

# The perception of consequences of artificial intelligence on Human to Human Interaction

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## ABSTRACT

In a world where artificial intelligence (AI) applications are being developed and where there is a rising trend of individualism, it can be hard to have a personal opinion about new technology. Within this research, 18 participants were asked to pick a side regarding six different AI applications. They were asked to motivate their choices and were confronted with possible consequences of their choices on the social interactions that they have on a daily basis. The general knowledge about AI technologies influences the awareness of the social consequences AI entails. Clear trends could be seen in the technologies that were generally found acceptable, often motivated by arguments of practicality and efficiency. On the other hand, a clear pattern can be seen where it concerns people's boundaries related to AI, which were often linked to feelings of personal contact and human values.

## Author Keywords

Artificial intelligence, showroom research, constructive design research, vending machine, individualism, charity, greed

## ACM Classification Keywords

H.5.m Information interfaces and presentation (e.g., HCI).

## INTRODUCTION

Human values are the norms and values that guide people to consider human elements when they interact with other human beings. Charity and greed can be seen as such values. One can be charitable relating to the assistance of those in need. When one is greedy, one has an intense desire for having more than another. Human values, and thus charity and greed, gain meaning from a relation to another human being.

Recent evidence suggests that individualism in Western society has been rising for the past century [7]. The industry itself is shifting from a general market for all users to the knowledge paradigm for individual users [3]. People who live in this society become more independent and self-reliant and therefore want to be less dependent on others [16]. Radically seen, when there is a completely individualistic society, every human is independent. There is no need for others, which leads to less human contact. Will the values of charity and greed still be the same? Do

charity and greed exist when human to human interaction does not?

A vending machine is an electronic machine used to disperse a product to a consumer after a certain amount of money has been put into the machine. The concept of vending machines is part of automated retail which is the category of a self-service. There is no need for an external human factor [15]. These kind of machines are changed over time and have become more user friendly and more intelligent. Coca Cola has already been working on an artificially intelligent (AI) experience for consumers, this allows a consumer to start a conversation with the machine, which will respond in the right accent and discuss topics that are relevant to the consumers based on their Facebook profiles [11].

At the beginning of this century AI technology became widely used within elements of larger systems. The first intelligent machines were bought by many regular consumers, examples include autonomous vacuum machines and lawn mowers. Interest in AI intensified in the first decades of the 21st century when the complexity of the technologies increased and machines became capable of the most intelligent actions [4]. As observer Ray Kurzweil predicted in his book *The age of Intelligent Machines: The imminent arrival of artificial general intelligence: a machine with intellectual capabilities that exceed the abilities of human beings*.

With this development, the values of intelligent machines become preferred over human values. In combination with the increased individualism and the current mentality in society, people will sooner choose for practical solutions and therefore intelligent machines. Human machine interaction will occur more often than human to human interaction. Several AI researchers predict a 50% chance that AI will outperform humans in all everyday tasks within 45 years and that they will fully automate all human jobs in 120 years [6].

Looking back at the definition of vending machines and the change in interaction, the world will become more machine related and bring less human interaction in daily lives. How does this influence our social life?

Humans are social by nature. Humans need other humans to survive, humans tend to be perpetually ready for social interaction, and studying specifically the social features of human functioning is profoundly important [14]. When AI contains the main form of interaction between two human beings, human interaction will decrease and ultimately disappear.

Interaction among humans should be chosen over robot contact, according to the Rathenau Institute. In addition, the Institute pleads for the right to significant human contact. New technologies advance humanity, but create new social challenges in society at the same time. Currently ethical systems are still adjusting towards these technologies [5]. Trust in these technologies is an issue. Will the interaction with this technology be trusted by the users just as interaction between humans? [13] Are the people in current society ready for the arrival of new intelligent machines?

In this research we look at human to human interaction related to new intelligent machines from the perspective of replacing the former with the latter. The aim is to let the participants think about what human interaction means to them and how new technologies could influence that. The research focusses on people's reactions to future utilisation of AI, whether different types of AI provoke different reactions, people's awareness of social consequences of AI and the circumstances under which people now find it acceptable to replace HtHI with intelligent machines.

