Development of Robot-enhanced Therapy for Children with Autism Spectrum Disorders

Project No. 611391

DREAM

Development of Robot-enhanced Therapy for Children with Autism Spectrum Disorders

Agreement Type: Collaborative Project
Agreement Number: 611391

D7.2 Ethics white book for child-robot interaction for children with ASD

Due Date: **01/03/2017**
Submission date: **01/03/2017**

Start date of project: **01/03/2014** Duration: **54 months**

Organisation name of lead contractor for this deliverable: De Montfort University

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Revision: **11.0**

Project co-funded by the European Commission within the Seventh Framework Programme		
Dissemination Level		
PU	Public	**PU**
PP	Restricted to other programme participants (including the Commission Service)	
RE	Restricted to a group specified by the consortium (including the Commission Service)	
CO	Confidential, only for members of the consortium (including the Commission Service)	

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I Executive Summary

Deliverable D7.2 An Ethics White Book for Child-Robot Interaction for Children with Autism Spectrum Disorders (ASD) is a final deliverable version produced by M36. The final deliverable is written mainly by the ethics team, rather than a consortium-wide consensus.

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III Revision History

Version 1.0 (KR 01-02-2016)
Version 2.0 (MC 18-02-2016)
Version 3.0 (Group Discussion Review Meeting 18-02-2015)
Version 4.0 (MC 29-02-2016).
Version 5.0 (KR 29-02-2016) Final preliminary version.
Version 6.0 (Group input via email - DV, TZ, ST, BV, DD, CP)
Version 7 (MC)
Version 8 (KR)
Version 9 (BV)
Version 10 (DD, CC, SM, AS, AD)
Version 11 (KR 1.4.16)
Version 12 (KR 30-11-2016)
Version 13 (MC 1.1.17)
Version 14 (KR 23.1.17)
Version 15 (KR 31.1.2017 with updated interview material included)
Version 16 (KR 2.1.17 edited and sent to consortium)
Version 17 (KR 25.2.17)
Version 18 (MC, KW)
Version 19 (KW)
Version 20 (MC)
Version 21 (KR – submitted as final deliverable)

III Context and Background

Robots for use in healthcare are predicted to radically alter the way in which healthcare services are delivered and practiced. Technological innovation is led by healthcare challenges of reducing costs, maintaining or increasing beneficial impacts. With population ageing combined with a declining European birth rate robots and the automation of healthcare is expected to alleviate some anticipated problems in finance and resource allocation. When it comes to specific lifelong conditions, extra resources are necessary. Autism is an expensive medical and lifelong condition with one estimate on US society as $35 billion including medical and care costs over the course of a lifetime (Ganz, 2007). The development of different methods for helping to support adults and children with autism is an urgent priority. But how should the development of this technology be shaped? What kinds of issues are important that we should consider in the ethics process? Robot-enhanced therapy is developing as an important strategy to help support these healthcare goals, support children and innovate in technology. In this discussion document, we present some of the findings of recent stakeholder engagements (parents, autism educators, autism academics, adults with Asperger's) and take our research aims, goals and findings to these different stakeholders for their critical reflection and engagement. Our findings point to developing an ethically nuanced version of autism informed by the social model of disability and parental insights into autism. We discuss these issues in what follows.

At the end of the document we have enclosed two short interviews with children with autism for your interest and attention. Please note how the children have different perceptions of robots. The child with Asperger's was cautious of robots because he had seen them in cartoon depictions as violent and threating to humanity. This is important to note as children may receive information about robots from sources such as cartoons, which may influence how they view robots. As children learn about the world through a variety of sources it brings into question whether we have to be concerned about the impact on their behaviour and how they socialise and communicate.

1. Rationale for using robots for helping children with autism

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 behaviour (American Psychiatric Association 2013). The diagnostic criteria for ASD included in the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5) (American Psychiatric Association, 2013), 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 (APA 2013). 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 (Trevarthen et al., 1996 p. 3).

According to the Centers for Disease Control and Prevention (CDC), ASD occur 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 become ignored in females, for instance through 'camouflaging' techniques. Females with autism for instance use gestures more frequently than males with autism (Rynkiewicz et al., 2016). ASD behaviours include, compulsions, echolalia and motor mannerisms such as hand flapping and body rocking (Matson and Rivet 2008). There is some debate on the 'primary impairment' in ASD. Kanner's original paper (1943) cited 'affective disturbance' as the primary impairment but today, the primary impairment is recognised to be cognitive, specifically in the social domain described as "theory of mind" or "mentalizing" (Leekam 2016).

Some specialists in autism have argued that children (and adults) with ASD tend to prefer and gravitate towards things over and above other persons (Kanner 1943; Baron-Cohen 2002; Baron-Cohen and Wheelwright 1999; Baron-Cohen et al., 2002; Overskeid 2016). Baron-Cohen has termed these interests to be characteristic of *systematising,* a drive to know and build systems (2002) The drive to systemize is assumed to explain central aspects of autistic behaviour (Overskeid 2016 p. 18). Moreover, autism researchers have proposed that autism is linked to biological markers, such as high levels of testosterone, as a sex based disorder of the Extreme Male Brain (EMB) (Auyeung et al., 2009). Roboticists have creatively used this understanding of autism from psychiatry and developed robots as autism therapies. Robots retain their object like status (something children with ASD prefer), with social like qualities (which the children find difficult to understand) and research has shown this is an effective way to engage children with ASD. The challenge and unique position of DREAM is to conduct the first major study, driven by clinical researchers at Babeș-Bolyai University (UBB), to explore the effectiveness of using robots for helping children with ASD develop social skills.

1.2 The robot NAO

Research shows the positive effects of using robots as educational and therapeutic tools (Peca et al., 2014; Scassellati 2007; Dautenhahn and Billard 2002; Pop et al., 2014). In DREAM, the robot platform NAO is used in the clinical experiments and these experiments are carried out in Cluj, Romania with the help of Asociația Autism Transilvania – Cluj. NAO is 58-cm tall, has 5-kg in weight and 25 degrees of freedom for movements. It is equipped with a rich array of sensors: 2 cameras, 4 microphones, sonar rangefinder, 2 IR emitters and receivers, 1 inertial board, 9 tactile sensors, and 8 pressure sensors. NAO has various communication devices including LED lights, two loud-speakers, a voice synthesizer with language-specific intonation and pronunciation. However, the Romanian voice is not yet available on the NAO platform so that a pre-recorded human voice with sound processing effects was used in these experiments (D2.1.1 p. 9). Again language learning is not a static formalistic activity, but one in which children learn about culture and norms of social interactions. What might be the impacts of communication with a robot? This may have a direct implication on their socialisation and communication. The robot has a simplified face (no nose, no ears, a small square shaped mouth), and two eyes that use LEDs. Though NAO acts in a very sophisticated manner through speaking and moving, the robot also retains its object-like properties. It is mechanical, and 'cute', like a small astronaut. Robots are very effective tools for working with young children, typically developing and children with ASD.

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 (Ikegami and Iizuka 2007). Imitation is a vital human skill for social cognition, and helps support interactions with others, speech and language and cognitive development (Ingersoll 2008; Tapus 2012). Joint attention is the ability to attend to objects in the same space and is enacted through pointing or gaze gestures (Charman 2003).

The turn-taking task is a game and the child interacts with NAO via a Sandtray platform developed by Plymouth University (D2.1.1 p 9). The sandtray platform is drawn from the 'sandbox' and is used to help encourage collaborative playing and storytelling (Baxter, Wood and Belpaeme 2012). Robot and child can play a game by selecting the relevant objects on screen and assigning it to a relevant category. During the turn-taking task on the screen appears an emotional expression (either sad or happy) and the child has to match this facial expression with one of the categories from the left or right of the screen (the sadness category or the happiness category) (D2.1.2 p. 7)

The *JA task* consisted in the interactional partner using one of the following methods: gazing; gazing and pointing; gazing, pointing and vocalizing at different objects in order to induce JA responses. Two different objects are placed on the table that sits in front of the child (D2.1.2 p. 7).

