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Robot Enhanced Therapy for Children with Autism (DREAM)

A Social Model of Autism

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The development of social robots for children with autism has been a growth field for the past 15 years. This article reviews studies in robots and autism as a neurodevelopmental disorder that impacts social-communication development, and the ways social robots could help children with autism develop social skills. Drawing on ethics research from the EU-funded Development of Robot-Enhanced Therapy for Children with Autism (DREAM) project (framework 7), this paper explores how ethics evolves and developed in this European project.

The ethics research is based on the incorporation of multiple stakeholders' perspectives including autism advocacy; parents of children with autism; medical practitioners in the field; and adults with Asperger's disorder. Ethically, we propose that we start from the position that the child with autism is a *social being* with difficulties in expressing this sociality. Following from this core assumption, we explore how social robots can help children with autism develop social skills. We challenge the view that children with autism prefer technologies over other kinds of activities (exploring nature or the arts), engagement with other living beings (animals),

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or that they lack interest in human relationships (particularly with close caregivers).

Autism Spectrum Disorder

According to biomedical science, Autism Spectrum Disorder (ASD) is characterized by widespread abnormalities in social interactions and communication, as well as severely restricted interests and highly repetitive behavior (41). The diagnostic criteria for ASD included in the *Diagnostic and Statistical Manual of Mental Disorders*, 5th edition (DSM-5) (41), refer to ASD as a single diagnosis category that includes autistic disorder (autism), Asperger's disorder, childhood disintegrative disorder, and pervasive developmental disorder not otherwise specified (41). Autism is a very specific difference in the ability to read social cues, understand social interaction, and respond appropriately. In general terms, the level of cognitive ability, intelligence, perception, use of language, degree of withdrawal, excitability, self-injury, and physical appearance will vary greatly in autistic persons (43).

According to the Centers for Disease Control and Prevention (CDC), ASD occurs in 1 in 68 children and is almost five times more common among boys than girls: 1 in 42 boys versus 1 in 189 girls. While autism affects

more males than females, new research has begun to look at the gender bias in the testing procedures for autism, such as the Autism Diagnostic Observation Schedule (ADOS) and highlight different ways that autism can be overlooked in females, for instance through "camouflaging" techniques. Females with autism for instance use gestures more frequently than males with autism (44). ASD behaviors include compulsions, echolalia, and motor mannerisms such as hand flapping and body rocking (45).

DREAM is a consortium made up of engineers, computer scientists, psychotherapists and psychologists, and ethicists. The robotics research is driven by the clinical team of psychologists and psychotherapists at the Universitatea Babeş-Bolyai in Romania. The members of the clinical team are schooled in Applied Behavioral Analysis (ABA), a learning theory based on behavioral repetition and cognitive association. The DREAM project uses a well-defined clinical psychotherapeutic method.

As children with autism have a deficit in social behaviors, three tasks have been identified as crucial to social interaction, communication, and learning: turn-taking, joint attention, and imitation. Turn-taking involves reciprocal interaction with others and is necessary for collaborative learning (21). Imitation is a vital human

skill for social cognition, and helps support interactions with others, speech and language, and cognitive development (22), (39). Joint attention is the ability to attend to objects in the same space and is enacted through pointing or gaze gestures (10).

In traditional ABA therapy, the psychotherapist works with the child to develop these skills. In Robot Enhanced Therapy (RET), the robot is used as tool by the therapist to help the child embed these social behaviors into their learning repertoire. The technical team provides support to the clinical team, who establish the challenges the technical team must resolve if the robot is to carry out any useful ABA therapy.

Research into the therapeutic development of robots for children with autism has relied strongly on biomedical perspectives of autism as a deficit in social-communication and interaction.

We explore the ethics of robots for children with autism as part of research conducted on the Development of Robot-Enhanced Therapy (DREAM) project. The DREAM project was funded by the European Commission Framework 7 science program. The project runs for five years from 2014, and will conclude in September 2018. In the DREAM description of work (DOW), the project objectives are described as follows:

The scientific and technological goals of the DREAM project are the study and development of artificial cognitive robotic systems to support psychotherapy for children with mental disorders, in particular children with Autism Spectrum Disorders (ASD). Although some research projects focus on improving efficiency in robot assisted

therapies (RATs), they mainly consider only relatively passive or remote controlled tele-operated robots. In the long term, however, therapy robots need to become more autonomous in order to reduce the burden on human therapists, giving them a powerful tool for clinical interventions and diagnostic analysis, and providing ASD children consistent therapeutic experience (DREAM Description of Work FP7-ICT-2013-10-611391).