## THEORETICAL BACKGROUND

### Constructive design research

A lot of different research techniques have been developed since the industrial revolution, one of the most recent being research through design or constructive design research. This technique developed by Koskinen et al. (2011) describes three different ways of doing research with the help of design. There are three types of constructive design research; lab, field and showroom [10]. Lab is focussed around using design to create a consistent user test. In lab research the most important task is to compare the relationship between a dependable and an in-dependable variable while taking away all other influences. Lab research uses mainly quantitative data. Field focusses more

on bringing a design into context. This context allows the user to react in their own familiar environment making the outcome closer to the real life situation. Field research uses a combination of observations, qualitative and quantitative data. Showroom is about using design to create a conversation. It focusses on making people aware of something and helps them to start a discussion about it. The main goal of showroom is to create awareness for the user, but also to gather qualitative data for the operator. Therefore within this research, the showroom methodology was used.

### Provocative design

One of the most important goals of showroom research is to provide participants with food for thought. Ozkaramanli (2016) has mapped three ways to do so: embodied symbols, forced choice and behaviour barriers [12]. Embodied symbols change a feature of a design with a feature closely connected with the discussion. An example can be seen in figure 1.1, where a piece of candy is shaped like a gun. This change of shape from the standard candy shape into the gun shape will make people think about suicides when eating the candy. With forced choice the user has to choose between two extremes. These choices cannot live side by side, they are absolute choices. An example can be seen in figure 1.2 which shows a serving tray that can be used either as a bowl or as a canterbury. This absolute choice will make you think whether you want sweet or savoury snacks without giving you the choice for both. With behavioural barriers a habit of the user is blocked. An example can be seen in figure 1.3 where users cannot snack whenever they want anymore. The blocking of the habit gives them a moment of reflection during the use.

### Economic paradigms

The economy has since the industrial revolution gone through different stages and has seen different paradigms. Brand and Rocchi formulated four paradigms [3]. The first paradigm is the industrial paradigm where businesses create one product for all their users. The experience paradigm brought more user involvement and showed the beginning of different customer segments. With the introduction of the internet the knowledge paradigm was brought into existence, where exchanging knowledge through different platforms became the norm. Within this paradigm users



**Category 1: Embodied Symbols**  
**Sugar Gun Lollipop by Marije Vogelzang**  
 Photo by Patricia Schimmel.  
 Courtesy of the designer.



**Category 2: Forced Choice**  
**Dilemma by Dean Brown for Fabrica**  
 Photograph by Shek Po Kwan.  
 Courtesy of the designer.



**Category 3: Behavior Barrier**  
**KitchenSafe by TheKitchenSafe**  
 Courtesy of the designer.

**Figure 1. Examples of provocative design [12]**

form a network that businesses have to tap into. Brand and Rocchi expect that a more locally focused paradigm, the transformation paradigm, will follow. However, we would like to propose another possibility which is the individual paradigm, where individuals focus on their personal gain. In this paradigm every individual becomes a separate entity that is only connected through businesses and the services these businesses supply.

### Vending machines

In today's society vending machines are an important way of getting our products. But what is the true definition of a vending machine? To better understand a vending machine three levels of abstraction were created. First we have the vending machine as we know it today. This machine exchanges money for a product. In Japan there is a vending machine for every 23 inhabitants [8]. The second level of abstraction is self-service. Here you are part of the vending machine, but most of the time you still have an exchange of money for a product or service. The third level of abstraction is a trading service where a value is traded. This can be anything from products and money up to services. This last level of abstraction was also used in this paper where information was changed for awareness.

### DESIGN

In order to test the awareness of people towards AI and robots a conversation catalyst was created, see figure 2. This catalyst was in the form of a vending machine. The goal of the machine was to start a conversation about AI and robots by asking users the question: do you want this technology in your life. This question was asked for six different technologies; drone delivery, VR meetings, self driving cars, care robots, sex robots and conversation robots. For each question the user could select whether they would like the technology or not by flicking a switch, see figure 3. After the selections had been made a lever was pulled to make the decisions final. By flicking the lever six marbles representing six personas would fall (when a technology was accepted) or stay (when a technology was not accepted). This was to mimic you dropping your friends for technology in the real situation. After this six persona's came out the machine explaining the relationship you now have with these friends, shown in figure 4. For the dropped friends it is about the relation you had and for the friends that you kept it is about the relationship you still have, shown in figure 5a and 5b. After this confrontation a conversation could be started with the users about the influences this has on them. Although the presence of an interviewer might influence the results and the reactions of the participants, within this research the interviewer is believed to be of significant additional value to the results of the study. Research by Bardzell et al. has shown that it is important to develop a slow and deep relationship with participants where it concerns provocative design. It is often only after talking for a while that the true opinion of participants becomes apparent [1].