The *imitation task* consists of four different parts. The first part is represented by functional imitation with objects, and there are 4 different movements and sounds that the child has to imitate: moving a car, drinking from a cup, moving a plane and smelling a flower. The second part of the imitation task is the symbolic imitation with objects, which has the same four movements as the functional imitation task, only that this time instead of the real objects the child and his interactional partner use a wood cylinder pretending that it is a real object. The third part of this task is imitation without objects and it consists in four types of arms movements that are accompanied by sounds. The last part of the imitation task consisted in imitating four basic emotions: happiness, sadness, fear and anger. The emotions were illustrated by using hand gestures, head movements and sounds (D2.1.2 p8).

IV Methodological Discussion

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 (Stahl and Coeckelbergh, 2016a; Coeckelbergh et al., 2016). We characterise this approach to ethics 'as collaborative ethics' developed by Stahl and Coeckelbergh (2016a) in relation to developing Responsible Research and Innovation (RRI) in healthcare. We refer to the social model of disability and 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 (Mallett and Runswick-Cole, 2016; Grandin, 1992) In its most extreme form, the social model of disability suggests that all disability is a social construction and there is no ability or disability but normative models that privilege certain abilities over others, organise 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" (Beauchamp and Anderson, 2010), recognising 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 their family. In our ethics deliverable 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 trust healthcare providers, healthcare specialists, politicians, educationalists and members of the general public. By taking into account the views of the different stakeholders, 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.

Quantitative Survey Data Collection

In our quantitative research study we identified areas of concerns:

1.2 Ethical Acceptability, Replacement, and Autonomy

Given the general attitude towards robotics in health care mentioned previously, we want to know if this is also the case for therapists and parents of children with ASD. More specifically, do parents and therapists think it is ethically acceptable to use robots in therapy for children with autism? Do they have problems with accepting that robots may replace therapists or if it is more acceptable that robots help, without replacing the human therapist(s)? Replacement is not only an issue in autism therapy but in the ethics of health care robotics in general: there is a growing body of literature in this field (see for instance Sparrow and Sparrow, 2006; Sharkey and Sharkey, 2012; Coeckelbergh, 2010). What are the implications for human labour, and is the quality of the care process improved when robots are introduced? For instance, are robots introduced in health care and therapy only to save money, or also and mainly to improve the quality of care? And does the use of robots in care contribute to "cold", mechanistic aspects of modern health care, or are there other possibilities? What do we mean by good care, and does good care necessarily exclude the use of advanced technologies such as robots and (other) information and communication technologies (ICTs)? (Stahl and Coeckelbergh, 2016b). In this case questions are included regarding the following issues: What would the use of robots in autism therapy mean for the quality of therapy? Does it mean that humans are replaced by robots? How exactly would the therapy change? These questions also relate to the issue of autonomy: does the use of autonomous robots necessarily mean replacement of human carers and therapists, or not? How, exactly, do autonomous robots change the practice of care? For ASD therapy this means: how, exactly, do (more) autonomous robots change the way therapy is done, and what is the (remaining) role of the therapist?
In our survey we asked:

1. ● Is it ethically acceptable that social robots are used in healthcare?

2. ● Is it ethically acceptable that social robots are used in therapy for children with autism?

3. ● Is it ethically acceptable to use social robots that replace therapists for teaching skills to children with autism (e.g. imitation, social skills)?

1.3 Safety and Trust

Related to acceptability is the issue of safety and trust. Clearly robots should not harm people and be safe to work with. As Feil-Seifer and Mataric (2005) state, the most obvious risk of any assistive technology is the potential of physical harm. This is especially important in health care and therapy, since it involves vulnerable humans such as ill people, elderly people, and children. In this case children are involved. Child–robot interaction should be safe and social robots are often explicitly designed for safety (see for instance (Goris et al., 2011). However, to address the issue of safety it is not sufficient for robotics researchers to say that, on the basis of literature and experimental tests, their robot is safe. There may be a difference between "objective" safety based on experimental evidence (if this exists at all) and perceived, "subjective" safety. The importance of the latter is also acknowledged by many robotics researchers. In our survey, we asked if people think that it is safe for children with autism to interact with social robots (with or without therapist supervision), if children can get physically hurt by the robots (for instance if it fell on a child), if it is safe for them to touch and hug the robots, and if they would feel comfortable in the presence of the robots. We asked for instance:

● It is safe for children with autism to interact with social robots under the supervision of a therapist?

● Is it safe for children with autism to interact with social robots without therapist supervision?

The use of robots in this kind of therapy also raises the issue of trust. Are parents prepared to leave their children under the care of the robot? Can the children be left without any adult supervision? Do parents

trust robots that move, or that are bigger and stronger than the child? Do therapists think it is safe for children to interact with a robot? There has been philosophical reflection on trust and robots in general Coeckelbergh (Coeckelbergh, 2012) and Feil-Seifer et al (2005) mention trust as part of their discussion of benchmarks for evaluating socially assistive robotics: 'Can a user and caregiver put the necessary trust in a robot system for that robot to be able to perform effectively?' (Feil-Seifer and Mataric, 2005). But so far no work has been done on trust in robots used for autism therapy; again it is important to know what stakeholders think about this. Therefore, in our survey we also asked questions about trust: would people trust a robot (mobile or not mobile)? Should social robots respond autonomously to the child's behaviour's, without an operator?

1.4 Emotions and Attachment

Emotions are very important in social interaction and studies showed that the motivation of the children is very important. But is this also perceived by parents and therapists? We want to know if parents and therapists think that robots could be perceived by the children as having emotions and elicit enjoyment and fun in play settings. There is also the issue of emotional attachment on the part of the child, and this is again an ethically relevant issue: is it acceptable that children with autism get attached to the robot?

In our survey, we asked about the ethical acceptability of children with ASD perceiving social robots as friends, of children with ASD becoming attached to social robots, and of making social robots that look like humans, like animals, like imaginary creatures, or like objects. Questions included:

- Is it ethically acceptable that, as a result of their therapy, children with autism perceive social robots as friends?

- Is it ethically acceptable to make social robots that look like humans?

- Is it ethically acceptable to make social robots that look like animals?

In our survey, we asked many questions about how helpful social robots can be in therapy for children with autism. Can they be helpful at all, can they improve the outcomes?

1.5 Privacy and Data Protection

On the one hand, there is a need for researchers, therapists, and parents to retrieveinformation about the progress of the child and monitor the quality of the therapy. On the other hand, there are issues concerning the recording and storage of information: who has access to this information, are the data securely stored, to whom are the data passed on, etc. Again these issues are not confined to RAT but are relevant to all uses of robotic technology and ICTS in health care. In our survey, we asked participants to respond to the following claims:

- It is ethically acceptable that information is recorded and stored by a robot when it interacts with a child with autism.

- It is ethically acceptable that social robots are used to monitor the progress and help in the diagnosis process of a child with autism.

1.6 Practical Aspects of the Methodology

The questionnaire was mainly offered on-line by the free and open source online survey application LimeSurvey installed at the Free University Brussels webserver and was available in three languages English, Romanian and Dutch. This software enables the researchers to develop and publish surveys, and collect responses, without doing any programming. Robots exists in different shapes, sizes and capabilities for wide range of applications; we introduced the social robots to be used by means of a 1 min video in

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. As mentioned before 23 % of the participants were parents of children with ASD and 17 % of the participants were therapists or teachers of children with ASD.

1.7 Data Analysis and Results

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—see Fig. 2) 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 health care. 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 autism therapy.

However, in line with our discussion of ethical issues, it turned out that a significant number of participants (44 %) were opposed to the idea of the robot replacing therapists (Fig. 3): instead many respondents preferred that the interaction is supervised by the therapist and that the robot is tele-operated rather than fully automated.

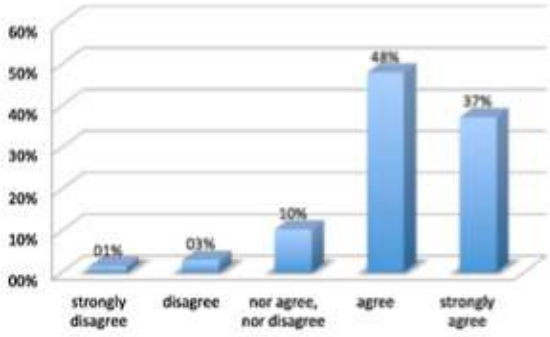

Fig. 2 It is ethically acceptable that social robots are used in therapy for children with autism

A large majority of respondents—84 %—rather agree with the robot supporting the interaction between therapist and child, instead of replacing the therapist. Most respondents (84 %) also think that it is ethically acceptable that social robots are used to monitor the progress of the child and help in the diagnosis. But what is the most acceptable appearance of the robot for these purposes? We asked about robots that look like humans, animals, objects, and imaginary creatures. Most respondents (74 %) think it is ethically acceptable to make social robots that look like animals (Fig. 4).

