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If I had a Robot it should do Everything for me: Children's Attitudes to Robots in Everyday Life

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Abstract: This paper presents evaluation research studying Danish children's attitudes towards robotic technologies. The purpose of the paper is to focus on children's contextualisation and evaluation of different robotic technologies and discuss an approach combining contextual and technical issues in a learning context. It appears from this study that children know pretty much about robots, and they distinguish between different kinds of robots, and their attitudes towards robots is rather complex. It seems that children evaluate robots from four elements of technology, which consist of technical perspectives, sociological perspectives, knowledge perspectives and cultural perspectives. The paper is based on comparisons between two groups of children aged 9-14 with different experiences of building a robot. One group participated in the robotic competition First Lego League (FLL), which goal is to give children positive attitudes towards science and technology, including robots. The other group of children (coming from the same geographic area) did not participate in FLL.

Keywords: First Lego League, Robots, Attitudes, Technological Literacy

Introduction

ROBOTS ARE INCREASINGLY becoming part of our society as both tools and toys. The hardware of the robot is now so small that it can be integrated everywhere (Lund, 2007), resulting in brand new types of robots and new forms of interactions between humans and robots. Computational objects are not simply objects which do things for us, but "they do things to us as people, to our ways of seeing the world, ourselves and others" (Turkle et al., 2006). This paper will focus on the research question "what are children's attitudes towards robotic technologies?, and is based on a study following two different groups of children. One group participated in the robotic competition First Lego League (FLL). The purpose of FLL is to give children a positive conception of science and technology, including robots (www.firstlegolegaue.org). The other group of children did not participate in FLL.

Related Work

Robots are seen as central to the fulfilment of the promise of the information revolution (Facer et al., 2001), or as the Danish Government stated in one of it´s goals for the next 10 to 20 years: "we want to develop Denmark into one of the leading high tech societies…and the development will open up for new possibilities where robots interact with humans to solve more and more advanced tasks (Ministry of Science Technology and Innovation, 2005). There are, however, different exposures to robots through media or through personal experiences in different cultures and countries (Bartneck et al., 2005). It appears that high usage of robots in a country does not necessarily lead to positive attitudes towards robots (Barneck

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et al., 2005). Different target groups in the same country also have quite different attitudes towards robots and different opinions about them, no matter whether it applies to children, adolescents, adults or elderly. Previous research revealed differences between young and elderly towards the idea of having a robot in the home (Scopelliti et al., 2004). Young people scored highly positive towards the idea of having a robot assistant in the home, whereas elder people expressed more negativity and anxiety.

A huge survey from UNECE (United Nations Economic Commission for Europe) identified personal service robots as having the highest expected growth rate (UNECE, 2004). Robots are not only used in the industry, but are increasingly able to engage in more extensive social interaction with humans (Canamero, 2002; Bartneck et al., 2005 and Kuno et al., 2007), such as delivering hospital meals, helping elderly and people with handicaps, being museum guides, assisting in the household with such tasks as vacuuming, lawn mowing, guarding of homes, or even being babysitters. In a learning context robots are also used more and more. From a learning and pedagogical perspective there are several studies about FLL [Lau et al., 1999; Lund, 1999; Johnson, 2003; Gabauer et al. 2007; Lindh & Holgersson, 2007; Chambers et al. 2008) with the overall research question – do children learn anything from robotics? In a well documented study, two Swedish researchers (Lindh & Holgersson, 2007) investigate the effect of a one-year regular Lego robot toy training on the performance of school pupils. It appears that there is no statistical evidence that the average pupil gains better learning skills from Lego robotic training (Lindh & Holgersson, 2007). In a study exploring children's conceptual development concerning gear function and mechanical advantage, Chambers et al. (2008) found that the majority of children have difficulty explaining the reasons underpinning their gear arrangement choices for making their Lego robots fast or powerful. Research in the technology education field, dealing with young children's attitudes towards robotic technology in a sociological paradigm is, however, sparse. Turkle (1984) and Ackermann (1991) speak of two distinct frameworks for approaching the artificial world – the psychological and physical/technological. Several studies use these frameworks (both separately and related) to study children's attitudes and conceptions towards a specific robotic technology (Fleer 1999; Carr, 2000; Levy and Mioduser, 2007). I would like to supplement the technological and psychological framework with a more sociological approach by focusing on children's attitudes within the contextualisation of robotic technologies.

