NTNU – Trondheim
Norwegian University of
Science and Technology

User Acceptance of Social Robots

Ibrahim A. Hameed,
PhD, Associated Professor
NTNU in Ålesund, Norway
ibib@ntnu.no

Paper:

- Hameed, I.A., Tan, Z.-H., Thomsen, N.B. and Duan, X. (2016). User Acceptance of Social Robots. *In Proceedings of the Ninth International Conference on Advances in Computer-Human Interactions* (ACHI 2016), Venice, Italy.
- This research has been done in collaboration between Aalborg University, Denmark and NTNU in Ålesund, Norway.

Outline

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- Possible applications of social robot?
- Challenges
- What is user acceptance?
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Motivation

- Designing a new robot and the need arises to get a feedback from end-users to fulfil their expectations and needs.

What is social robot?

- A social robot is an AI (artificial intelligence) system, such as Android, that is designed to interact with humans and possibly also with other robots.
- Social and personal robots are a type of mobile robots that look like, communicate and interact like humans and are used where people used to live.
- It should be able to verbally and non-verbally (facial expressions, posture, nodding, eye-contact, gesture, waving, etc.) communicate with humans.

Possible applications of social robot?

- They are used to replace – in part – visiting human care giver in elderly/nursing houses in their roles of distributing and ensuring medication is taken and reporting back if they do not see the medicine being swallowed
- For childcare at homes and kindergartens
- To help people with reduced mobility
- As office receptionist
- As a school teacher for languages and other subjects
- For replacing real assist “seeing” and “hearing” animals for blind people to quickly clarify the situation and provide live feed
- Replace real animals with robotic animals
- etc.

Market value of personal and service robots

- By 2030, many households in the developed world will have personal robots in their home.
- Personal robots tomorrow will be like personal computers today.
- According to a Forest & Sullivan's recent study, the future of mobile robots, the market for mobile robots is expected to reach $17.4 billion by 2020.

Challenges

- The challenge is to have robots that can understand human emotions, expectations and needs and react accordingly.
- Integration of artificial intelligence, deep learning, cognitive behavior and sensor fusion is expected to help such types of robots to act and behave like humans, have personality and take right decisions in various situations.

What is user acceptance?

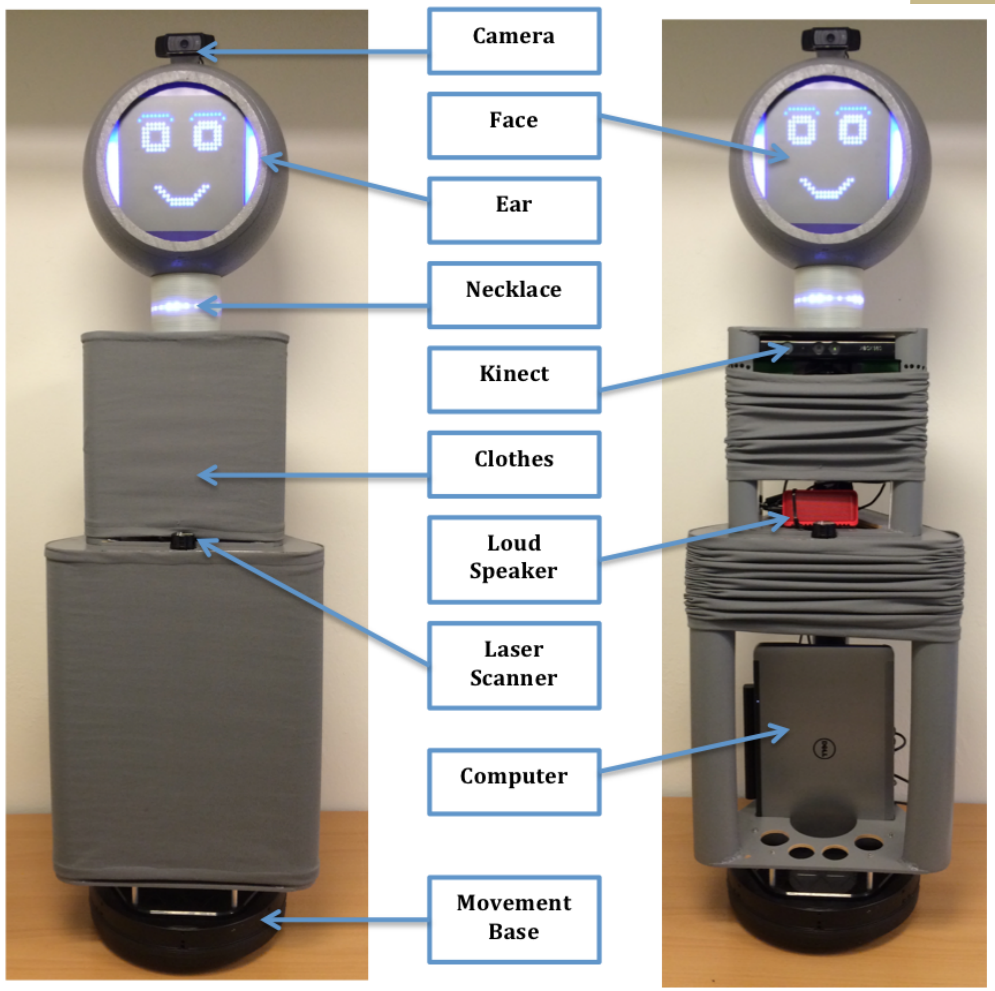
- It is a test used to make sure that the final product can handle the required tasks in real-world scenarios, according to specifications.
- A mismatch between the user's expectations and the actual reality of social robots may negatively impact the acceptance and use of the robot.