Figure 2. The vending machine as it was used within the interviews (at Dutch Design Week 2017)



Figure 3. One of the panels on the vending machine, showing the drone delivery technology

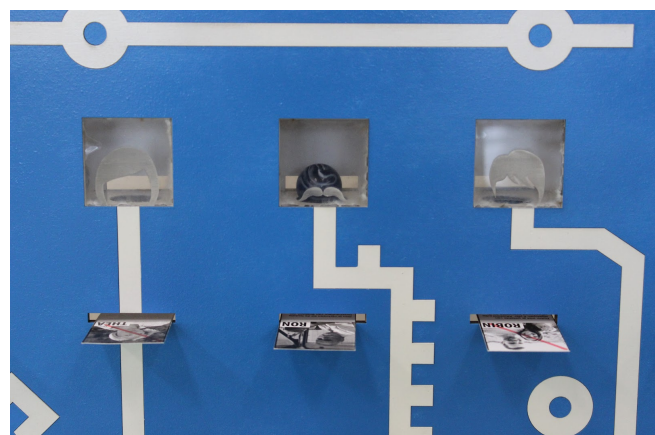


Figure 4. The windows for marbles and the personas coming out of the machine





**Figure 5a. A non-rejection card of one of the persona's. The text says:**

**'Jonathan is your favourite colleague because he has a great taste in pastry. He is the guy who is always late for company meetings. As compensation he buys the best pastries for everyone.'**



**Figure 5b. A rejection card of one of the persona's. The text says:**

**'Jonathan was your favourite colleague because he had a great taste in pastry. Before the company meetings were online, he was always late. He compensated by buying the best pastries for everyone. It has already been four years since you have seen each other in real life and you miss his pastries.'**

## METHOD

To gather responses, the vending machine design was deployed at two different locations: a design-oriented event (Dutch Design Week 2017) and the faculty building of Industrial Design at Eindhoven University of Technology. These locations were chosen in order to get a broad sample concerning age while focussing on design and technology oriented individuals. There were 18 participants in total, 8 male and 10 female, with ages starting from 20 and reaching to over 60.

During the study, the participants were asked to select the technologies that they would not like to have in their lives. This was done through an opting out interaction, which meant that the default for each choice was set to accepting the technology. It was hypothesised that through this method, more participants would select that they were okay with certain technologies, allowing more room for discussion within the interview. Additionally, when individuals do not interfere with the development of new technologies in the future, they will most likely reach the market. Within the development of technology, a lot of consumer choices are already made through an opting out policy. A study by Johnson et al. shows that this type of decision-making already has a large impact where it concerns giving access to private information [9].

The machine was operated by the researchers. One of the researchers explained the machine to the participants and interviewed them in a semi-structured manner after the interaction with the machine. Semi-structured interviews were used to get reliable and comparable qualitative data [2]. Another researcher transcribed the interviews and made observations about the interaction and the conversation between the interviewer and the participant. Two more researchers were positioned behind the machine to facilitate the wizard-of-oz interaction. Quantitative data was gathered

about which technologies the participants selected and the hesitation that was associated with these choices. The interviews were used for qualitative data and to follow the line of reasoning of the participants. Each interview took between five and ten minutes and was used to discuss why the participant selected the technologies that he or she selected. Additionally, the interview was used to start a discussion with the participant about what the consequences of his or her choices could mean. The participants were also asked whether they would like to change their choices based on the (new) perspective they were offered during the interview.