The Robot Festival, FLL

Before describing the methods and findings, I would just like to put some context on the robotic festival First Lego League (FLL). There are many competitions worldwide besides FLL involving robot constructions for children (e.g. RoboGames, Best Robotics, RoboCup Junior, Botball, Robofest etc.). FLL is an international program for children aged 9-14 (9-16 outside of the U.S. and Canada) and was created in a partnership between FIRST and The LEGO Group back in 1998. FIRST (For Inspiration and Recognition of Science and Technology) was an organization founded to inspire young people's interest and participation in science and technology through teamwork and problem solving. From the development of the FLL concept and the first pilot tournaments in the USA in 1998, FLL International has grown to nearly 90,000 participating children in 2008. FLL combines a hands-on, interactive robotics program with a sports-like festival atmosphere. The interactive robotic programme is made via Lego Mindstorms and provides an educational platform, where children use an iconic programming interface, allowing the children to guide the behaviour of robots (Mikhak et al. 2002). The robots in FLL can be classified as open robotic toys, where the users can build and develop the robot on their own (Lund, 2007). In educational context, open robotic toys are often used (Lund, 2007).

The teams in FLL consist of up to 10 members and focus on such things as team building, problem solving, creativity, and analytical thinking. Each September FLL provides teams around the world with an annual Challenge. The Challenge is based on a set of real-world problems facing scientists today and therefore the theme is different each year. The theme in 2007 was: Power Puzzle: Energy Resources - Meeting the Global Demand. The challenge has two parts: a robot game and a project. In the robot game, teams design, build, program, and test autonomous robots that must perform a series of tasks or missions. In the project, teams conduct research and create a technological or engineering solution to an aspect of the Challenge and present that solution. The philosophy behind FLL entails that children build and experiment; they live the entire process of creating ideas, solving problems, and overcoming obstacles. The FLL program "meets children where they are and helps to shape a positive perception of science and technology" (www.firstlegoleague.org).

Methods

Methodologically, it is a hard task to get hold on and measure attitudes. The concept of attitude is a complex construct, and therefore attitudes can not be measured directly, but must rely on inference. Spooncer describes how attitudes are composed of affective (feelings), cognitive (beliefs) and behavioural (actual) actions (Spooncer, 1992). Similarly, Baron and Byrne define attitudes as relatively lasting clusters of feelings, beliefs, and behavior tendencies directed towards specific persons, ideas, objects or groups (Baron and Byrne, 1984). In this paper the word "attitude" will be used broadly to describe attitudes which have to do with affect, feelings, beliefs and values. The book "How to Measure Attitudes" (Hennerson, Morris, Fitz-Gibbon, 1990) recommends some procedures, rules of thumb, and practical strategies to perform evaluation tasks related to assessment of people's attitudes. The perspective is from the study of evaluation, and though the book reflects on evaluation concerns and practices, the social, cultural and contextual perspective is not given much focus.

Considering the limited amount of empirical and theoretical evidence of children's attitudes towards robotic technology, this research follows the inductive grounded theory approach developed by Glaser and Strauss (1967; 1978). The practice of grounded theory in this research includes at least two things: 1. Simultaneous involvement in data collection and analysis. 2. Construction of analytical codes and categories from data. This research employed a method design based on a quantitative (survey) method[1].

The survey is based on questionnaires in paper form. The data was collected in November and December 2007, and it took about 3 weeks to collect the data, having a deadline before Christmas. 300 children aged 9-14 participated in the study, having 150 in two groups. Group

[1] The question arises whether it is actually possible to use quantitative methodology as part of the grounded theory approach. Glaser and Strauss (1967, 1994) answer this question by pointing out that the use quantitative methods is not opposed to the generation of grounded theory. On the contrary: "The freedom and flexibility that we claim for generating theory from quantitative data will lead to new strategies and styles of quantitative analysis … that will bring out the richness of quantitative data that is seen only implicitly while the focus remains on verification" (Glaser 1994, 198).