Factors affecting user acceptance

- Given that the use of personal robots may be expected to become a part of people's everyday lives, it is critical to understand and consider the factors that may increase acceptance and adoption when robots are designed and introduced.
- How the robot is accepted by end users may be influenced by factors, such as:
    1) the role assigned to the robot (i.e., robot function),
    2) the robot's social capabilities or skills such as the robot's social intelligence and emotions expressions, and
    3) The robot appearance.

Robot platform (iSocioBot)

- The autonomous robot platform used in this experiment is a newly developed in-house intelligent social robot (iSocioBot) using off-the-shelf standard components.
- The main goal behind building iSociobot is to attempt to make service robots socially intelligent and capable of establishing durable relationship with their end-users.



Human robot interaction using speach

- The system consists of spontaneous automatic speech recognition (ASR), audio-visual perceptual system, speaker localization and tracking, dialogue system, and speech synthesis.
- When a user speaks to the robot while they are not facing each other, the robot tends to slowly spin around until it can clearly face him/her.
- The dialogue system consists of a very primitive, flexible, and answers-independent dialogue script is used

Dialogue system

- The dialogue script consists of a set of ordered groups of sentences and questions.
- In the experiment, the robot randomly chose a sentence or a question from each group in order.
- Detecting when the user starts and stops talking timely control the transition between each script item.
- The dialogue starts by greeting the user using one of the welcome statements, asking about his/her name, a few sentences and questions to discuss the cultural night event, and then it ends by wishing him/her a pleasant event.

Dialogue script

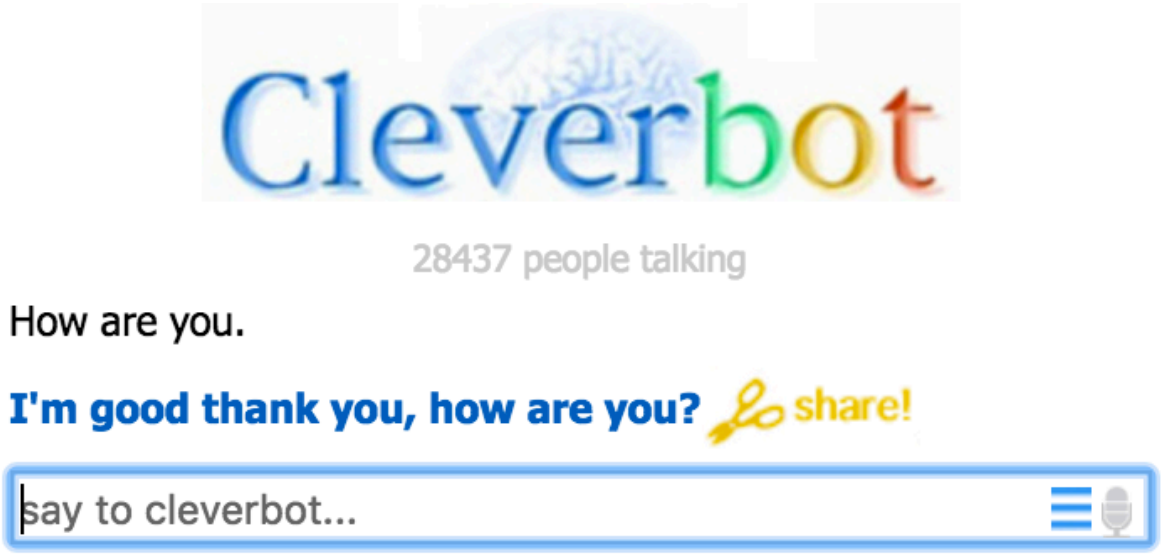
No.	iSocioBot's Dialogue Script
1	Hello. Welcome to the cultural evening. I am SocioBot from Aalborg. What is your name?
2	Hello. Welcome to this glorious event. My name is SocioBot and I come from Aalborg. What is your name?
3	Hi there. Welcome to Culture Night. My name is SocioBot, and I come from Aalborg University. What is your name?
1	Great to see you.
2	Nice to meet you.
3	Om, it is nice to be with you.
1	Where are you from?
2	Where do you live?
1	It's a good place. I have heard very well about it.
2	It sounds like a nice place. I would like to visit it one day.
1	What made you decide to attend the cultural evening?
2	Why are you here tonight?