According to DREAM goals, children with ASD exhibit a preference for interacting with non-human agents (empathizing-systematizing theory), a theory developed by autism expert Simon Baron-Cohen (2). This has meant that researchers in robotics of autism have come to the issue with the premise (taken from a strand of autism studies inspired largely by Baron-Cohen) that children with autism are deficient in sociality (the ability to relate to others and themselves), and from this assumption relate to the child with autism as though the robot will be a preferred alternative to a human being.

The scientific team at the very onset decided to include ethics in the project, and this article contains the findings of the ethics team, in light of the assumptions, goals, and practices of the robotic scientist and the clinical psychotherapists.

As an ethics team, we have tried to broaden the discussion about what autism is, and show that it is neither a thing or fact, fixed in space or time, but undergoes transformations as a concept, and set of practices. Moreover, as the ethics team, we stress how important it is to show that children with autism have a different sociality, rather than an absent one. As the ethics team we believe starting from the premise that children with autism have strong emotional attachments to their primary caregivers, and express interest in other activities besides engaging with technological items. They also enjoy relationships with animals, physical activity, and artistic play.

This article is informed by research conducted as part of the ethics studies of the DREAM project and the data are drawn from qualitative research.

In our ethical study we collected data using qualitative data collection techniques including: drawing on technical studies of robot therapy for children with autism; participant observation of DREAM experiments; interviews with parents of children receiving the therapy, and parents of children not receiving the therapy; autism specialists and educationalists, attendance at playgroups and community groups; attendance at workshops on robot ethics; and meetings with autism specialist scholars and healthcare practitioners.

Additionally, we organized a mini public (meeting) in early 2017 to elicit general views on the development of



FIGURE 1. Autism diversity poster.

robots in healthcare, and to engage with the public's concerns and hopes about these issues. A mini public is an event that brings together different stakeholders to deliberate on a topic of personal or political importance. The mini public is a form of "deliberative democracy" (23) where "experts" deliver information to the public for their consideration. The political sciences developed mini public methodologies to encourage public engagement and to help develop policy. The DREAM mini public explored stakeholders' perceptions on healthcare and robots. We invited experts in the field of medical robots to give presentations of current and predicted ways in which robots will be used in healthcare. The mini public attendees deliberated on these issues and were invited to give opinions on some of their concerns and hopes about the future of healthcare and robots for children with autism.

As LaFont (23) explains, "deliberation" follows information. Ordinary members of the public are not "experts" in fields (in our cases, none of the participants were experts in robotics), and to compensate for an information deficit, the invited experts must impart useful knowledge to the attendees to help them in their deliberation process. Participants raised concerns about the future of healthcare that the National Health Service (a free to all British and European citizen medical service) would be less supported financially. The attendees also expressed concerns as medical professionals are replaced by technologies to save costs at the expense of patient care.

Qualitative research methods allow for personalized experiences to be called forth and provide autobiographical and contextual information. Moreover, as robot therapy becomes mainstream in autism circles, addressing the normative models and frameworks that underlie the use, development, and potential of the robots to assist children with autism is crucial.

We carried out in-depth interviews lasting from 30 min to two hours. Our paper is informed by the following sources:

- Interviewed 4 parents receiving robot therapy in Romania.
- Interviewed 8 parents of children with ASD in England.
- Interviewed 1 deputy head of an autism specialist school.
- Interviewed 1 professional practitioner of the Horse-boy method in Texas. (The horse-boy method (Equine therapy approach) is a therapeutic method using horses to help support neuro-psychiatric conditions. Developed by Rupert Isaacson was developed with his son Rowan, who has autism.)
- Interviewed 4 associated professionals (technologist, building designer interested in autism).

Children with autism may be more responsive to social feedback when administered by a therapeutic robot.