1 participated in the First Lego League Competition (Response: 94%, 67 boys and 83 girls). Group 2 did not participate in FLL (Response: 86%, 79 boys and 71 girls). Group 1 was sampled by a list of participating schools in the regional FLL competition, taking place in the city of Ballerup (in a surburb of Copenhagen) the 10th November 2007. The representing schools were from the municipality of Ballerup. I selected this list from the FLL competition in Ballerup for this research, because this municipality had taken lots of efforts in developing FLL as an integrated educational platform. They have developed the so called "Ballerup Model", which is different from other FLL teams in the country by the implementation of FLL in the schooling and by use of parents as associated mentors during the FLL project. As part of the effort in FLL the municipality of Ballerup brand themselves as "The municipality of Science". Group 2 was sampled by a list of schools with contact to the municipality of Copenhagen, and make sure they did not participate in FLL by contacting the specific school. All the schools (from both Group 1 and 2) had an equal chance of being selected as part of the sample by randomly taking a name of a school from the lists. The schools are representing very differently physical and social environments, ranging from large city schools and small urban schools to a small school class with autistic children. The high response is caused by prior agreement with teachers on the selected schools, to whom the questionnaires were sent. The teachers handed out the questionnaires to the children, meaning that they were filled in during class, when there was sufficient time. The questionnaire was divided into five different sections. Section one requested socio-demographic data (gender, age, school/ geographic area). Section two requested one word, which the children mostly related to robot. Section three included nine 3-point Likert type items (Likert, 1932), measuring either positive or negative response to statements related to robots. I used a 3-point scale, "agree, disagree and neither agree nor disagree". Section four included 6 items focusing on the perceived capability of robots to perform different everyday activities at home. Section five was an open ended question related to "If you have further comments, please write it here". The questionnaire had two pages for supplementary comments. It was very significant that many children (249 questionnaires, corresponding to 83%) filled in further comments to the open-ended question, and in several cases long comments going outside the text box. Some of the further comments corresponded, however, to the specific questions in the questionnaire.

These free-text responses contain rich information, since it allowed the respondents to express their opinions without being influenced by the researcher (Foddy, 1993). The advantages of open-ended questions include the possibility of discovering the responses that individuals give spontaneously, and thus avoiding the bias which may occur in the case of close-ended questions. A disadvantage of open-ended questions is the extensive coding needed before the actual analysis can take place (Sudman and Bradburn, 1991: 149-156). In addition, children tend to write text with use of short words and typing errors. They also put a lot of typographical representations of smiley faces (emoticons), factors which make the reading and coding of the written material even more difficult. For a systematic content analysis of the open questions, I identified response categories by the method "Emergent categories" (Unrau et al., 2006: 344). Categories are identified by looking through the data, and emerge naturally from the data. Just as suggested from the grounded theory approach, the categories were defined as a result of working with the data (Glaser & Strauss, 1967: 23). Next I placed each response from the children into one of the categories I identified, and afterwards created composite responses/ quotes that reflect the content of all the responses in each category.

Findings

It appears from this research that children know rather much about robots. They distinguish between different kinds of robots and their attitudes towards robots are rather complex. I identified that children seem to evaluate robots from four elements of technology, i.e. technical perspectives, sociological perspectives, knowledge perspectives and cultural perspectives. It is also significant from the children's responses that they see humans a a central part in their arguments and evaluation in the robotic discourse. The children implement a human perspective in all aspects of their evaluation of the robots, and in the following, I will present the results from the grounded theory approach, and give some examples of the children's responses in the categories from the data.

Technical Perspectives: Robots are seen as Hardware

The children were asked to select one out of 13 words, which they mostly related to the word "robot". The 13 words were mixed in a random order. The meaning behind the selected words was to evaluate the perception according to three categories: optimistic (including the words improvement, discovery, development, new technology and knowledge), pessimistic (including the words fear, robot takeover, unemployment and alarming) or as hardware/ tool (including the words computer, machine, electronic and microchips).