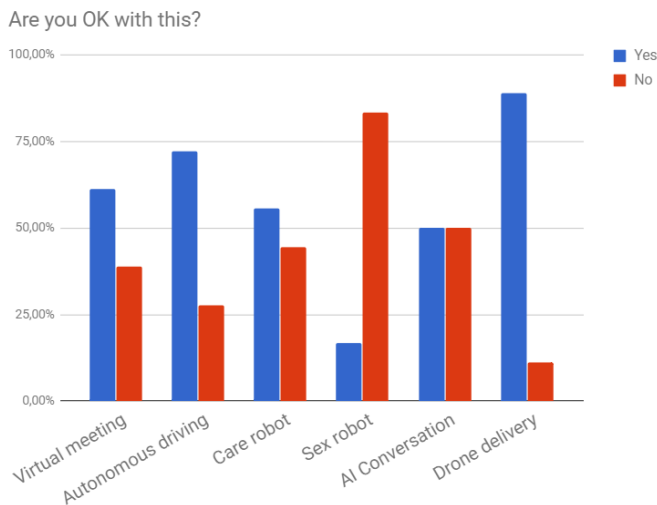
## RESULTS AND INSIGHTS

The data collected for this research are of both qualitative and quantitative nature. The quantitative data consist of participants demographics and initial answer per artificial intelligence application acceptance. Participant demographics are presented in figure 6 (N = 18). In figure 7 the answers to the question 'Are you OK with this?' are given. This chart represents the input given by the participants. The qualitative data consist of answers supporting the choice for each artificial intelligent application and interview answers related to the consequences of the choices that are made.

The answers were coded in three iterations and themed using thematic analysis. This resulted in five clusters which comprise the main essence of the answers given by the participants. These clusters are represented by the codes; Practical, Human values, Safety, Additional and Skeptical. The code Practical represents the practical and efficient reasons for choosing the artificial intelligence replacement. The code Human values is meant for when ethical and moral values of a human interaction are in conflict when

<b>Number of Participants</b>	18	
<b>Participants</b>	Female	10
	Male	8
<b>Age</b>	20 - 30	8
	30 - 40	1
	40 - 50	3
	50 - 60	2
	60+	4

**Figure 6. Participant demographics**



**Figure 7. Acceptance rates of different AI applications**

interacting with the intelligent application. Safety is coded regarding the concerns or increase of human safety and security. There is no trust in the artificial intelligent application or it gains more trust. Additional is defined as when an artificial intelligent application should be used only in a supportive way and not as a total replacement of human interaction. The Skeptical code represents the thought the participants have. The thought is that it is highly unlikely that the intelligent machine is able to replace the human interaction related to the intention of the machine.

### Reactions to AI applications

Within the conversations with the participants, there were some clear themes that kept coming back. For instance, when talking about the delivery drone, a lot of participants mentioned the practicality as a reason for choosing the technology:

*"[The delivery drone] is just practical. This already has become separated from social interaction, I just get*

*annoyed when I'm not home to accept a parcel and they come back the next day."* - P18

*"The interaction [with a parcel deliverer] has less personal value which means that it is not so bad if it is replaced."* - P8

*"I think [the delivery drone] is allowed because it is practical."* - P9

For the care robot, loneliness was a common theme, which was often mentioned in comments that opposed the technology:

*"Human contact is more important. You won't solve loneliness in healthcare like this."* - P7

*"The human aspect. A robot shouldn't be allowed to start talking to elderly."* - P10

The reactions to the sex robot were most extreme and repulsive:

*"You miss the warmth that you give each other [when using a sex robot]."* - P12

*"[Sex] is something you should do yourself."* - P6

The repulsion also showed in the lack of hesitation when making the choice for most participants.

Participants were more talkative when arguing for practical replacements by AI. Also, these practical applications were relatively more accepted than the applications with a higher level of human social interaction. The more personal interactions provoked most intense and defensive responses.

