmed by a therapist or parent with no technical expertise.

The robot is intended as a catalyst for social interaction, rather than as a teacher for a specific social skill. This exhibits that the robot is not specifically generating social behavior or participating in social interaction but instead the robots behave in ways known to provoke human-human interaction. For example, a bubble blowing robot provokes social interaction between a child and a parent.

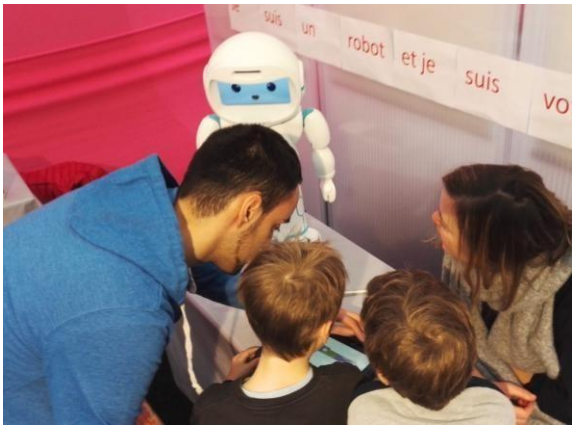

Fig.6: Children and Therapists interacting with QTrobot [source: luxai.com]

BEHAVIOR THERAPY:

In an institutional context, behaviour therapy has been used to successfully eliminate self-destructive conduct, grasp the principles of social behaviour, and improve certain language abilities. Ivar Lovaas, a pioneer in autistic children's behavioural therapy, claimed extremely favourable outcomes. Over the course of several years, the children are generally engaged in one-on-one educational scenarios for the majority of their waking hours. Both discriminating training procedures (reinforcement) and contingent aversive treatments, such as punishment, are used in the intervention. Parents are usually

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2019.25.01.013

included in the therapy process, and the emphasis is on training children to learn from and interact with normal peers in real-world circumstances. This therapy necessitates a significant amount of staffing, with well-trained therapists working with each kid for at least 40 hours per week for at least two years. This is where the robot comes into play, assisting and minimising time, personnel, and energy while also producing exceptional outcomes.

RAT & RET – AN OVERVIEW:

The Development of Robot-Enhanced therapy for children with AutisM spectrum disorders (DREAM) is the project that will design robots that can operate autonomously and help the therapist to improve the autistic child's social interaction skills, such as turn-taking, imitation and joint attention. This Project aims to develop an autonomous robot that minimizes the therapist's intervention so they could focus more on the child and improve the outcome of the therapy. The DREAM robot will be made to function as a diagnostic tool by collecting clinical data during therapy. RAT also abbreviated as Robot Assisted Therapy involves well-designed robotic agents that have been proven to be particularly effective and increasingly important tool for mediating between therapists and ASD children. However, therapeutic interventions also require significant human resources over extended period of time. As a result, therapeutic robots may need to have more autonomy than present remote-controlled systems in order to make a substantial difference. Furthermore, they must respond on more than the child's directly seen actions, as emotions and intentions play a larger role in determining which therapeutic responses are most successful. The next generation of RAT, known as Robot-Enhanced Therapy (RET), will be capable of inferring ASD children's psychological disposition and assessing their behaviour in order to pick therapeutic activities. Since these children require therapy tailored to individual needs, the RET robots will provide that as well Driven by therapists, The DREAM project will deliver next- generation RET, developing clinical interactive capacities for supervised autonomy therapeutic robots – robots that can operate autonomously for limited periods under the supervision of a therapist, while at the same time it will operate under strict ethical rules and the project will provide policy guidelines to govern ethically-compliant deployment of supervised autonomy RET.

Fig.7: RET Implementation [source: dreamproject.com]

Fig.8: RAT Implementation [source: dreamproject.com]

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2019.25.01.013

CONCLUSION:

Social robotics could be a promising method for treating autism spectral disorder. Robots provide therapists, parents and researchers a means to connect with autistic subjects in a easier way. Since autistic children live in their own world and it would be really a challenging task for parents as well the therapists wherein these social robots would be of much help to facilitate their interaction and further development of social skills and communication. Social robots have a lion's share in making the autistic child's world more beautiful and meaningful, however much researches have to be conducted in this area to make social robots much beneficial to the society at a minimum cost so that even economically backward men could afford, since autism and any other disorder could affect any sizable section of the society irrespective of cast, creed, culture and economic background.

REFERENCES:

[1]. M. Schuetze, C. S. Rohr, D. Dewey, A. McCrimmon, and S. Bray, "Reinforcement learning in autism spectrum disorder," Frontiers in psychology, vol. 8, p. 2035, 2017.

[2]. K. Tsiakas, M. Dagioglou, V. Karkaletsis, and F. Makedon, "Adaptve robot assisted therapy using interactve reinforcement learning," in Social Robotcs. Springer Internatonal Publishing, 2016, pp. 11– 21.

[3]. St. Clair and M. Mataric. How Robot Verbal Feedback Can Improve Team Performance in Human- Robot Task Collaborations. In Proceedings of HRI, pages 213–220. ACM Press, March 2015.

[4]. Dickstein-Fischer, L., & Fischer, G. S. (2014). Combining psychological and engineering approaches to utilizing social robots with children with Autism. 2014 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBC 2014, 792–795.

[5]. Ricks, D. J., & Colton, M. B. (2010). Trends and considerations in robot-assisted autism therapy. Proceedings - IEEE International Conference on Robotics and Automation, 4354–4359.

[6]. A. L. Thomaz and C. Breazeal, "Teachable robots: Understanding human teaching behavior to build more efectve robot learners," Artfcial Intelligence, vol. 172, no. 6, pp. 716 – 737, 2008.

[7]. Karsten Berns and Jochen Hirth (2006). Control of facial expressions of the humanoid Robot Head ROMAN. IEEE International Conference on Intelligent Robots and Systems, Oct. 9-15, 2006, Beijing, China.