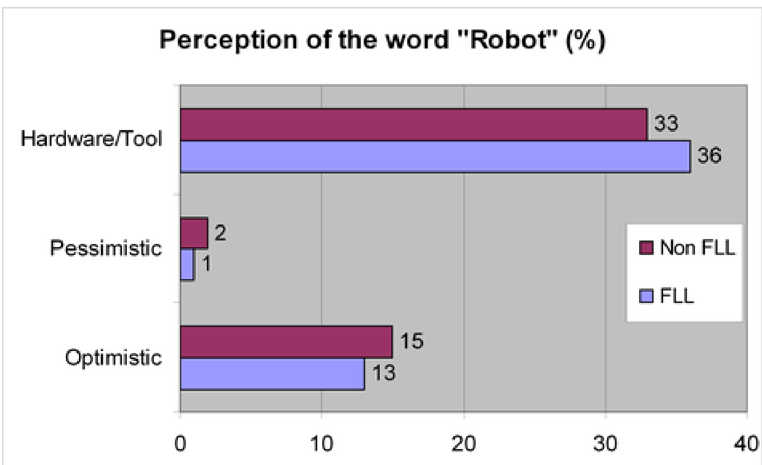

Table 1: Perception of the Word Robot Divided into 3 Categories. N: 300

It appears that very few relate fear, robot takeover, unemployment or alarming to the word robot. Previous work revealed that this has something to do with age, as elderly people are most fearful about robots (Scopelliti et al., 2004). The children participating in this research have already strong familiarity with technology, and they recognize some of the benefits technology can provide. As one boy stated in the comments (having an optimistic view on the word robot):

> "If I had a robot, it should do everything for me...Robots are cool and can be a great part of our everyday life". (Boy, 13 years, FLL).

This boy perceives robots as service robots which could relieve him from boring, unpleasant jobs. But even though a majority of the children see robots as hardware, their comments emphasize that humans are behind the electronic devices. Here some comments from children, perceiving robots as hardware:

> "Robots are good, if we just program them properly" (Boy, 12 years old, FLL)
> "Robots are machines – controlled by technology. It is not possible to make a robot do things without some kind of programming". (Girl, 12 years old, Non FLL).

Sociological Perspectives: Macro and Mirco Levels

From the comments, it appears that the children distinguish between an everyday life perspective (micro level) and a global/society perspective in a higher level of abstraction (macro level). Lots of children mention everyday life, even though it is not directly mentioned in the questionnaire. Almost all comments having an everyday life perspective show a positive attitude towards robots:

> "Robots are genius – and they can tidy up again and again – without being tired of it. Just remember recharging". (Boy, 12 years, Non FLL)".
> "Robots must be a part of our everyday life. In my opinion robots are electronic servants, which could help cleaning and tidy up. I think robots could be very useful for most of us" (Girl, 14 years, FLL).
> "Robots could also be brought up well. This could be pretty smart and could be of great help in the household". (Girl, 13 years, Non FLL).

From the macro perspective, it appears that the attitudes are more divided, with both positive and more negative attitudes:

> "In my opinion robots are very important here on earth. We can learn new things and develop different things. Robots can also create new jobs and make better life for us". (Girl, 13 years, FLL).
> "Robots can be useful, but billions of people are unemployed, and instead of robots you could educate people worldwide" (Girl, 12 years, Non FLL).
> "The world is fine without robots. We have survived 1000 years without having robots. If you develop robots so they are more independent, they will in the end control themselves. It threatens the survival of humanity. I will move out in space, if robots control everything here on earth". (Girl, 12 years, Non FLL).

These attitudes exemplify different perspectives. The first comment (from Girl, 13 years) is a perspective with a technological determinism expressing that robots can result in new jobs and a better life. The two other commnts belong to a perspective coming from a critique of technology, as the robot technology is critized for alleged negative impact on unemployment and threats to the survival of humanity. These attitudes emphasize how diverse opinions are, but also how much these children actually know about technology and society. They point at different perspectives concerning the sociology of technology. The statement from the girl mentioning the billions of unemployed people points at a complex issue concerning technology, development, employment, and education.

Knowledge Perspectives: Robots solving Climatic Changes

The only significant difference between the FLL group and Non FLL group was their opinion about how robots could be used to solve climatic changes. The FLL group of children had a more positive view on this issue. The main reason for this is probably that the FLL children worked with this topic, and knowledge about using robots for this purpose was higher:

> “We had some discussion about this in our school and we made a presentation on this topic. There are e.g. some robots called argo floats. More than 3,000 of these robots are dropped in the oceans to measure temperature. Argo was telling how global warming is affecting our oceans. I think robots in the ocean could also predict tsunamis and things like that so we can avoid millions of people dying”. (Boy, 13 years, FLL).