Most participants felt AI applications should be used as supportive tools, without completely replacing HtHI. However, where there is a lack of human practitioners for certain tasks or jobs it is noticeable that there is a generally larger acceptance towards AI solutions. This applies especially for health care, with examples of therapy or care:

*"In healthcare, a robot can help. For instance for children with autism who find it easier to talk to robots than to people."* - P5

### Social consequences of AI

Once the participants were confronted with the social consequences of the technologies that they selected, the reactions were mixed. Some participants expressed that this had not been their intention:

*"That was not my intention, I saw it as an enhancement rather than a replacement."* - P4

Other participants felt like they did not have the power to stop AI:

*"It's hard to stop these developments..."* - P6

Some participants were shocked by the consequences that were presented to them. In some cases this made them skeptical about the study:

*“It has been voiced very radically and pessimistically. You always still have your own choice.” - P16*

For others, it rather made them reevaluate their choices:

*“If it’s this extreme, then I would say no to everything. There has to be a balance. The experience has to stay.” - P17*

*“Then I wouldn’t want the AI conversation after all. I have my own friends for that. With the social aspect of jobs, I would also not want the drone delivery anymore.” - P9*

Sometimes the participants had some trouble finding the direct link between the AI and the persona that was related to it. This meant that for instance for the bus driver (who was replaced by autonomous cars), they found it hard to imagine that they would lose this kind of social contact:

*“Normally I don’t interact with a bus driver so much. You also have fellow passengers of course, but we already partially lost contact with them because everyone is on their phone. The bus isn’t really about social contact for me.” - P7*

From the responses of the interview it was retrieved that the participants did have a clue of possible social consequences of AI, but that these thoughts were often limited to a direct small form of interaction. The bigger consequences (e.g. societal impact and ethical issues) were only addressed by the participants who studied Industrial Design at the Eindhoven University of Technology. This observation suggests that the more you are familiar with the development of intelligent technologies, the more you are aware of the possible consequences on a societal scale. On

the other hand, this also suggests that when there is little to no experience with intelligent technologies, people find it hard to think beyond the obvious.

### Personal boundaries

The participants were asked where their personal boundaries lie concerning accepting the replacement of HtHI with intelligent machines. A frequent answer was concerning the personal and social aspect. Social contact is found important.

*“The personal aspect is the most important.” - P4*

*“When I think the social contact is important in the situation.” - P15*

*“Social interaction. A replacement of human contact is always difficult and therefore less important. AI can be an addition in the case of social interaction, not a replacement.” - P18*

Another answer to this question is regarding freedom of choice. The technology should not be forced and leave the choice to use open. This comes back that there should still exist a grey area and keep the ability to have both and not make radical replacements.

*“When you get forced because of the technology”. - P16*

*“The choice to use the new technology should stay.” - P17*

*“It should not replace but support. I hope that this choice will never be so radical as shown here.” - P3*

Figure 8 shows the level of personalised interaction and the level of acceptance which is the amount of ‘yes’-categories