Dialogue script

1	I am glad you are here. There is much to see. I hope to get time to look around later, but so far I have to stand here and greet people.
2	It is great that you are here. I have heard that there are many different exhibitions and stands around, so I hope to get time to try them later. For now, I greet people, when they come.
1	How many people do you think there are here tonight?
2	How many do you think there comes to culture tonight?
1	It is a great event. I guess around 3000 visitors.
2	Yes, it's a great event. My best guesses are that there will be about 3000
1	What do you think about my appearance in general?
2	What do you think of the way I look like?
1	It's good to hear. Thank you.
2	Thank you, your opinion is important to me. I would probably just consider it.
3	Thank you, it's good to hear your opinion. I way just think about it.
1	It was nice to talk to you. I hope you get a lovely evening.
2	It's been exciting to talk to you. I wish you a fun night. '

Cleverbot

- Integration between AI chat and script can be a better idea.



Experiment

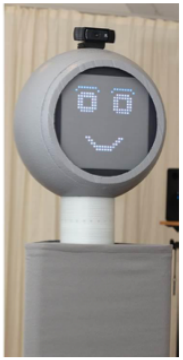
- Each participant has been given an introduction to iSocioBot, design, functions and its possible applications.
- They are also given a brief explanation about what kind of data the questionnaire will collect, why it is collected and how it will be used.
- The experiment is conducted in culture night event in Copenhagen, Denmark in October 2014 http://www.kulturnatten.dk/en/culture-night/Culture-Night-2014

Paper questionnaire

- It consists of four main questions with a set of standard answers, a section for demographic information, and three illustrative pictures.
- The first two questions are addressing the social intelligence skills of the robot by assessing the user's impressions and views before and after interacting with the robot.
- The third question is about the user's preferences of the robot appearance by asking whether they would prefer the human-likeness or machine-likeness of the robot and how this can affect their engagement with and acceptance of the robot, and
- Finally the fourth question is addressing the robot functionality by assessing the need for a touchscreen display on the robot's chest to facilitate robot's control and user interface issues and how this can affect robot acceptance.

Paper questionnaire

SocioBot Feedback Questionnaire

	Criteria	Score				
		Strongly Disagree	Disagree	Neither Disagree Nor Agree	Agree	Strongly Agree
1	You feel that SocioBot did NOT understand you.					
2	Your impression about SocioBot is getting WORSE after interacting with it.					
3	SocioBot should have more mechanical appearance (left picture) than a soft appearance (right picture).					
	 					
4	SocioBot should NOT have a touch screen on its chest.					
						

Gender	☐ F ☐ M	
Age	☐ < 14 ☐ 25 - 54	☐ 15 - 24 ☐ 55 +
Do you have some previous experience in interacting with robot?	☐ Yes ☐ No	

Participants' analysis

- *Gender*:
  - among the 97 participants there are 40 females (around 41.24%) and 57 males (around 58.76%).
- *Age*:
  - 86.60% of the participants are less than 14 years old,
  - 1.03% from 15 to 24 years old,
  - 9.28% from 25 to 54 years old, and
  - 3.09% of the participants are above 55 years old.
- *Cultural background*:
  - 88 participants (around 90.72%) of the sample have no previous experience in personal and social robots beforehand,
  - Only 9 participants (around 9.28%) of the sample have experienced personal robots before.

Questionnaire analysis

- ***Q1***: do you feel that that iSocioBot did not understand you?
- ***Q2***: your impression is getting worse after interacting with iSocioBot?

Social Intelligence of the robot

- ***Q3***: iSocioBot should have more machine-likeness than a human-likeness appearance?

Robot appearance

- ***Q4***: iSocioBot should not have a touchscreen display on its chest?

Robot functionality

Statistical Results

Labels	Frequency of questionnaire answers			
	Q1	Q2	Q3	Q4
SA	9 (9.28%)	4 (4.12%)	7 (7.22%)	12 (12.37%)
A	23 (23.71%)	10 (10.31%)	2 (2.06%)	20 (20.62%)
NAND	13 (13.40%)	22 (22.68%)	7 (7.22%)	19 (19.59%)
D	34 (35.05%)	29 (29.90%)	27 (27.84%)	15 (15.46%)
SD	18 (18.56%)	32 (32.99%)	54 (55.67%)	31 (31.96%)

Conclusions

- From this study, we can summarize the following concluding remarks;
  1) In the area of social and humanoid robots, it is crucial to achieve a kind of matching between robot appearance and actions, if a robot's designer will go for the human-likeness appearance, a satisfying degree of robot's social intelligence and skills must be achieved, and vice versa,
  2) In addition to the voice communication between the robot and its users, a secondary way, such as a touchscreen display on the robot's chest, to communicate with the robot in emergency cases or in case of ASR failure is crucial,

Conclusions

- From this study, we can summarize the following concluding remarks;
  3) Children are more interested in experiencing new technology and therefore they should be given a more effective role in the design and development of such kind of technology, and finally,
  4) Personal robots are very well accepted product and therefore it can be employed to work with humans in very challenging environments such as in classrooms for educating children and in nursery homes for elderly care giving.

references

- A full list of reference is provided in the paper version.

- For correspondence:
- ibib@ntnu.no

Thanks for your attention …

Questions?