- Interviewed 2 children with autism (full transcripts in the appendices).
- Met with six autism academics and established a working network.
- Attended regular meetings of a social group for adults with Asperger's.
- Attended over 20 workshops and meetings related to robot ethics.
- Developed a partnership with the Critical Autism Network (an international research collaboration on autism that includes partners from Sweden, U.K., Brazil and Italy).

The research we present here will open the debate to the ways in which children with autism are sometimes presented in the robotics literature as beings detached from intimate relationships and preferring instead mechanical systems. This is an important debate to hold in the community. The consequences of avoiding this conversation in the community could have serious implications. If children with autism are presented as preferring objects (particularly robots and other technological items) over their interactions with other humans, we must ask 1) Is this true, and 2) What are the consequences of this approach?

In regard to the former issue, parents of children with autism, and autism educational providers stress the role of intimate relationships for children with autism and the importance of an empathetic relationship with educational or healthcare providers that come into regular contact with the child.

In regard to the second issue, could the framing of autism as an asocial condition to promote robotics studies in this area impact negatively on children with autism? The children are already singled out as having specific kinds of qualities, rather than, as many parents and teachers explained, children with autism build affective relationships with people and animals they care about. Could children with autism be *othered* by the framing of autism in the robotic literature — led by researchers who have a stake in emphasizing (or over-emphasizing) the benefits of robots? Othering creates a hierarchical order for sorting human beings, with white heterosexual wealthy and able-bodied males at one extreme, and people of color, women, children, or people with disabilities spread through the hierarchy.

Otherring works to the detriment of humanity, as it can create practices that are based on stereotypes. In the history of humanity, racial prejudice, sexism, and anti-disability are all ways in which people have been otherring on the basis of their racial origin, sex, or abilities.

In the field of autism, the scientific community's attempts to produce robots that could help children with autism and contribute to well-established therapeutic goals will not be helped by making analogies between children with autism and robots. If we chart the rise in using humanoid robots for children with autism we find analogies between children with autism and robots are present in the earliest works. Take for instance the pioneering work of Brian Scassellati whose early papers include *Theory of Mind for a Humanoid Robot* (34) and *Implementing Models of Autism with a Humanoid Robot* (35). A more recent example is by a cognitive scientist who in a recent paper made the claim

"Almost all robots are autistic; very few humans are" (46).

The paper is also titled "Curing Robot Autism: A challenge." The author goes on to write "Robots and other synthetic agents (e.g., virtual humans) are generally Autistic" (46). If robots are autists, then are autists robots? What exactly is this language implying about human beings with autism? The analogies between an autistic mind or state is taken into robotics from the field of development psychology and autism studies, particularly the model of autism developed by Simon Baron-Cohen. Baron-Cohen also coined the term "mind-blind" in his book *Mindblindness: An Essay on Autism and Theory of Mind* (3). If an autistic child is mindblind, so figured Scassellati, a robot, which has no mind, is also mindblind. This particular way of understanding autism has been criticized by many researchers including Runswick-Cole, Mallett, and Timimi (37), Timimi and McCabe (24), (25), and Collins (9), who argue against biomedical models (or the mental disorder models) setting up the Critical Autism Network. These researchers argue these deficit models fail to take into account the varied complexity, and real-lived life experiences of people with autism and the importance of their social relationships. This theme was confirmed in our interviews and during our meetings with adults with Asperger's.

Adults with Asperger's described their hurt at being socially excluded from peer networks during their school years. Rather than prefer objects to people, many had little support, and autism awareness was often lacking in their schools. Autism awareness is important as it can help people around those with autism to be sensitive to the behaviors of autistic people

Specialist help and support for the autistic person, combined with more autism awareness in the school or work environment, reduces feelings of social isolation or distress (33).

Including Stakeholder Perspectives in Ethics

Ethics is a school of philosophy devoted to exploring what is right or wrong and developing reasons for judgments informed by ideas of what it means to be human and what it means to be part of a social community. The ethics approach we use in the DREAM project problematizes the "top-down" model of the "expert" (philosopher, psychiatrist, etc.) who knows the "truth" about the world, and comes to reason about the truth outside of relations with others. DREAM ethics is built around the involvement of multiple stakeholders who hold different amounts of power, and are embedded in different knowledge systems and practices (8), (38).