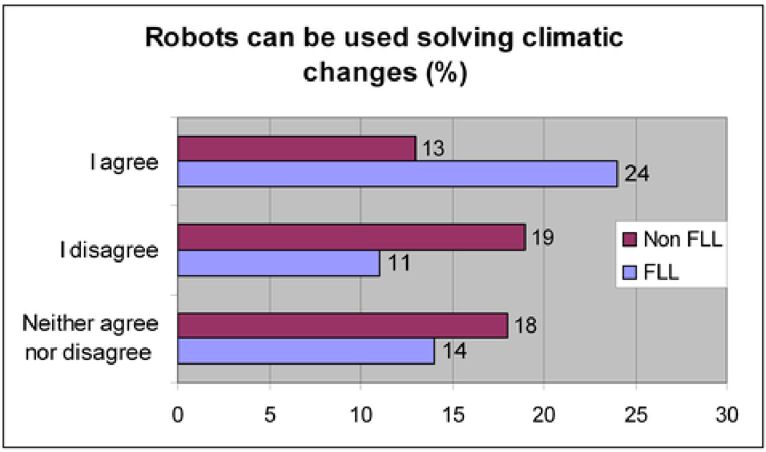

Table 2: Robots can be used Solving Climatic Changes. N: 300

It is already documented that children can learn about the real world (including math, physics and engineering) by working with robots, when using a constructionism approach, especially when using a guided constructionism approach (Lund, 1999). It also appears from this research that 20% of the children (from both the Non FLL and FLL group) agreed that robots can be used in math classes, whereas 12% (Non FLL) and 11% (FLL) agreed that robots could be used in the humanistic school subject Danish:

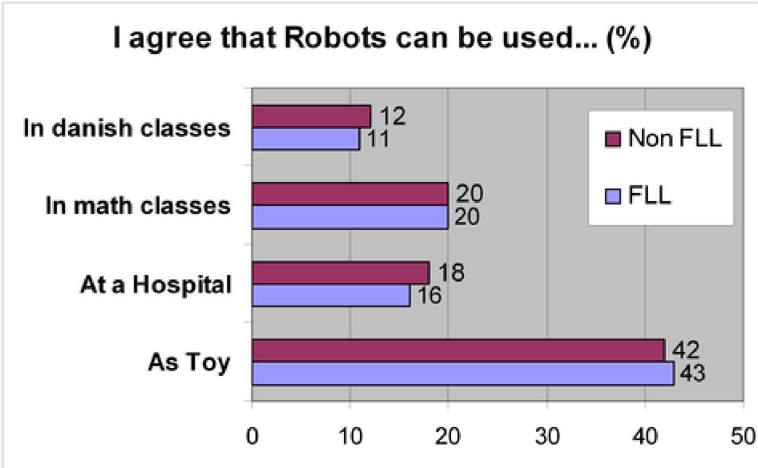

Table 3: % agreement towards robots in Danish classes, math classes, at a hospital and as toy. N: 300

42% (Non-FLL) and 43% (FLL) agreed that robots can be used as toys. Children are already familiar with robot toys, and toys nowadays are being dominated by more and more complicated contraptions. There are all sorts of robot toys available on the market today, from costly high tech robot toys to cheap and unsophisticated.

> "In my opinion robots are still only toys, not more than that" (Girl, 13 years, FLL).
> "My youngest brother, he is 6 years old, got a RoboSapien. It is a human like robot, which can do different things. But I find it rather boring". But robots can be cool. (Boy, 11 years, Non FLL).

Cultural Perspectives: From Vacuuming to Baby-sitting

The questions about which tasks a robot could do in a household was designed to have attitudes to more specific devices. There was also a possibility for answering "a robot should not have any kind of tasks in the household", but only 4% (FLL) and 5% (Non-FLL) are of that opinion.