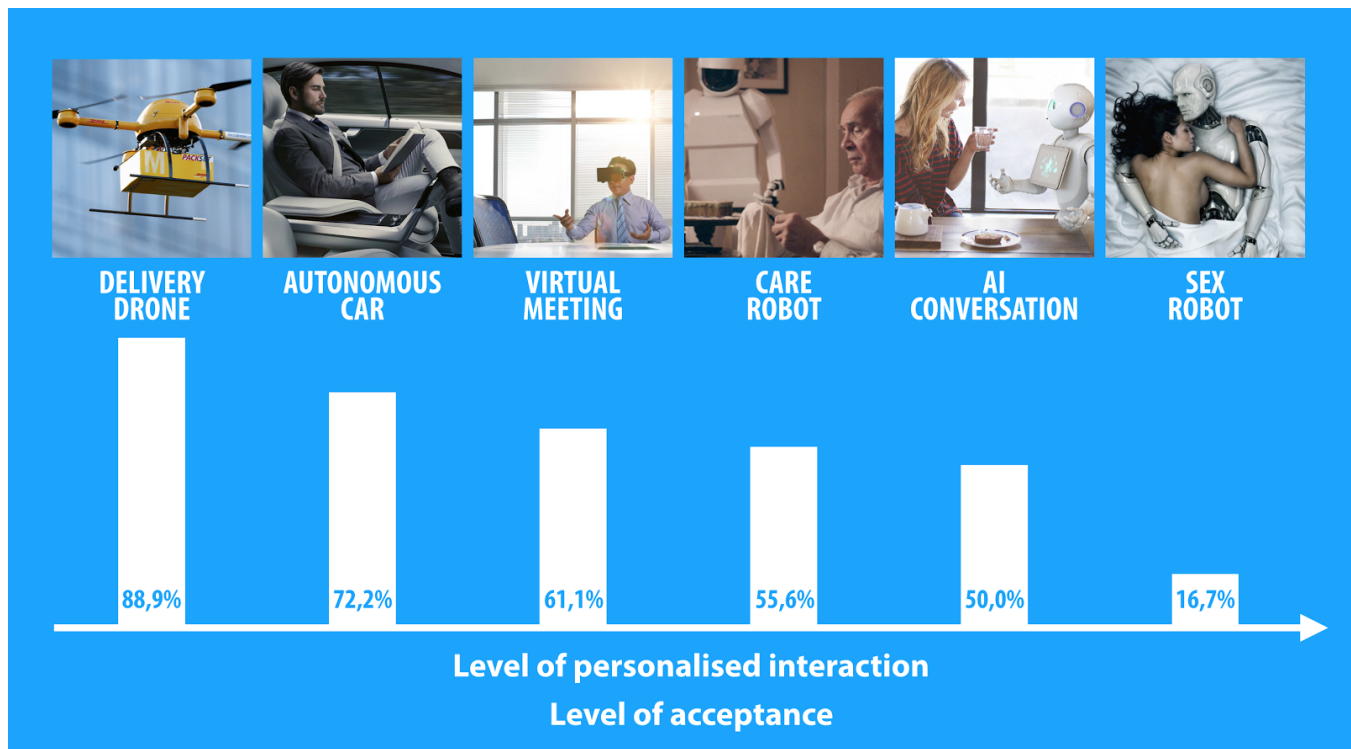
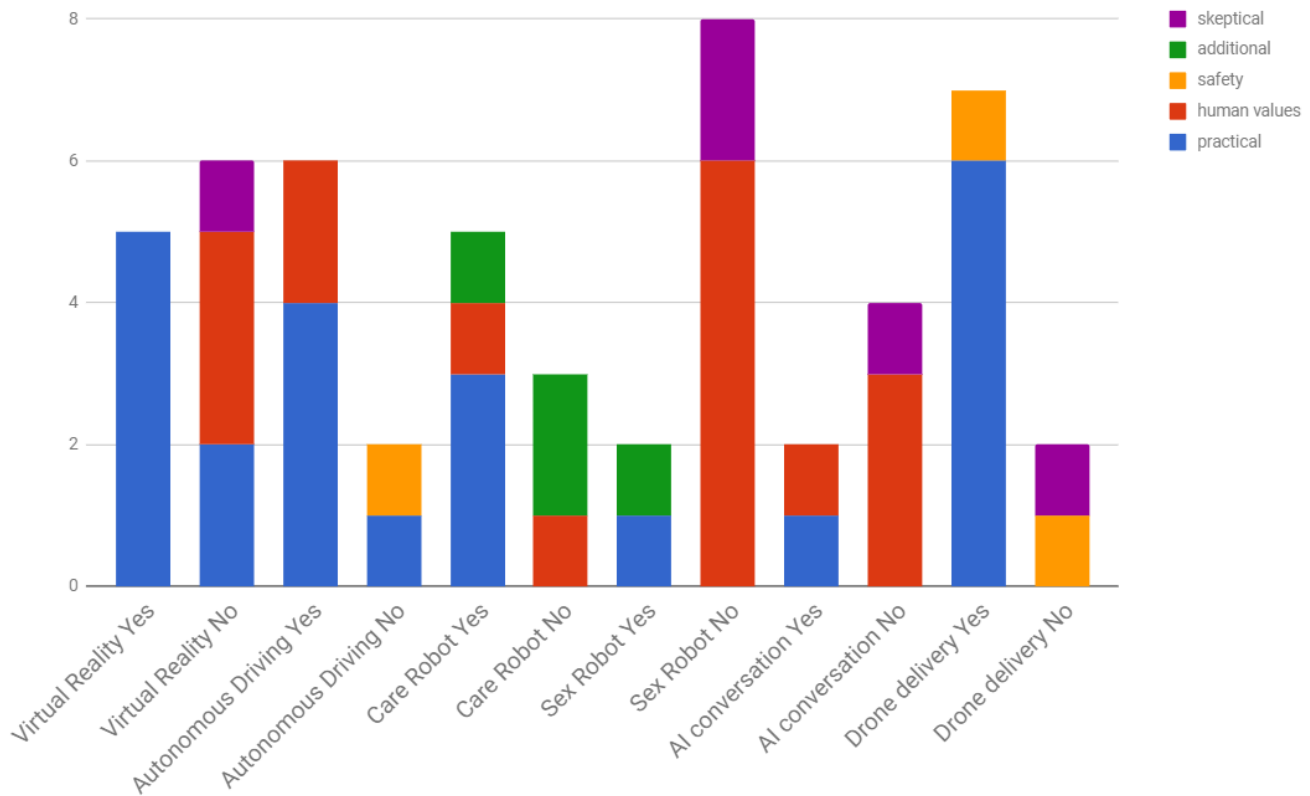