We refer to the social model of disability and the difference model that explore how bio-medical critiques and practices, and social norms about "ability" and "disability" impact on the life experiences of children and adults with autism (15), (27). In its most extreme form, the social model of disability suggests that all disability is a social construct and there is no ability or disability but normative models that privilege certain abilities over others, organize society and normal functioning. We use a developmental biopsychosocial model (SOCIAL) which "incorporates the biological underpinnings and socio-cognitive skills that underlie social function (attention/executive function, communication, socio-emotional skills), as well as the internal and external (environmental) factors that mediate these skills" (5), recognizing the real difficulties children and adults with autism experience. We believe that autism spectrum conditions awareness can positively promote understanding of the difficulties experienced by a child or adult with autism, and the family of the person. However, in our ethics we include the multiplicity of perspectives to give a fuller picture of what it might be like to have autism, to be a parent of a child with autism, or to be someone in the robotics field wanting to develop socially beneficial robotic systems.

The ethics we employ in DREAM has to take into account the multiple perspectives of the consortium team, as well as parents of children with autism, adults with Asperger's, government and trusted healthcare providers, healthcare specialists, politicians, educationalists, and members of the general public. By taking the views of different stakeholders into account, we dispense with the top-down model and instead give credence and value to the experiences of all actors. This is pertinent because all lived experiences need to be taken into account and given some value in order to understand people's lived

realities, including the solutions they may attach to the challenges associated to their beliefs and value systems.

Autism Models and Change

Autism is a complex congenital condition involving severe delays and deficits in speech and language and communication and social interaction skills. The use of robots as therapeutic tools for children with autism is inspired by a number of factors summarized here:

The clinical use of interactive robots is a promising development in light of research showing that individuals with ASD: a) exhibit strengths in understanding the physical (object-related) world and relative weaknesses in understanding the social world... b) are more responsive to feedback, even social feedback, when administered via technology rather than a human,...and c) are more intrinsically interested in treatment when it involves electronic or robotic components (cited in (47, p. 2).)

In the field of robot therapy for children with autism, the theories of autism specialist Simon Baron-Cohen, particularly the Empathizing-Systemizing (E-S) theory of autism, and the Theory of Mind Mechanism (ToMM), continue to impact the underlying theory of the potential benefits of robot therapy for children with autism spectrum conditions (8), (20), (48). Recent studies have explored development of a multilayer reactive system for robots “creating an illusion of being alive” (13) to exploring how robots could engage in “synchrony and reciprocity” in social encounters between therapy robots and children with autism (26). The push to enhance the technology to explore more possible therapy scenarios is technically demanding, with real-time reciprocal social interaction still problematic. Moreover, many researchers work within the confines of existing robotic technology, virtual reality, and computer technologies developed for other purposes and studied in relation to an autism focused requirement, e.g., turn-taking, joint attention, or imitation. DREAM’s robot-enhanced technological software and hardware designed specifically for autism therapy has the potential to move the research forward. Much of the literature on robot therapy for autism rarely accounts for the changing meaning of autism over time. Autism, as a category is not fixed in time and space and its diagnosis and relevance to medicine and society is constantly shifting. For example, in the 1980s, only twenty percent of persons diagnosed with autism had an I.Q. above 80, whereas today this figure is radically different as in the 1994 version of DSM-III autism began to include persons with Asperger’s who typically had a higher I.Q. (19). Furthermore, the “deficit model” of

autism by Baron-Cohen *et al.* is challenged in some quarters by disability and difference advocates and new empirical studies (7).

Using particular types of language and premises to describe what a person with autism is like might be helpful to roboticists, but is it useful for children and adults with autism? Robots are not autistic, as machines cannot be autistic, and the analogy or metaphor of people with autism to machines and robots is highly problematic. If robots are autists, then are autists robots? What exactly is this language implying about human beings with autism? Mechanistic descriptions of autism have been used in robotics because they are drawn from the Baron-Cohen model, without taking into account the varied complexity, and real lived life experiences of people with autism.

For example Baron-Cohen’s emphasis on a lack of empathy in individuals with autism has provoked criticism from some researchers, adults with Asperger’s, and parents (33).