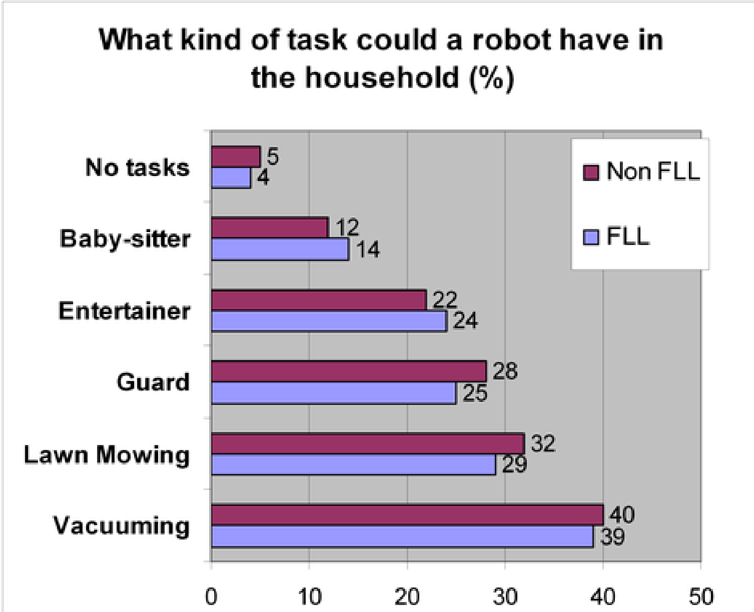

Table 4: Different Tasks a Robot could have in the Household. N: 300

Vacuuming and lawn mowing are the most popular tasks that children would like robots to do in a household. These findings are also echoed in a pilot study (Khan, 1998), which reported that respondents mostly wanted the robot to perform cleaning tasks. 14% (FLL) and 12% (Non FLL) of the children would like a robot to be a baby-sitter in the household. Robot babysittes are not speculative fiction but are already on the market (Murph, 2008; Keim, 2008), which raise some ethically problematic areas (Sharkey, 2008). Very few girls (1% from both the FLL group and the Non FLL group) have a positive attitude towards having a robotic baby-sitter. It is also reflected in the open box, where 25% of all responding girls (out of 154 responses) reflect and write further comments about this issue, and relate some ethically problematic areas:

"Robots can be used for work – NOT as a babysitter" (Girl 12 years, FLL).
" I do not think robots should take over human things" (Girl, 12 years, FLL).
"What if some technically error happen - it could kill the baby" (Girl, 12 years, FLL).
"It seems to be a bit inhuman to have a robot-babysitter" (Girl, 14 years, Non-FLL):

These answers also reveal some cultural aspects of the technology, and the attitudes from quoted girls indicate that technology is not just seen as objects, but is seen in a complex frame at both macro and micro social levels.

Conclusions

The Danish children's evaluation of robots is a technology assessment, which is not free of ethical and human implications. Children evaluate robots in a rather complex way, showing that they know pretty much about robots. The evaluation consists of technical perspectives, sociological perspectives, knowledge perspectives and cultural perspectives.

Danish children have a sensible, down-to-earth approach to robots, i.e. they seem not to be overly influenced by the media hype surrounding the subject. They perceive them just as what they are: machines built and programmed by humans.

There are no significant differences concerning attitudes towards robots between children participating in the robotic festival First Lego League, and children not participating. According to this study, FLL does not lead to more positive attitudes towards robots, even though this is one of the purposes of FLL. This could be explained by the limited time the FLL children work with the robotic toys. The exposition time was about 10 weeks, and it might also be questioned if this time can be considered long enough for evidence of this kind of attitudes. Another question for further study is also the role of the teacher. There are lots of research showing that the teacher plays an important role in stimulating pupils in their school work and giving them positive attitudes. Is this also in evidence for attitudes towards robots? Robots are increasingly becoming part of our society as both tools and toys, and children are already familiar with robot toys as they have only lived in a world of robots.