Using social robots that look like objects (66 %) and imaginary objects (63 %) seems slightly less accepted, but still a large majority does not have a particular ethical problem with it. A human shape, by contrast, is perceived as more ethically problematic: in this case only 55 % thinks they are ethically acceptable; 16 % disagrees and 5 % strongly disagrees.

Furthermore, our respondents seemed to worry that children will see the robot as a friend (only 43 % thinks it is ethically acceptable) (Fig. 5) and that children will become attached to the robot (only 40 % thinks this is ethically acceptable).

Finally, for most respondents data protection was not a big issue. For example, about 78 % think it is ethically acceptable that the robot records and stores information when it interacts with the child. Only 6 % think it is a problem—they disagree and think it is not acceptable.

1.8 Discussion and Limitations

In general, it turns out that key stakeholders find it acceptable to use social robots in healthcare and for therapy for children with autism.

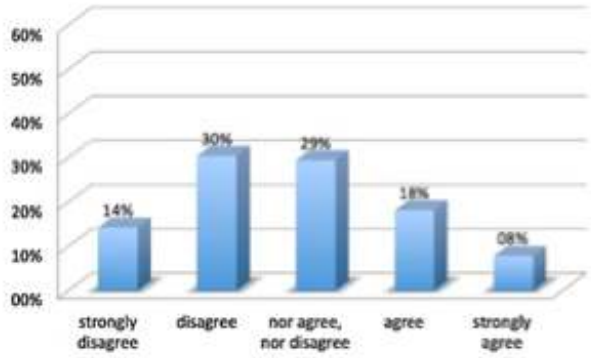

Fig. 3 It is ethically acceptable to use social robots that replace therapists for teaching skills to children with autism (e.g. imitation, social skills)

Perhaps part of the difference with the Eurobarometer results is due to our choice to explain in a video the concept of a social robot. But in general the likely reasoning for this acceptance, if any, is that people agree to the design and use of these robots if they are beneficial to a therapy. There is a relatively high demand in the autism community for trying new therapies, including therapies that involve robots.

However, our respondents are far more hesitant about the idea that these robots would replace therapists; most participants seem to rather think that if they are used at all, robots should support the interaction between therapist and child and monitor the progress of the therapy, without replacing the therapist. Based on our ethical discussion, we speculate that the reason for this could be that therapy, like health care in general, is seen as a “human” activity and practice in which humans should retain the role of the therapist. Robots could be part of the therapeutic process, but not as therapists.

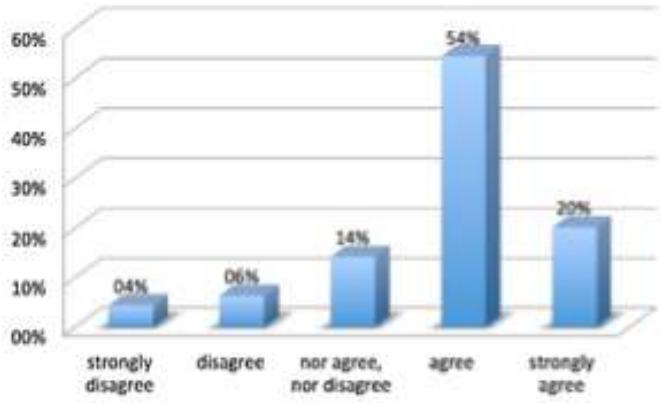

Fig. 4 It is ethically acceptable to make social robots that look like animals

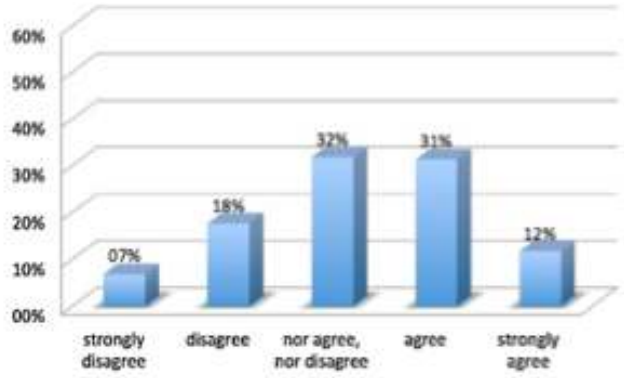

Fig. 5 It is ethically acceptable that, as a result of their therapy, children with autism perceive social robots as friends

This is an important message for the ethical discussion about robot-assisted therapy and for therapist and researchers using and designing social robots. These results suggest that therapists should conduct their therapy and research in such a way that (perceived) replacement or displacement of the therapist is avoided and support the idea of giving the robot—at most—what we in the FP7 project DREAM call supervised autonomy (Thill et al., 2012). The robot is then capable of some autonomous behaviours and interaction, but the therapist remains in the room and supervises and—if necessary—intervenes in the child–robot interaction.

Some respondents are also worried about the possibility that the robot is perceived by the child as a friend, or that the robot looks too human-like; they are generally more positive about robots that look like animals. They even seem to prefer the animal-shaped ones over object-shaped ones or imaginary creatures, expressing perhaps the hope that animal-shaped robots will be better at performing a social, interactive function in the therapeutic process. Maybe parents and therapists do not want children to see the robot as a human or a friend because they worry that the robot would replace human–human relationships (see also again the replacement issue). Animals may then be a “safe” choice since generally we do not seem to worry too much about human–pet relationships replacing human–human relationships. Our respondents also worry that the child might become attached to the robot and see the robot as a friend. The additional reason for this worry may be that people think that if the child becomes too attached to the robot, this then causes distress when the robot is no longer present. This result presents a challenge to those roboticists who develop robots that look like humans in ASD therapy.

In general, however, the responses to the other questions suggest that most stakeholders approve of using social robots in autism therapy, for example to learn social behaviours, and therefore (we may suppose) they approve of developing this kind of robot.

Finally, privacy and data protection was not seen as major ethical issue, or at least most respondents agreed with the robot collecting and storing data during the therapy. This does not mean that this privacy and data protection do not deserve our attention in this context and the 6 % minority should not be ignored. But the replacement issue and the question regarding the appearance of the robot seemed to elicit more ethical concern. The reason for this may be that generally people do not associate robots with privacy problems (in contrast to computers, for instance).

These results are important for at least the following target groups of this article: designers of robots for RAT and therapists who use RAT. While our data do not suggest in any way that research and use of robots in ASD therapy is unethical, both groups need to take into account the ethical issues indicated by the ethical analysis and the survey. Specifically, our results suggest that particular attention needs to be given to the issues of replacement, appearance, and attachment, since these are key issues that emerged from the research: key issues that emerged from the ethical analysis and key issues that seemed problematic in the opinion of stakeholders. Furthermore, we hope that ethicists working in other fields of human–robot interaction may find these results helpful. It is clear that there are many similarities and convergences when it comes to ethical issues; the challenge is now to better understand them conceptually (the deception issue for instance is rather complex) and to draw implications for design and use in practice.

The results of the study are presented in two peer-reviewed published journal articles (Coeckelbergh et al., 2016; Peca, 2016).

2. Qualitative Data Survey Collection

In our ethical study we collected data using qualitative data collection techniques and these include: drawing on experimental studies of robot therapy for children with autism; participant observation of DREAM experiments; interviews with parents receiving the therapy for their children and those who are not; 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. We organised a mini-public in early 2017.

Qualitative research methods allow for personalised 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.

2.1 Interviews

Interviews are a well established qualitative research method. In depth interviews allow researchers the opportunities to collect ‘life histories’ (Thompson, 1993) of the participants. Interviews can open up previously unexplored terrain and allow the researcher to be open to personal histories, experiences and lived accounts that may be excluded or ignored from quantitative studies. Another way of conceiving the interview is as a form of ‘narrative’ (Riessman, 1993). Narrative analysis is a form of story telling. We association stories with fictions, but scholars increasingly drew upon narrative analysis to show how accounts of the world were made, produced and what kinds of evidence produced them (interlocking

narratives) 'Narrative analysis takes as its object of investigation the story itself' (ibid p. 1) and 'Narrators creates plots from disordered experience, give reality "a unity neither nature nor the past possesses so clearly. In so doing, we move well beyond nature into the intensely human realise of value"' (ibid p.4).