The use of particular kinds of language can impact the acceptance or rejection of autism-focused technology or medicine. One unsuccessful campaign was launched by Autism Speaks in 2014 titled MSSNG. The MSSNG campaign referred to a genome sequencing project, but individuals with autism took issue with the explicit “neuro-typical” language in the public launch. This led to a backlash from the autism community, particularly adults with Asperger’s and parents of children with autism. Also, there are some adults with autism that reject a biomedical approach that aims to “cure” autism. Autism advocates see autism as part of their identity. Bagatell (1) for example describes attending an Asperger’s group with a member wearing a T-shirt “eye contact is overrated” as group members subvert normative assumptions about what is socially normal. In some cultures, it is considered disrespectful for a young person to maintain eye contact with an older person or a female person to maintain eye contact with a male, so eye-contact norms can vary from culture to culture (28).

It is important in the DREAM project that language used to describe children or adults with autism is carefully considered as such language can lead to negative impacts on persons with autism and their families. As Richardson (31) has explained, the use of mechanical metaphors can be taken to extremes and persons with autism are often described as occupying a state between a typical person and a machine.

Themes from the Interviews

The research identified a number of themes relevant for discussion. These are as follows:

No One Autism for All (Nor One Robot for All).

We found that among the cohort of our interviewees,

Robot therapy must take into account the diversity of autistic children's difficulties.

children had a wide range of behavioral, social, learning, affective, and cognitive difficulties. When developing a robot therapy it is vital that the diversity of children be taken into account because at present it feels as if it is a one size (one type robot) fits all scenarios for children with autism despite their varied challenges.

Humanistic Impulses Behind Robot Therapy Might be Driven by Resource Issues and Not the Best Interests of the Children.

When we asked parents about any concerns about robot therapy, some pointed to concerns that technologies were favored over other therapeutic forms as they are less labor intensive, such as Speech and Language Therapy or traditional Applied Behavioral Analysis therapy. As an ethics team we anticipate it might be more expensive at present to deliver ABA robot therapy than typical ABA therapy as there are multiple technological devices involved (robot, computer, hard drive, kinnect system, etc.), as well as the use of an extra person at the keyboard controlling the Wizard of Oz system.

Parents Wondered to what Extent Introducing a Robot into a Child's Life at an Early Age Could Impact on Their Learning.

As the child receiving robot therapy interacts with the robot for short periods of time, we do not envisage this to be a problem for now. In the longer term, if robots become more sophisticated, then perhaps more ethical study needs to be done on the impacts of longer term exposure of a robot on the child's development. However, if demonstrable effects are noticed during the DREAM project, it will be important to highlight and discuss these.

Parents of children with autism were often in receipt of several therapies. The main therapy of U.K. parents was Speech and Language Therapy which is provided by the National Health Service. Most parents are offered and receive only a few sessions. Other therapies parents cited included music therapy, horse therapy, sensory diets,¹ and the movement method (a parent-inspired therapy focusing on learning and movement).

¹A sensory diet gives a child sensory experiences, developed by Patricia Wilbarger, they are designed to give a child enough sensory stimulation to assist the child in emotional, cognitive and motor self-regulation. Sensory diets are provided by teachers at schools for children with autism and other learning disabilities.

As researchers developing the technology and therapy of ABA, it is important to know that parental views on ABA as a therapy were mixed. Some parents identified it as an expensive and time-consuming therapy. Some even referred to it as "robotic" as it relies on repeating the same behaviors over and over again and rewarding positive behaviors.

Reactions to Baron-Cohen's Perspectives on Autism Spectrum Disorders

Central to the DREAM theoretical starting place is the importance of Simon Baron-Cohen's particular perspectives on autism:

The rationale of using robots for ASD therapies is based on the systemizing theory of Baron-Cohen: children with ASD prefer the interaction with a robot over humans because, in contrast to the human social world, robots are highly lawful systems. Being simpler and more predictable than humans, robots have the potential to become interactive partners for ASD children and can serve as an intermediate step for developing better social interaction with humans. The working assumption is that, based on the positive responses of children with ASD towards robots, the child will be more motivated and engaged in learning activities, so the abilities will be mastered earlier with less time and human resources (42).