Almost none of the children have a pessimistic attitude towards robots in general and very few are of the opinion that a robot should not have any kind of tasks in the household. They look at new technology as something which could make everyday life easier. This research indicates that children's attitudes towards robots reflect the attitudes of different households in the contemporary society. Different families draw on different cultural resources, which also reflect children's attitudes towards robots. In the questionnaire I target "household" to emphasize the creation of the home – as the private and which turns space into place, and which supports the temporal routines of daily life. The positive attitudes towards having a robot doing the vacuuming and lawn mowing could be seen as a minimum of control problems for the household, problems of regulation and negotiations. All new technologies are expressed through decisions to include or exclude some technology in everyday life. Vacuuming and lawn mowing are considered by many to be some of the most boring and tiring routine household tasks. The negotiations and conflicts in a household when considering having a robot doing the vacuuming or lawn moving are, all things being equal, low. These technologies do not turn upside down the routines of domestic life, whereas it could be a challenge by common agreement to agree on a robot guard or a robot baby-sitter in the household.

Technology is never completely in control because of its conditions of existence. It has only an active relationship with its users, which is also evident from children's attitudes. How much robots will affect everyday life and learning in schools depends critically on the price of the technology. It also depends on the extent robots can be used. Or to put this in more sociological terms, robots are not only material objects but also social and symbolic artefacts, which are embedded in the structures and dynamics of our culture and everyday life. I would deprecate one-sided attitudes towards how people should use robotic technologies because there are huge individual and cultural differences in attitudes towards how close the interactions between humans and robots should be. New technologies will be created, current technologies will be improved and robots will play a growing role in daily life. As already stated in this research, Danish children are not pessimistic towards robotic technologies, and they see the technology as something which could make everyday life easier. They are already familiar with robotic technologies. This is challenging educators both because learning takes doing and because of reflecting the technological environment of the present.

The big question is how to expand and enhance learning and thinking by use of robotic technologies. Further research could benefit by examine how robotic technologies could support literacy, and how these tools could be used in the curriculum.

References

Ackermann, E. (1991). The agency model of transactions: Towards an understanding of children´s theory of control. In: J. Montangero & A. Tryphon (Eds.): *Psychologie genetique et sciences congnitives*. Geneve: Fondation Archives Jean Piaget.

Baron, A. & Byrne D. (1984). *Social Psychology - Understanding Human Interaction*, 4th edn. Boston: Allyn and Bacon inc.

Bartneck, C. Nomura, T, Kanda, T., Suzuki, T. and Kennsuke, K. (2005). Cultural Differences in Attitudes Towards Robots, In: Procedings of the AISB Symposium on Robot Companions: Hard Problems And Open Challenges in Human-Robot Interaction: Hartfield.

Canamero, L. (2002). Playing the emotion game with Feelix: What can a LEGO robot tell us about emotion?, In: K. Dautenhahn, A. Bond, L. Canamero and B. Edmonds (Eds.). *Socially intelligent agents: Creating relationships with computers and robots*, Massachusetts, USA: Kluwer Academic Publishers.

Carr, M. (2000). Technologcial affordance, social practice and learning narratives in early childhood setting. *International Journal of Technology and Design Education*. 10, pp. 61-79.

Chambers, J.M., Carbonaro, M., and Murray, H. (2008). Developing conceptual understanding of mechanical advantage through the use of Lego robotic technology. *Australasian Journal of Educational Technology* 24(4): pp. 287-401.

Facer, K., Sutherland, R., Furlong, R. and Furlong, J. (2001). What´s the point of using computers? – The development of young people´s computer expertise in the home. *New media and society*, Vol3(2): pp. 199-219, London, Thousand Oaks, CA and New Delhi: Sage Publications.

Fleer (1999). The science of technology – Young children working technologically. *International Journal of Technology and Design Education*. 9, pp. 269-291.

Foddy, W. (1993): *Constructing Questions for Interviews andQuestionnaires : Theory and Practice in Social Research*. Cambridge: Cambridge University Press.

Gabauer, D., Bayse, T., Terpenny, J., Goff, R. (2007). Improving undergraduate engineering design instruction through lessons learned mentoring First Lego League. ASEE Annual conference and Exposition, Conference Proceedings.

Glaser, B., and A. Strauss (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research.* Chicago: Aldine Publishing Company.

Glaser, B. (1978). *Theoretical Sensitivity.* Mill Valley, CA: Sociological Press.

Glaser, B. (1994). Theoretical Elaboration of Quantitative Data. In Glaser, B. *More Grounded Theory Methodology*: A Reader. Mill Valley (CA): Sociology Press, pp. 197-232.