We carried out in-depth interviews lasting from 30mins to two hours. Deliverable D7.2 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[1]
- interviewed 4 associated professionals (technologist, building designer interested in autism)
- 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 in autism that includes partners from Sweden, UK, Brazil and Italy).
- KR spoke directly with Mady Delvaux-Stehres about the ethical issues of reframing robots as 'electronic persons'.
- Scheduled and planned a Mini-public (10 attendees including parents of children with autism, non-user group members of the public, robotic scientists and researchers interested in public engagement on robotics).

The ethics team contacted more participants for interviews but some of our respondents had difficulty in meeting up, including parents and professionals. For example, speech and language therapists were the group that was most frequently cited by parents of children with autism as therapy they receive on the National Health Service (NHS) for free. Yet despite repeated attempts to make contact with speech and language therapists, no therapist was able to participate *in any interviews* due to the following reasons:

- Email addresses or phone numbers out of date/out of service
- Speech and language therapists not responding to or returning phone calls or emails
- Unable to meet up due to heavy workloads.

This is an important finding as it indicates how difficult it is for researchers to engage with the field of speech and language therapy. Our experiences of trying to make contact with the therapists echoed many of the problems described by the parents who had tried to access services. As a consequence, this may have an impact on the children that need the services as they may not have access to them on time. And potentially when they do, the time allocated to them may be limited because therapists need to attend to other workloads. In addition, chances are that the experiences of the children and even those of the parents may not always be taken into consideration, thereby missing valuable insight into the therapies that can work best for the concerned parties.

[1] 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 (Isaacson, 2009). Advocates of this method were open to using robots. The ethics of Horse boy and other methods was very much about connecting with what works for each individual child with autism.

2.2 Mini Public

A mini public is also known as an 'action method' involving diverse participants to deliberate on a topic.

What is a Mini public?

"Deliberative Workshops are a form of facilitated group discussions that provide participants with the opportunity to consider an issue in depth, challenge each other's opinions and develop views and arguments to reach an informed position. They allow the organisers conducting the event to have a greater understanding of what may lie behind an opinion or how people's views change as they are given new information or deliberate on an issue. Deliberative Workshops can be similar to focus groups, although there tends to be a greater emphasis on deliberation".

Source: Action Catalogue - http://actioncatalogue.eu/method/7388

Thephilosophy underscoring the development of mini publics is inspired by democratic deliberation, and are geared towards generating discussion for future policy recommendations and political impact. Established democracies have seen a decline in public participation over the last 60 years. In his classic text, *Bowling Alone*, Putnam (2001) describes the people's retreat from the public sphere, using the example of bowling clubs. In areas of conflict and controversy, mini-publics provides a means to examine different concerns about a specific topic. Mini-publics differ from focus groups as they are not instrumental, the facilitator does not have an agenda to advocate for one position or another, but to facilitate openness among participants. Elected officials represent a constituency, and with decreased political participation it has disconnected public office and the people. The mini public is about reengagement, and reinvigoration in the public sphere. Inspired by the philosophy of Jürgen Habermas 'communicative rationality' in which speakers come to consensus through rational discourse. Niemeyer (2011) writes 'Although the Habermasian tradition of deliberative democracy began with concern about the corruption of the public sphere, the grander claims of deliberative theory have largely been tested using deliberative mini-publics' (p. 104).

There is some disagreement whether the ideals of 'communicative rationality' can be achieved through the mini public process, as the principles are drawn from abstract socially engineered ideals 'Deliberative democracy stresses broad-scale participation in political decision-making and the activation of "citizenship" in determining outcomes. Ideally speaking, citizens are supposed to be willing to engage in "communicatively rational" discourse, free ofstrategic manipulation' (ibid, p. 105). Such an approach can ignore the role of power and how it is held in different ways by citizens. In order to minimise bias, the facilitator took no active participation in the group discussions, and only recorded findings made by the group.

We invited a mixture of participants: parents, autism professionals, medical professional, speech and language therapists, the local government assistive technology liaison officer, a local MP, local business leaders, retired professionals and students and academics. Despite attempting to reach out to a wide and diverse community, it was challenging to find a suitable date and time which all the participants could attend. Despite the problems in recruitment for public engagement we believe as an ethics team this is a vital and important area to pursue and encourage. By including stakeholder perspectives in this ethics document, we have remained committed to our collaborative ethics approach (Stahl and Coeckelbergh, 2016b). Collaborative ethics is involves paying attention to others, developing partnerships, valuing different perspectives, and encouraging diverse involvement. A mini public (deliberative workshops) allow members of the public to come together to dialogue about a specific issue. Our final attendees

included a parent of children with autism, lay members of the public, undergraduate students, academics and researchers in public attitudes to robots.

2.3 Structure of the Mini Public

The participants were asked to deliberate on the question:

For good or bad: How should robots change healthcare, & autism healthcare services?

We asked participants to consider the following issues by presenting short presentations:
General perceptions of robots – cute, scary
Does it matter if a service (therapy) is delivered by a person or a robot?
Can automation of services for autism be a good for the NHS? Or what are the potential pitfalls?
Issues related to unemployment and robotics.
Perceptions and experiences of ABA therapy
Could robot therapy work with other therapy approaches? e.g., speech and language therapy
Privacy and data protection issues
Health and safety and robots
Autism advocacy and alternatives to expert models of care

Figure 6. A mini-public discussion – consent to use of this issue granted with permission, February 2017, De Montfort University, Leicester

Four short presentations were used as a platform to encourage discussion. The presenters included an ethicist of robots, a public engagement researcher in robotics, and a robotic scientist who had carried out research on autism and robots (using the robot NAO).

2.4 Summary of Main Issues

In general we found the participants of the mini public to be more concerned about robots and the use of robots more widely than we had encountered from the parents in the previous interviews. Participants raised issues of:

- dependency on robots - getting too attached as are concerned raised about mobile phone, social network checking (twitter, facebook)

- privacy and data protection - potential for abuse of young children when data generated from robot use is managed and accessed by unscrupulous people

- wizard of oz – someone in control of the robot behind the scenes who may not be known to the users

- concern about introducing robots in healthcare by presenting them as harmless without full discussion about their impacts.

- narrative and decision making of the introduction and use of robots in healthcare. Although this ties in with concern about introducing robots in healthcare, the participants went further to discuss the narrative taking place in robots in healthcare. They indicated that the narrative was unclear in terms of who decides that robots should be used in healthcare and by implication who is consenting to such use because to them, it appears that the public has very little input in this narrative and decision making if at all.

- concern about isolation – that robots are part of an ongoing problem of increasing isolation

We found the mini-public offered a way in which participants could explore and take conversations in different directions. In general participants enjoyed the experience and had much to contribute on this topic.

V Autism(s)

3. 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 Diehl, Schmitt, and Crowell 2011, 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 Theory of Mind Mechanism (ToMM) continues to impact on the underlying theory of the potential benefits of robot therapy for children with autism spectrum conditions (Richardson 2016; (Gillespie-Lynch et al., 2016; Coeckelbergh et al., 2016; Huijnen et al., 2016). Recent studies have explored development of a multilayer reactive system for robots 'creating an illusion of being alive' (Esteban et al., 2016) to exploring how robots could engage in 'synchrony and reciprocity' in social encounters between therapy robots and children with autism (Lorenz, Weiss and Hirche, 2016). 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 per cent 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. (Hollin, 2014). Moreover, recently the 'deficit model' of autism by Baron-Cohen et al. is challenged in some quarters by the disability and difference advocates and new empirical studies (Grinker, 2008; Grinker, 2010; Ochs and Solomon, 2010; Brownlow and O'Dell, 2009).