In our interviews, parents and academics challenged Baron-Cohen's perspectives on autism as typifying an autistic person as lacking in empathy (33), lacking in theory of mind (7), and disinterested in social and communicative relationships. Baron-Cohen's "deficit" model of autism, or describing children with autism as lacking empathy is now challenged in many quarters of the autism community who advocate the social model of disability: "The central tenet of the social model of disability is therefore its rejection of the conception of disability as an individual problem, and instead seeing disability as a social construction" (6).

All the parents interviewed in the DREAM study agreed that their children enjoy interacting with computers (iPads, PCs, video games), but they also encouraged and supported their children's experiences with nature and animals. During our participant observation of experiments in Romania, and in the U.K. (the Explorers workshop) children preferred their primary caregivers and voluntarily spent more time close to their caregiver (or requested to be close to their caregivers) than any game or activity. These findings suggest that, as with typically developing children, autistic children may initially get excited when first using a new technology, but may lose interest and

revert to the one person or people they are closest to. Therefore, relating to the children in ways that expect them to prefer robots may be a disservice to them, which may lead to a lack of investment in helping them develop their social skills through more human than robot interaction. During our participant observation during the Leicestershire Asperger's group, members expressed a strong interest in engaging in social activities even though they struggled with social understanding. Here are some responses from the parents:

"We always joke he's a lover not a fighter. He's really affectionate. His hormones haven't kicked in yet, so he doesn't hit people, the only sort of challenges we have — he runs off, he's a runner."

"Nobody has actually thought about the issue is, it is that on a Tuesday morning, his taxi is different. He didn't like the taxi driver so he gets in the taxi, taxi driver winds him up, he gets out the car, doesn't really know what to do, somebody said hello to him and actually he wants to go — that taxi driver is an idiot. So he hits the person who has targeted him, we end up restraining him. So what we brought in with the calm model is that we actually become, "what is the function of the behavior that the child or young person is displaying? What are they trying to communicate with that? What state are they in?"

"Because we are devaluing the relationship, for a person with autism, they need things acknowledging us so they can deal with them, know them and shape them and move on. And if we are not doing that, then we perpetuating the cycle actually and they become less empathetic. Because we are not supporting empathy and we are not supporting those kind of things."

Moreover, adults at the Asperger's group can choose voluntarily which activities to participate in and during our observations of the group many chose to attend activities that explored social relating. Adults in the group ages ranged from 16–65 years old and there were a mixture of male and female attendees. Adults in the group were asked questions such as "what should you do if you go to a party?" or "What are the qualities of people we like or don't like?"

We believe that the ethics of child-robot interaction, for helping children with autism develop social behaviors, should value and emphasize the importance of affective attachments for the child. These important relationships in the child's life include the mother, father, siblings, or other significant caregiving others. This approach does not discount or exclude the real ontological, and neurodevelopmental difficulties

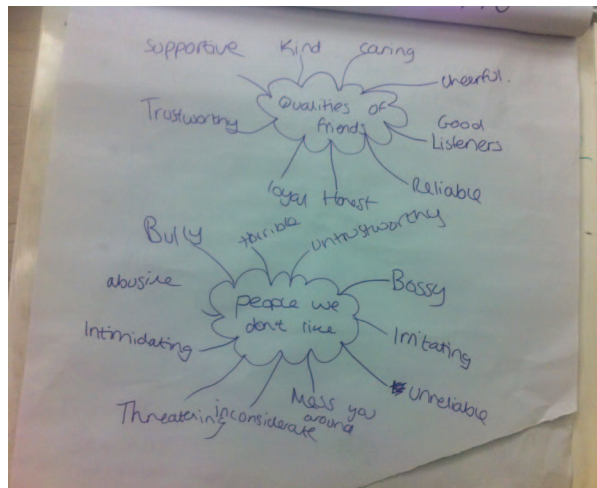


FIGURE 2. A social skills workshop at a group for Adults with Asperger's, Leicester, U.K.

experienced by a child with autism. Rather than reject opportunities to socially interact with others, the adults in this group actively participated in developing their social skills by engaging in regular workshops to improve their social skills. Adults were given specific scenarios and asked to make choices about appropriate social behaviors. Questions included "what makes a good friend" or "what makes a good work colleague." (See Figure 2.) In conversations with the young adults, they reported that bullying had been a problem for them, and although they wanted to make friends at school, they had not been accepted by their classmates. Perhaps this may go some way to explain why children with autism might seem to prefer using robots or technological tools. Also this shows that as with any child facing bullying or rejection, they eventually turn to things that they see as more accepting to them. This is different from lacking social skills and preferring robots.