Figure 8. Level of personalised interaction and level of acceptance, as indicated by the participants

## coding by category



**Figure 9. The coding of the different AI applications, based on comments that the participants made during the interviews**

in percentages. The personalised interaction are levelled according to the kind of human to human interaction and which human values correspond with that. The delivery drone has therefore a low personalised interaction level and a sex robot a high one.

In figure 9 the results of the coding by category are shown. Hereby the code for each answer, given by the participants as argument for an acceptance, is given for each category. For every artificial intelligent application there is a 'yes'- and 'no'-category. This gives in total 12 different bars where the code is given.

As you can see in chart 2 there is a clear correlation between the personality of the interaction and the amount of people choosing for the interaction. When comparing this with the reactions above about the limit there is a clear correspondence with these reactions. It is apparently indeed easier to replace HtHI with a intelligent machine when the interaction is less personal/social.

In the data about the codes by category in chart 3 it is visible that the reasons to choose for a certain technology are in every category 50% or more because of practical reasons. This is expected since most users state that they will only use these technologies when they have practical

advantages. In the 'no'- categories you would therefore also expect to see the reason social interaction pop up most, this is partly true, however some categories have a size that is too small for this to be visible.

For the technologies it is clear that the amount of information at people their disposal plays a big role in the way in which they make their decisions. The more they know the more they tend to allow certain technologies. This often has to do with misconceptions people have when thinking about the technologies. These misconceptions are often already solved, but when the user does not know this it can make their decision go towards no quicker. An example is people thinking a sex robot would be very cold although there are already technologies to solve this:

*"You miss the warmth you give each other." - P12*

## DISCUSSION

Although the results of this research are promising, we believe that future research can enhance the quality of the outcome, mainly by supporting the qualitative findings with more quantitative findings. For next design iterations it will be beneficial to create a vending machine that is

autonomous, which means human errors or influences can be eliminated.

The design of the vending machine allowed for a discussion on the collective data, as the marbles within the machine correspond with the decisions participants made. However, due to the low amount of quantitative data, this opportunity was not made use of. When upscaling the research testing, it would be very interesting to add this quantitative information as a statement for further provoking and interviewing the participants on a more collective scale.

For this research six different types of AI that may replace human factors in different forms of interaction were selected. The study shows that in some situations, these technologies were not interpreted the way they were intended. For example, the delivery drone was mainly linked to replacing a deliverer and not to replacing all sorts of buying behavior in general – in this way the replaced interaction was way less valued than what had been intended. On the other hand, with the sex robot many people underestimated the resemblance a of humanlike contact that a robot might be able to achieve (i.e. they expected a sex robot to be cold, while it could easily be warmed up with a heating element). The assumption is that the presence of the option of having a sex robot had a significant influence on the interpretation of other technologies. For future studies it would be interesting to leave this option out or replace it by a less provocative subject, in order to research the difference in accepting the other technologies in more detail.

The participants in this research were (nearly) all people with a feeling for or interest in technology and design as they were either visiting the Dutch Design Week or studying Industrial Design at Eindhoven University of Technology. As this group can be considered to be quite a niche, the insights from this research cannot be generalized into bigger figures. It was found that the more people were involved with the development of AI, the more they were already thinking of ethical and societal consequences, rather than individual impact of these technologies. This led to a new hypothesis for future research that the impact of the provocation might increase when having more participants with less awareness of the possible consequences of AI.