Moreover, using particular types of language to describe what a person with autism is like might be helpful to roboticists, but is it useful for children and adults with autism? Let us give a recent example of the kind of language and perception used in computer science circles about autism:

> "Almost all robots are autistic; very few humans are." (Kaminka, 2013)

Robots are not autistic, as machines cannot be autistic, and analogy or metaphor of people with autism to machines and robots is highly problematic. The paper is also title 'Curing Robot Autism: A challenge'. The author goes on to write 'Robots and other synthetic agents (e.g., virtual humans) are generally Autistic' (Kaminka, 2013). If robots are autists, then are autists robots? What exactly is this language implying about human beings with autism? We believe that such descriptions of autism have come about in robotics because of narrow descriptions of autism drawn from 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 lack of empathy of individuals with autism has provoked criticism from some researchers, adults with Asperger's and parents (Robinson, 2014).

The use of particular kinds of language can impact on 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 advocate see autism as part of their identity. Bagatell (2010) 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-contract 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 (McCarthy et al., 2006).

It is important in the DREAM project that language which is 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 (2016) 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.

Figure 7. Autism diversity Poster

3.1 Accounting for differences in perspectives between parents, ethicists and roboticists

No one autism for all

We found that among the cohort of our interviewees, their children had a wide range of behavioural, social, learning, affective and cognitive difficulties. When developing a robot therapy it is vital that the diversity of children is taken into account because at present it feels as it is a one size (one type robot) fits all scenario 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 of any concerns about robot therapy, some pointed to concerns that technologies were favoured over other therapeutic forms as they require less resources. As an ethics team we anticipate it might be more expensive at present to deliver ABA robot therapy than typical ABA therapy as there is technology involved (robot, computer, hard drive, kinnect system), as well as an extra person 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. However, if demonstrable effects are noticed during the DREAM project, it will be important to highlight and discuss.

Parents of children with autism were often in receipt of several therapies. The main therapy of UK parents was Speech and Language Therapy which was just offered for a few sessions. Other therapies parents cited included music therapy, horse therapy, sensory diets and the movement method (a parent inspired therapy focusing on learning and movement).

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

3.2 Structural problems for parents in receiving therapies

All parents of children with autism indicated they had significant problems accessing services and support for their children. Parents notice something different about their child early on and visit a GP in the first instance. Many parents assumed their child's lack of response might be a hearing issue, or as a 'slow learner' and their development was just delayed. Parents of children with autism described how it took many years for their child to receive a diagnosis of autism. Some parents began to search independently of medical support on the World Wide Web. The internet is an important source of information (and misinformation) for parents, and also a way in which they connect with other parents. One parent for example has an international following. All parents were open to receiving ANY therapy for their children.

"About 1 and a half we realised that possible she could be deaf. She really wasn't responding to verbal things. If you walked into a room she wouldn't turn around. So we had to go through that process with the NHS. So we went to a charity in Cambridge and got a proper test to basically say it wasn't conclusive. And then they did an ERA. …which is a brain stem response test. It was at Kettering at the hospital, so she had to be put to sleep for that. They put earphones on and put stickers all over her head and they then, it was the only way to conclusively say, 'she can't hear or she can hear'. Because the problem is a child on the spectrum they can be ignoring life so much, in their own world, just blocking people out. And all of the hearing tests they came back and we didn't know. It was the only way to know, and it came back and her hearing was actually better hearing. That was a good moment, but then a bad moment because we got dumped out of the system then, like 'you're hearing's fine, whoopie'….then there was no follow up. She was only one and half so they said it's too early. At 1 and a half then, that was 4 years ago. [Cambridge] it's a charity that does hearing tests. My husband found it. He was on my crusade. That wasn't done on the NHS that was done privately. It was just to get enough ammunition for us to say to the NHS we really need a hearing test. This particular hearing test. It's so expensive."

"Yes it is a long time. It's a long time especially when you go straight into the world of google and all you see is early intervention is crucial. So us as parents wanting to do the best for him but we couldn't access anything until he had his diagnosis, just because I had autism specialists saying he's autistic, until someone gave me the piece of paper I couldn't do anything about it."

"Well that's a problem. Once you put autism in a google search it's just massive. I remember looking at it at the time and it was just we're about to emigrate to New Zealand. He got a job, we knew we were going but we knew something was wrong with A but no one was confirming it. The pressure was on really. I can remember my husband night after night and he would be on the computer looking at, autism and seeing some scary things, seeing 10 year old kids in nappies. It's those sort of things, when you've got this beautiful perfect baby, I had a normal pregnancy, I had a normal delivery. The only sort of difference about it was he was a whooper, he was 10Ibs 1. So he was a big baby. Googling it was just massive. We decided to focus down on communication and what we could do to help him. And that's when I started on laminating, laminating everything in sight. When you're an autism parent the first thing you should buy is a laminator. I went around photographing everything and using those as basic symbols, so we had some basic form of communication."

We realised all parents had experienced difficulty in early years diagnosis of autism and it can take many attempts by parents to visit healthcare providers to receive appropriate diagnosis, care and support. All parents turned to independent research to find out more about autism, and used the available information on the internet as a means to gain awareness, insight and seek help for their children. This often puts parents in touch with other parents, and creates an online dialogue and helps parents to overcome feelings of isolation.

3.3 Perspectives on ABA therapy

Applied Behavioural Analysis (ABA) is a well-supported therapeutic intervention in autism that is supported by several hundred 'single case experiments and an increasing number of between-groups experiments' (Granpeesheh, Tarbox and Dixon, 2009). ABA is informed by the behaviourist traditions in psychology and founders include John. B. Watson who coined the term 'behaviorism' in 1913 and early forms of description of behaviourism by Watson rejected any 'introspection' and claimed it to be a purely objective experimental branch of natural science (Schneider and Morris, 1987 p. 29). Watson's reaction to 'introspection' has to be contextualised in the 1900s that was dominated by the study of mental processes 'carefully observing one's own conscious mental, emotional, or feeling states was the primary method of investigation' Watson's theories was followed and complimented buy the work of B.F Skinner Later adaptions of behaviourist therapies recognised the 'cognitive' element of behavioural patterns. According to Autism Speaks, a US based autism charity:

> 'ABA is a set of principles that form the basis for many behavioural treatments. ABA is based on the science of leaning and behaviour...ABA therapy is used to increase language and communication skills. It is also used to improve attention, focus, social skills, memory, and academics….ABA is considered an evidence-based "best" practice treatment by the US Surgeon General and by the American Psychological Association. "Evidence based" means that ABA has passed scientific tests of its usefulness, quality, and effectiveness' (Dixon, Vogel and Tarbox, 2012).

ABA is an intensive therapy (e.g., up to 40hours per week which is more than the average working week for a European adult), and treatment is started as early as possible. The importance of behaviourism in the clinical research of the DREAM project is exemplified in the built environment of the Department of Clinical Psychology and Psychotherapy Babes-Bolyai University which features rooms that are named after Skinner and Watson and portraits of these founders hanging on the walls of the institute. As an ethics team it is important we try to gain more understanding of ABA as this is the primary therapeutic method, and the robot will be an 'instrument' of supporting the therapists. We wanted to engage with different stakeholders about their perspectives and experiences of ABA therapy.

In our interviews parental responses to ABA therapy were mixed. All parents agreed that more therapy for their children was needed and necessary. All parents agreed that therapy was time-consuming and expensive. However, responses to ABA therapy were mixed. Many parents thought the reward behaviour system was limited because it was learned behaviour that may not be generalised to other situations outside the therapeutic encounter. Some parents believed the success of different kinds of therapy (including ABA, speech and language therapy, Horse-boy method and music therapy) depended on the child. All parents agreed that autism is expressed uniquely in each individual child. Some interview responses:

"the child does anything because he or she learns"

"A chicken is only a chicken if it is this one. From this point of view my husband was not very happy."

"Yes it's a high level of activity. But now at five years and four months we started a treatment with him on his behaviour and ADHD and verbal behaviour and everything that's new. I said I wanted behaviour therapy, three years of intensive therapy, 7, 8 hours a day, no break, during the holiday we had one week when we go to the seaside and then we come back and go on with therapy. He was not like another child, but everyday! Everything!"

"It's very important for the person who works with the robot and to have principles from classic therapy. Especially when you work with a child with behaviour problems. Not to, reinforce…functional behaviours. It's important to know the principles."