In Romania, observing the experiments, it was clear there were strong bonds between the children with autism and their parents. The children actively tried to keep their parents close by during the experiments.

Reflections

If we are to build better technologies for the benefit of humanity, we must ensure that we start from the accurate premises that all humans share a common identity as a species. As a species, social attachment to others is crucial to each human being's survival. Children come into the world without the necessary cognitive, motor, social, and emotional skills necessary to survive. These developmental aspects of the human being develop over time with help and support from adult caregivers. Moreover, as a society we have established ethical principles about the way we treat each other as human

beings and enshrined law is a respect for the dignity of human beings regardless of race, class, sex, or ability. It has been necessary to enshrine these rights in juridical-legal systems because unfortunately, the history of humanity is littered with abuse and exclusion including slavery, racism, and genocide.

On our research team there were a variety of perspectives about what makes us human, and what are the similarities and differences between humans and machines. As a research collective we approach these issues in different ways. It is fortunate to work in a scientific community that allows this diversity of perspective. In this paper however, we have tried to consider the consequences of using particular kinds of models of autism that go onto inform the premises and consequential practice of the research and development into the robots for children with autism. Robotic science, clinical psychotherapy (influenced by the biomedical model of disability and difference), and the ethics of autism and robotics construct, investigate, and problematize issues in very different ways. As an interdisciplinary team we have approached the issue of autism and robots from different perspectives: experimental, clinical, engineering, philosophical, and anthropological. Synthesizing these approaches can be challenging as each discipline has its own vocabulary, history, methodologies, and unique data preferences.

Future Steps

During our first wave of ethics studies (8) that were built around a quantitative survey we found that support for robot therapy for children with autism was viewed positively by our interview cohort including parents of children with autism. Our target population was parents and therapists in Romania, Belgium, the Netherlands, and England. Participants were recruited based on databases of persons involved in our past research and messages were posted on relevant blogs, Facebook, newsletters, and websites of autism organizations. A total of 416 subjects participated in the study. Data from 22 participants were excluded from the analysis since their responses were incomplete.

In this study conducted in 2014, 23% of participants were parents of children with ASD and 17% of the participants were therapists or teachers of children with ASD. The analysis of the distribution of responses to the first two questions, "It is ethically acceptable that social robots are used in therapy for children with autism" (85% agree) and "It is ethically acceptable that social robots are used in healthcare" (85% agree) indicate that a great majority of the respondents agree with using robots in the health-care system, including in robot assisted therapy for ASD children. This is somewhat surprising, given that according to the

Eurobarometer study many people in Europe do not accept the use of robots in healthcare. Note the difference with the Eurobarometer results about care mentioned above; apparently the autism community is far more positive about using robots in healthcare, including in autism therapy. The results from this research study can be found at (8).

In order to build on this trust offered by parents it is proposed to embed humanistic ethics in any study of robots and autism, and always situate the person with autism as a *social human being with important intimate attachments*. A child with autism does not have an absent sociality, but an different sociality. The burden on people with autism can be eased when people around the autistic person gain more awareness of the difficulties of social communication. Anthropologists Ochs and Solomon (29) referred to this as an "autistic sociality" rather than an absent or deficient sociality.

The autism *community* is not a homogenous community, but is made up of medical experts, educationalists, children and adults with autism, and autism advocates. Any research into the development of robots for children with autism must consider that autism narratives are influenced by a heterogeneous set of voices, often contradictory, and conflictual. From the ethics perspective, it is important that this heterogeneity is taken into account when developing robots for children with autism.

Finally, as a generation of children with autism is exposed to robots in experimental settings in research labs, or in therapeutic settings in clinics, what will be the long-term consequence of these therapeutic interventions for the children? What will be the child's memories of their own experiences? Will children as they become adults reflect on these encounters positively? These are questions we are not able to answer, but are important to consider in the here and now.

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