## CONCLUSION

The complexity of new artificial intelligence technologies increases and machines become more capable of the most intelligent actions in these first decades of the 21st century. Human machine interaction will occur more often than human to human interaction. In this research the main question is how people perceive the consequences of artificial intelligence on human to human interaction.

The participants were aware of possible social consequences of AI but not all had many experience and found it hard to look past the short-term consequences. It was found that the more people were involved with the development of AI, the more they were already thinking of

ethical and societal consequences, rather than individual impact of these technologies. The general knowledge of the participants around this research subject was important for the results.

The intelligent machines used with this research should not replace the human to human interaction completely. The practical applications, such as the care robot, should act as an additional and supportive help next to the current human procedure. Additionally, it was found that the more personal interactions were provoked, the more intense and defensive the participants responded.

Altogether human to human interaction is perceived as too important to disappear because of an artificial intelligent replacement. It can support or replace practical applications whereby the human to human interaction is not of great importance or where the personalised interaction is small and can be ignored. When the AI technologies were close to personal boundaries related to feelings of social contact and human values, it is perceived as intrusive and should not be accepted.

## ACKNOWLEDGMENTS

We did this research as part of the course Constructive Design Research at the Master program of Industrial Design at the Eindhoven University of Technology. First of all we want to thank Stephan Wensveen, the lecturer of this course, for his critical and constructive guidance and feedback. Also we would like to thank Ilpo Koskinen for sharing his wisdom during the introduction of this course. We are also very grateful for the feedback we received from our fellow course students from all research clusters, and specifically the ones we discussed with most frequently: the showroom research students. Your input stimulated several iterations which contributed to better research! Lastly we want to thank our participants and NUL ZES for providing us with a location to perform our research during the Dutch Design Week 2017.

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## AUTHOR BACKGROUNDS



**Nasir Abed** is a master student at Industrial Design faculty within Eindhoven University of Technology. In 2010 he obtained a Computer Science bachelor degree and started working. In 2016 he started his pre master at this faculty driven by his constant curiosity and hunger for knowledge. During

this project, he looked paper and sources in joined effort, took part in the realization of the vending machine and analyzing the collected data.



**Job van Gennip** is a master student at Industrial Design at Eindhoven University of Technology. In 2016 he also passed his bachelor degrees in the same faculty with a project on the shared control within autonomous vehicles. Having started the Research Design and Development

track in his master and with his expertise in rapid prototyping techniques like 3D printing and lasercutting Job has a tendency to think in the physical. In this research Job therefore helped with the building of the vending machine. Also during the discussions Job was not afraid to make bold statements. This attitude also made Job the person to be the main spokesperson during the user tests.



**Caro Heesackers** is a master student Industrial Design at Eindhoven University of Technology. After her bachelor studies at the same faculty, she invested a year in gaining more general knowledge in mathematics and ways of communication. This knowledge is meant for design

research projects during her masters focused on data mining and sharing combined with the ethics around artificial intelligence. Her work in this research is related to the elaboration of the right definitions of all involved subjects and terms. Furthermore she took part in the realization of the vending machine as well as the discussion of the subject of the research.



**Renee Noortman** is a design researcher with a background in Industrial Design. She obtained a BSc degree from Eindhoven University of Technology and is currently working towards a MSc degree from the same institute. She did an intervention design internship at Afdeling

Buitengewone Zaken in Rotterdam and has worked on several projects relating to our daily perception of technology such as an exposition about responsible IoT and her graduation project Knitwit. Within this research her focus has been on documentation and the design of the intervention, besides the team effort of discussing the philosophy behind the project and building the vending machine.



**Daniëlle Ramp** is a social designer with a background in Industrial Design, BSc. With an interest in education and entrepreneurship she has recently started the Design Leadership and Entrepreneurship track at the Master program of Industrial Design and is working towards obtaining her Physics

teacher degree at the Eindhoven School of Education. She did a social design internship at CvdBremen and Capsters and worked on several bottom-up design projects, sessions, workshops and events within this field of interest. She used her expertise in this research by focusing on the (detailed) interaction of the intervention from multiple perspectives and contributed to the physical design of the machine. Next to that she had great passion for the joint philosophizing about the essence of this research!