The parents in our interview cohort expressed different concerns and hopes about ABA therapy as a technique. In general, *the robot was not perceived as threatening because parents were familiar with ABA therapy prior to the commencement of the robot therapy*. Parents expressed a lack of concern about using robots as therapeutic tools for helping children with autism. Academic narratives of autism and robot therapy are produced, in the main, by robotic science as the primary field of expertise (Robins, Dautenhahn and Dubowski, 2006; Robins et al., 2005; Vanderborght et al., 2012; Scassellati, Admoni and Mataric, 2012) and follow-on studies that show improvement or prosocial behaviours of children's outside the specific experimental or observation context are rarely accounted for in many studies. Although Scassellati, Admoniand Mataric (2012) report the transference of social behaviours in children with autism from using computer-assisted therapy and virtual reality approaches (p. 278). In the context of ABA therapy, all parents had previously used ABA therapy before the robot experiments, had some knowledge of the principles of the technique. This is important for contributing to the question asked by Costescu and David (Costescu and David, 2014) that knowing underlying reasons is important for us to understand why users will or will not accept robots in healthcare.

Parents' lack of concern about using robots for autism therapy is notable. In general, all parents had encountered many different forms of therapy. Two of my interviewees were pioneers of new therapy methods for children with autism (methods that had received considerable public attention). Parents do not believe one therapy form will provide all the answers. Similarly, parents do not express fear that a robot will become more important to a child than they are. Most parents view robots alongside other kinds of technologies, such as the ipad, mobile phones, computer games or computers. Parents did express concerns about letting their children spend too long on these devices. The concerns of parents of children with autism are not too dissimilar from concerns of parents of typically developing children (Hiniker, Schoenebeck and Kientz, 2016).

This is not to discount the research that shows that children with autism enjoy, or can benefit from interacting with technology (Baron-Cohen et al., 2009; Tapus et al., 2012; Scassellati, Admoni and

Mataric, 2012), just that parents in our study did not privilege therapy delivered by technology – robot therapy. Parents engaged in many different activities to help soothe, comfort or assist learning for the child which included cycling, learning about nature, painting, meeting with relatives and learning about animals (cats and horses were important animals in the cohort).

3.4 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 (Annex 1 – description of work – Part B p. 106).

In my interviews with parents and academics challenged Baron-Cohen's perspectives on autism as typifying an autistic person as lacking in empathy (Robinson, 2014), lacking in theory of mind (Brownlow and O'Dell, 2009) 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' (Brownlow, 2010).

All the parents interviewed 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 out participant observation of experiments in Romania, and in the UK (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. This suggestions that like with any child, autistic children may initially get excited with any sort of technology but may lose interest and revert to the one person or people they are closest to. Therefore, relating to them in ways that expects the child 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 behaviour 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 my observations of the group, many choose to attend activities that explored social relating. Adults in the group ages ranged from 16-65 years old and had 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?'

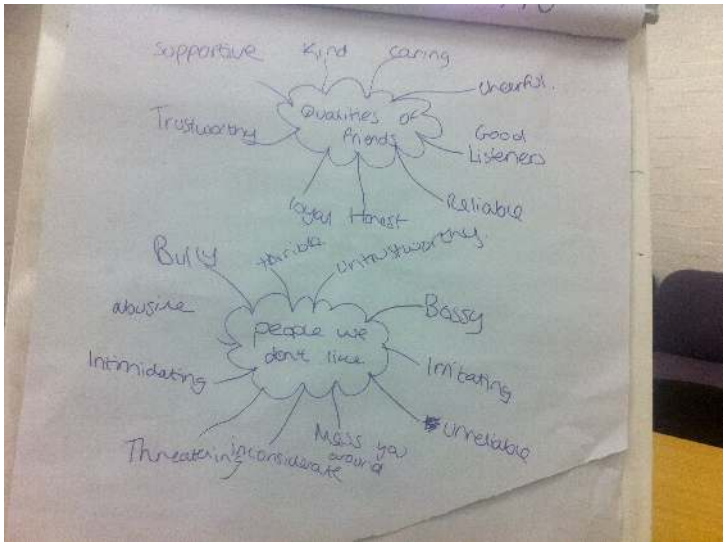

Figure 8. A social skills workshop at a group for Adults with Asperger's, Leicester, UK.

We believe the ethics of child-robot interaction for helping children with autism develop social behaviours should ensure that an appreciation of the presence of social, and affective attachments are also of high importance for the child with autism. This does not discount or exclude the real ontological, and neurodevelopmental difficulties 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. In conversations with the young adults, they told me that bullying had been a problem for them, and though 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 like 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.

VI General Issues

There are critical evaluations of healthcare technology visions in terms of their implications for society and on healthcare, for example:

4.1 Replacement and its implications for labour

Are robots introduced to solve problems in healthcare and elderly care, or are they introduced to save money by replacing human care givers by robots, and to help robotics research and industry? For instance, in research concerning the development of robots for the elderly, robots are often presented as a response to demographic challenges. But are such technological solutions the main or only way we should tackle these challenges? And if there is truth in the suspicion that robots will replace humans, which problems exactly would they solve, and is robotics really a threat to employment? More generally, what are the consequences for healthcare work? For example, do robots and ICTs threaten ‘‘care craftsmanship’’ ?

4.2 Replacement and its implications for the quality of care: de-humanisation and “cold” care

An important fear in discussions about robots in healthcare is that robots may replace human care givers, and that this may not only put these people out of job, but also remove the capacity for ‘‘warm’’, ‘‘human’’ care from the care process. It is highly doubtful, for instance, if robots could ever be empathic or have emotions. Robots, it seems, are not capable of a ‘‘human’’ kind of attention and care, whereas healthcare seems to involve more than some ‘‘behaviours’’; humans have various social and emotional needs, which are not necessarily met by giving them a robot. ‘‘Machine care’’ sounds cold and mechanical. There is the concern that elderly people are abandoned, handed over to robots and devoid of human contact. More generally, do machines in care ‘‘objectify’’ care receivers? Do they objectify care givers (see also the previous point)? What do we mean by good healthcare? Do we have good healthcare today, without even considering robots? Is good care possible in the context of modernity? Second, there are issues that have less to do with the idea of replacement as such but are raised by human–robot interaction in healthcare and especially by the robot taking over tasks from humans, for instance:

4.3 Autonomy

Not all health care robots are autonomous robots. For instance, surgical robots are remote controlled by the surgeon. Yet health care research often aims to give more autonomy to the robot. An important term in the field, for instance, is autonomous systems (see also the title of this journal). Autonomy means here that the robot is designed to carry out tasks without continuous human guidance and assistance, preferably in an unstructured environment. This development could lead to a future scenario in which robots would replace human care workers, for instance if care robots take over the work of the human nurse. As indicated before, this is ethically problematic. But even if robots in healthcare did not entirely replace human care workers, there is still the question how autonomous (in the sense of doing tasks on its own, unassisted by humans) the robot would be and should be in the context of the interaction and the care, and how autonomous it should be in the sense of operating without human supervision. For example, if robots are used in therapy for children, should the robot be supervised (and if so in what way) and what exactly and how much should it do without direct human intervention?

4.4 Role and tasks

Related to the previous point is the question regarding the role of the robot in the particular care process. Even if humans are still part of the care process, what exactly should the role of the robot be (and the role of the human)? What tasks can and should be delegated to robots? And in general: should they assist or take over human tasks? When and where should they do what?

4.5 Moral agency

Robots do not seem to have the capacity of moral reasoning or, more generally, of dealing with ethically problematic situations. Hence when a moral problem arises within the human–robot interaction and within the healthcare situation, there seems to be a problem: the robot is given (more) autonomy, in the sense of doing tasks by itself without human intervention, but does not seem to have the capacity of moral agency: it can do all kinds of things, but unlike humans does not have the capacity to reflect on the ethical quality of what it does. Some philosophers therefore propose to build-in a capacity for ethical reasoning, whereas other philosophers deny that this is possible or think it is insufficient for dealing with complex ethical issues in healthcare. On the other hand, maybe the robot's lack of moral agency is not a problem as long as humans are involved and included in the process. Again the issues of autonomy and role are raised.