Henerson, M. E., Morris, L. and Fitz-Gibbon, C. (1990). *How to Measure Attitudes*. Newbury Park: Sage Publications.

Johnson, Jeffrey (2003). *Children, robotics, and education. Artif Life Robotics*. 7: pp. 16-21. ISAROB, 2003.

Khan, Z. (1998). *Attitude towards intelligent service robots*. Stockholm: NADA, KTH.

Keim, B. (2008): ttp://blog.wired.com/wiredscience/2008/12/babysittingrobo.html

Kuno, Y., Sadazuka, K, Kawshima, M., Yamazaki, K, Yamazaki, A and Kuzuika, H. (2007).Museum guide robot based on sociological interaction analysis. Conference paper, Conference on Human Factors in Computing Systems – Proceedings, pp. 1191-1194.

Lau, K., Tan, H.K, Erwin B. T., Petrovic, P. (1999). Creative Learning in School with LEGO Prgrammable Robotics Products. Paper, ASEE/ IEEE, Frontiers in Education Conference, 12d4-26. November 10-13, 1999, San Juan, Puerto Rico.

Levy, S. and Mioduser, D. (2007). Does it “want” or “was it programmed to…”? Kindergarten children’s explanations of an autonomous robots adaptive functioning. In: Technol Des Educ 18: pp. 337-359. Springer Science + Business Media.
Likert, R. (1932). *A Technique for the Measurement of Attitudes*. Archives of Psychology 140: pp. 1-55.
Lindh, J. and Holgersson, T. (2007): Does lego training stimulate pupils´ ability to solve logical problems?. *Computers & Education* 49, pp. 1097-1111: Elsevier.
Lund, H. H. (1999). AI in Children’s Play with LEGO robots. In: Technical report AAAI, Spring Symposium series. Menlo Park, CA: AAAI Press.
Lund, H. H. (2007). *Robots at play*. Odense, Denmark: HTOdense
Mikhak B., Berg F. Martin, F., Resnick, M. and Silverman B. (2002). To mindstorms and beyond: evolution of a construction kit for magical machines, In: A. Druin and J. Hendlers (Eds.): *Robot for Kids: Exploring New Technologies for Learning Experiences*. San Francisco, USA: Morgan Kaufman.
Ministry of Science Technology and Innovation (2005). Beretning 2004. Rådet for teknologi og innovation: Videnskabsministeriet, Publikationer.
Murph, D. (2008). http://www.engadget.com/2008/03/25/robot-babysitter-keeps-kids-occupied-in-japanese-store/
Sharkey, N. (2008).The Ethical Frontiers of Robotics, *Science*, Vol. 322, No. 5909, pp. 1800-1801.
Scopelliti, M., Giuliani, M. V, D´Amico, A. M. and Fornara, F. (2004). If I had a robot at home…Peoples´ representation of domestic robots. In: S. Keates, J. Clarkson, P. Langdon and P. Robinson (eds.). *Designing a more inclusive world*. Cambridge: Springer.
Spooncer F. (1992). *Behavioural Studies for Marketing and Business* Leckhampton, UK: Stanley Thornes (Publishers) Ltd. (first published 1989).
Sudman, S. and Bradburn, N. (1991). The current status of questionnaire research. In: P.P. Biemer, R.M. Groves, L.E. Lyberg, N.A. Mathiowetz, and S. Sudman (Eds.): *Measurement Errors in Surveys*. New York: Wiley.
Turkle, S. (1984). *The second self: Computers and the human spirit*. New-York: Simon and Schuster.
Turkle, S., Taggart, W., Kidd, C. and Dasté O. (2006). Relational artefacts with children and elders: the complexities of cyber companionship. *Connection Science*, Vol. 18, No. 4, December 2006, pp. 347-361.
United Nations Economic Commission for Europe (2004). Press Release, Geneva, 17 October 2004, http://www.unece.org/press/pr2004/04stat_p01e.pdf.
Unrau, Y., Gabor, P. Grinell, R. M. (2006). *Evaluation in Social Work: The Art and Science of Practice.* Oxford University Press.

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My research focus is on the social use of different media in learning context. The purpose of my research is to focus on the social use and take the everyday life in account. My background is from a sociological field, and I have previous done research in Interactive Television.

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