4.6 Responsibility.

This issue raises again the question regarding the autonomy and role of the robot and the human and, more generally, regarding human–technology relations. How does the introduction of robots (re-)shape ethical responsibilities? If the robot takes over human tasks, who is responsible for these tasks? What should be the new distribution of responsibility, when robots take over some tasks? Does it mean that humans remain responsible (assuming the robots cannot be morally responsible), and if so, how can they exercise this responsibility if they have not direct control over the robot (if they do not continuously intervene) or even do not supervise the robot? Deception. If robots are used as ''social'' companions and are given other roles which encourage social–emotional involvement of the humans (e.g. elderly people or children), is this not a case of deception, and if so, is this deception justifiable? Trust. In so far as the robot acts autonomously and human care givers withdraw from the care process (to some extent at least), can the robot be ''trusted'', or is this term not applicable to robots ? Should we only talk about reliability? Or do ''social'' robots raise the issue of trust? Shall we ''trust'' giving patients, elderly people, and children ''in the hands of the robot'' ?

4.7 Robot as tool or electronic person

The robot as a particular kind of object is experiencing something of a transformation in public discussion. It would be helpful to engage with the DREAM consortium about what they believe a 'robot' is, and what it can and should not do. For example, is a robot a tool of ABA therapy? Or will enhanced-robots be something more? Should robots be considered as 'electronic persons'?

The debate about robots as tools or as something more (kinds of persons) has reached policy level discussion. In 2016, the European Union Parliament produced a draft report: *Commission on Civil Law Rules on Robotics*, led by Mady Delvaux has proposed to re-categorise robots as 'electronic persons' (2016, p. 12)[2]. There are two aspects to the proposal to create electronic persons, the first is to create the framework for a robotics sufficiently developed, that robots have 'rights and obligations, including that of making good any damage, and applying electronic personality to cases where robots make smart autonomous decisions or otherwise interaction with third parties independently (2016, p. 12). The second aspect for the commission is to create new income streams as robots replace human workers 'whereas at the same time the development of robotics and AI may result in a large part of the work now done by humans being taken over by robots, so raising concerns about the future of employment and the viability of social security systems if the current basis of taxation is maintained, creating the potential for increased inequality in the distribution of wealth and influence' (2016, p.3). The report indicates a shift in the direction of the commission to recategorise robots as 'electronic persons' f) creating a specific legal status for robots, so that at least the most sophisticated autonomous

[2] DRAFT REPORT with recommendations to the Commission on Civil Law Rules on Robotics. (2015/2103(INL)). Committee on Legal Affairs.

robots could be established as having the status of electronic persons with specific rights and obligations, including that of making good any damage they may cause, and applying electronic personality to cases where robots make smart autonomous decisions or otherwise interact with third parties independently (p. 12).

While the re-categorisation of robots as electronic persons does not have any immediate effect on the DREAM project, if ratified there are two important areas where the re-categorisation will influence:

9.1 Categorical boundaries between robot and person

The status of the robot with regards to a different view of its status as an artefact that can engage in some autonomous decision making. According to the European Union report, reclassification would take into account:

> 'The capacity to acquire autonomy through sensors and/or by exchanging data with its environment (inter-connectivity) and the analysis of those data
> The capacity to learn through experience and interaction
> The form of the robot's physical support
> The capacity to adapt its behaviours and actions to its environment' (p. 13).

As such, with the intended technological developments in the DREAM project, if achieved, the robot-enhanced capacities of NAO and the technologies embedded in the environment around the robot. The report suggests that all smart robots become registered in a Union-wide process managed by the EU Agency for Robotics and Artificial Intelligence (p.13).

Robot ethics emerges out of a growing involvement of machines where direct human contact is prescient, or the robot may take over the role of another person (Veruggio and Operto, 2008). Enlightenment narratives position human beings as 'rational agents' capable of reasoning about the world and changing it (Bynum, 2008). Different approaches to ethics put an emphasis on different values, Utilitarianism of Jeremy Bentham took an approach of 'do no harm' and promote goodness for the many. Kantian ethics warned against instrumentalising persons, persons should not be seen as a means to an end, while Aristotelian Nicomachean ethics is shaped by the concept of 'virtues' and show how action and inaction is vital in the creation of character (Bynum and Rogerson, 2003). (Coeckelbergh, 2009) has proposed that morality of a system depends on responsibility of the agent:

> 'For many moral philosophers, ethics is about holding someone responsible and about the rightness of one's actions, and then questions regarding moral status and action are central. We usually ascribe moral responsibility only to beings that have a sufficient degree of moral agency—whatever that means—and ask about the rightness of what that agent does, has done, or could do' (p. 218).

At the core of these theories lay an idea of the subject, as a rational, autonomous agent capable of acting in the world of relations. If robots and AI systems become autonomous, embodied and algorithmic vehicles for action, should moral responsibility be applied to these agents? This discussions will become more important in the coming months and years.

In January 2017, the proposal for a robot law passed its first stage of reading in the European parliament.

VII Findings and Recommendations

1. Through our surveys, we recognised that parents are not passive but actively concerned and engaged in learning about autism and providing the best care for their children. Parents are an important stakeholder group.
2. We found that the roboticists were not actively encouraged to learn more about autism as a condition, and drew on a very specific model. By showing the plurality of autism perspectives we hope to show that children and autism have complex emotional and social lifeworlds, and to respect this in our work with vulnerable communities. We feel this is an important contribution we can make as the ethics team.
3. There are many issues and concerns expressed by the public and ethicists of robots in regard to the introduction of robots into healthcare that cannot be addressed definitively in this deliverable. We however raise many of those issues here and will encourage ongoing discussion.

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VIII Appendices

Please find enclosed two short interviews with children with autism. Appendix 1 is an interview with a Romanian child who is receiving robot therapy. Appendix 2 is an interview transcript of a child who is not receiving robot therapy.

APPENDIX 1

Full interview with child with autism receiving robot therapy

4. April
Speaking to x (with a translator), aged six.

KR: What do you think of NAO?
TL: I like him when he wakes up. I like the robot to be active. I want to play with the robot that has the blue. I like the blue most.
KR: is that your favourite colour?
TL: yes. I want the blue robot from behind the curtain.
KR: Do you like the games you play together?
TL: I like it most when we play with the toys. I want to play with the red to go to sleep and then play with the blue ones. [this is some fixations].
KR: Is NAO a toy?
TL: It's a small robot
KR: What's a robot?
TL: A robot, a robot….a machine and then it's a pet.
KR: What kind of pet?
TL: He's a special robot.
KR: How does NAO work?
Child has difficultu finding an answer, but tries….
TL: The robot asks some questions, for example what's my name…
KR: it's not a toy, it's a robot. It might be a pet or a machine. Is NAO a friend?
TL: yes he's my friend
KR: what do you like in a friend?
TL: INAUDIBLE…The robot has two hands, a head…and a bottom.
KR: Does he like playing with NAO or with Anna?
TL: Anna. I like most with the therapist. I want to wake up the blue robot.
KR: What kind of robot would you like?
TL: a brown robot, or a white one. And yellow.

APPENDIX 2

Interview with child on the autism spectrum, aged 8.

KR: Kathleen Richardson
E: Child
P: Parent

P: So E we've talked about it haven't we, we've talked about 'ethics' and it will be anonymous haven't we.
KR: preamble…..I thought I wonder what X might think about robots? Do you know what a robot is?
E: Yes, who doesn't!
KR: Will you draw me a robot then?
E is humming as he draws.
[E draws a robot].
KR: Wow, that is a very impressive robot, will you tell me about your robot? What can it do? Does it do anything?
E: Well, it can…
P: Can it walk?
E: Yes, why do you think if it has legs? What's the point of legs if you don't need to walk?
KR: That's a very good question. I know lots of robots that have legs that can't walk. But yes, I think you make a very good point here! What else about your robot?
E: It can talk.
KR: How does it talk? What does it talk about?
E: Well, it can answer any question, it can answer a question, any question you ask it. Unless human intelligence does not know the answer.
KR: Right, it's a very clever robot. And do you like robots?
E: Yes.
KR: Have you got any robots at home?
E: [Thinking…hmmmm he says]…well, I don't know many actual robots, but I do have some real, some toy robots, like Lego robots.
KR: Well I've got some pictures of robots that I'm going to show you.
[continues humming]
…here's the first one. What do you think of that robot [I show him a picture of Nao robot]….
E: Very advanced.
KR: What do you think it can do? Do you like that robot? Is it OK?
E: Yes.
KR: Let's see if we've got another robot? How about this one?
[show him Mars Rover].
E: That's a Mars Rover…
KR: What do you know about Mars Rovers?
E: Collect bits of rock.
KR: yes, collects bits of rock. It's a very clever robot isn't it, collecting all that rock. Smart eh! What about this one [show him a factory robots]
E: is that building cars?
KR: it's a factory robot – have you ever seen one before?
E: Yes…
F: You've seen a real one haven't you? That's why you thought it was working on a car?
E: Actually I saw a lego model of something similar working on a car.
KR: when did you see this lego?
E: In a book.
KR: Have you been to see a robot factory.
P: We saw a robot something like that at a think tank in Birmingham, which was part of a display by Jaguar. It was a welding robot that was. But Euan might not remember because it was several years ago.
KR: Ok I've got another robot. What do you think of that robot? [it's a seal robot] – you don't recognise that robot? Does it look like a robot?
E: It looks like a Seal.
KR: It is a seal robot. And what about this one?

E: Is that a robot from some sort of computer game?
KR: It's a little robot and it's about this big [show a few inches] and it moves around like this [start bobbing around backwards and forwards]. I wish we could get them here at DMU that would be great. Of all these robots which robot do you like the best?
E: I think this one? [he chooses the Nao robot]
KR: Why that one?
E: Because it seems interesting.
KR: That's why we need to get hold of one of them. And which one do you like the least, which one don't you like very much?
E: hard to say?
KR: is that a bit too difficult?
P: you're not too keen on favourite and non favourite questions.
KR: you tell me which of these you like? Do you like this one, who's next?
E: That's a hard question…
P: Why don't you tell KR what you're drawing so she knows. A picture of DM fighting Greenback….
KR: Who's that then?
E: Danger mouse the world's greatest secret agent.
KR: I know Dangermouse, I can see it's DM now. Is that penfold.
E: No the other one is Baron-von-Greenback….
KR: Is DM on TV again?
E: Yes.
KR: I like DM. I like Penfold. Are you going to draw a Penfold. You don't have to if you don't have to. He's got big glasses hasn't he, PF. So when you're at home Euan, what kind of games do you like to play?
E: Mainly computer games.
KR: Computer games? What kind?
E: I like lots of different kinds.
KR: I like all kinds of different games. Do you like all kinds of different games?
P: I do yes. My favourite ones are mystery games where you have to solve a mystery. But you're not too keen on those are you E? Why don't you describe two of the games you've got on your DS?
E: I have a lego star wars game.
KR: Lego Star Wars...that sounds like a really cool game?
P: What do you have to do in a Lego Star Wars game. What's the objective?
E: That depends on which level you're on.
P: Describe a level or two.
E: In chapter 1 the Phantom Menace you have the stop the gunnery from destroying Nabu. In the second one you have to stop the separatist movement from ruling the galaxy. And in the third one it's the same as the second one. And in the fourth you have to get R2D2 to Yavin [Yavin is a planet]
KR: I forgot about R2D2. And what's the other one called?
E: CP30.
KR: Maybe you could draw me a picture of those. Do you know how to draw those?
E: [continues drawing]
P: What's a R2's great skill?
E: He can fly.
P: Pretty cool isn't it. And what about C3P0.
E: He's a proto cold droid. He's rather cowardly. He's meant to translate things and that sort of thing. R2 is an astro mec. He's meant to perform repairs on space ships, and assist with flying them.
KR: So if you had a robot, what would you like your robot to do?
E: Help me with a few things?
KR: What kind of things?

E: Jaws, that kind of thing
KR: Jaws?
E: Chores!
KR: That's a very popular reason for a robot. What kind of chores would it help you with? Could you draw me a robot doing your chores?
P: I don't know if you'd be able to draw a robot messy enough.
E: oooh…
KR: And you like animals as well is that right?
E: Yes…
KR: What's your favourite animal? Have you got a favourite one? Or do you like lots of animals?
E: I like quite a few. I'm thinking of getting a cat for pet.
KR: I've got a cat, cats are wonderful. What kind of cat would you get, what colour would it be?
E: I don't mind….
KR: That's nice. Have you got any pets at home?
E: No, it's because my little brother is a bit too young for a pet.
KR: That sounds like a good reason to wait doesn't it.
P: He's getting older now so pets are back on the agenda. Can you remember?
E: Because one of my favourite cartoon characters, Tom, from T&J is a cat.
KR: Cats are just brilliant. Where you live do cats come in your garden?
E: In my front garden sometimes….
KR: They come to visit you cats. They wander around? And do you like dogs?
E: A bit.
P: His brother really likes dogs in our family.
E: [draws our attention to his drawing] – I was trying to make purple…I think the problem was I put the blue on before I put on the red?
KR: you could try it and see if that works?
E: That looks more purpleish….
KR: So are you having a nice summer break, what have you been doing?
E: I went to a seaside holiday in Southwold.
KR: Was it nice and sunny and by the sea? Did you build sandcastles?
E: Yes.
P: do you need a little break and have a quick drink?
E: Yes.
KR: These are all the kinds of robots that I work with at DMU. We're trying to get a robot, would you like to meet it?
E: Why are you acting like it's a person?
KR: Am I acting like it's a person?
E: Yes a bit.
KR: oh, right. So it's not a person.
E: No it's a robot.
KR: What's a robot?
E: An intelligent machine.
KR: Right, but it's not a person?
E: Not it's not.
KR: What's a person?
E: A person is alive, a robot is not, it isn't.
KR: You're very smart. I can tell that. So it moves like a person, sometimes people say it looks alive but it's not.
E: I could use a bit of brown….
KR: What colours make green?

P: How about orange and green over the top to make brown?
[Humming continues…]
KR: what kinds of things do you think robots are good for? What do you think they good to do?
P: did you catch the question?
E: I caught it I'm not throwing it away.
P: What are they good for in your opinion, robots?
E: Robots I think they're good for saving people from doing work.
KR: Yes, that's right. Do you think robots could be someone's friend?
E: Not really.
KR: Why not!
E: Because robots don't really have emotions. And I think Artificial Intelligence is a bit dangerous.
KR: tell me about that - why is it dangerous?
E: I know you might think I'm being a bit too imaginative but a lot of the time in cartoons, artificial intelligent robots are also evil robots.
KR: And that's in cartoons? And what kind of evil do they do?
E: Try to destroy humanity.
KR: Phew, that's very difficult…
P: that's very extreme…on a scale of evil isn't it.
KR: And this is in cartoon is it?
E: Yes
KR: Are there any good robots in the cartoons that you watch?
E: yes they have a few. Mostly in CBBees cartoons.
KR: So they're not doing bad things?
E: No they're not trying to destroy humanity. Or whatever the protagonist species is.
KR: So does that make you worried when you see these robots?
E: Yes, or whatever the protagonist's species is.
KR: Does that make you a bit suspicious of them then?
E: yes.
KR: What are these cartoons that are trying to destroy humanity or the protagonist's species?
E: One of them from cartoon that try to destroy humanity is a marvel, is one from marvel called Ultron.
KR: What comic is that from? Is that the transformers?
E: No, from Marvel, do you know Iron Man, Captain America that sort of thing.
KR: And there's one called Ultron?
E: No no. villians don't necessarily have their own comics.
KR: So how did these robots become really intelligent in these comics?
E: Well, of Ultron, in the film, Ultron was an artificial intelligence left after the TUTORUM Aliens [need to check] that tried to invade Earth, the invasion of NY. When Start built a robot body for it, kept it there, STARK as in Iron Man, so it could help humanity, but it thought humans were a disaster and downloaded itself into a robot and tried to destroy everyone in the world.
KR: that's a scary robot? Why do you think it's important to save humanity?
E: Because otherwise how exactly will humanity develop?
KR: So you think it's important to save humanity then?
E: Yes, to keep it developing?
KR: How would you like to save humanity?
E: These questions are getting a bit much…
KR: Right, OK, I like talking about comics, and the themes in comics…maybe we can ask your daddy. How would you like to save humanity?
P: Can I also say these questions are getting a bit too much [he says while laughing]…I don't know. I think, I'm very keen to ensure that everyone has equality, that's my big thing. To reduce inequality to me

is how we save humanity. So we make sure that people all have enough to eat and to do, and to spend, if they need to spend. So that's my take on it.
KR: I think I agree with that. That's a good. Maybe that's enough for today.
E: Yes it is….
[I offer him the pictures of the robots but he doesn't want to take them]….END