GEORG-AUGUST-UNIVERSITÄT
GÖTTINGEN IN PUBLICA COMMODA SEIT 1737

Institute of Computer Science &
Campus-Institute Data Science

LAB USABLE SECURITY AND PRIVACY

Appearance of Robots & Privacy Concerns

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Introduction

- Over the past few years, android and biocentric robots have grown in numbers, types and popularity.

- Robotic systems are used in various sectors like manufacturing, agriculture, education and so on. They are also widely used in nursing homes for assistance and care.

Pepper robot, https://www.ansys.com/blog/engineering-humanoid-robots

Introduction

- Mori's uncanny valley paradigm[1] leads us to assert that people trust a human robot more than an animal-like robot.

Grace, the humanoid healthcare assistant robot

Humanoid robot, Sophia

[1] J. Seyama and R. S. Nagayama, "The uncanny valley: Effect of realism on the impression of artificial human faces,"

Robots In Healthcare

- The advancements in robotics and AI have enabled robots to be integrated into the field of medicine.

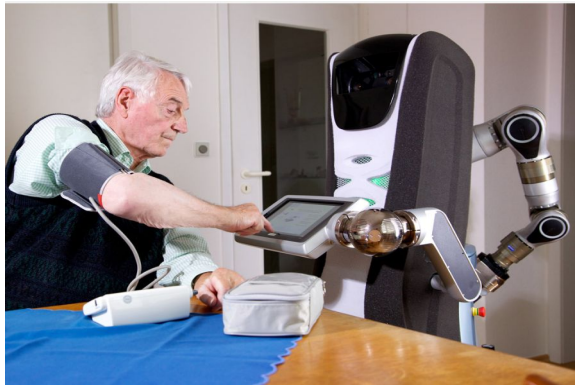
- Applications of Robot in Healthcare include :

  - Medical Device Packaging
  - Automation in Labs
  - Surgery
  - Nurse Robots
  - Care Robots
  - Companion Robots

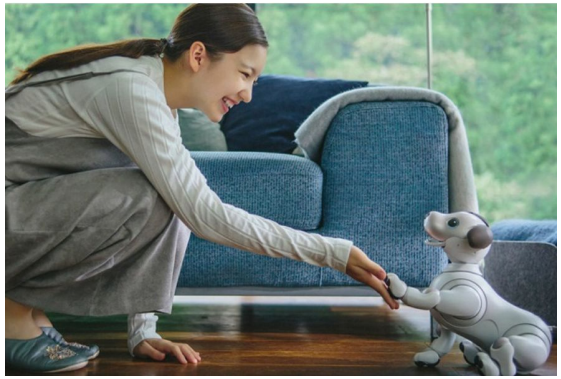
Impacts of Robot Appearance

- Research has shown that the human-likeness of robots enable rich social interactions.

- Some people prefer animal-like robots for assistance in treatment or care.



https://www.care-o-bot.de/en/care-o-bot-4.html



http://koreabizwire.com/kt-to-develop-companion-robot-for-children-and-elderly/169648

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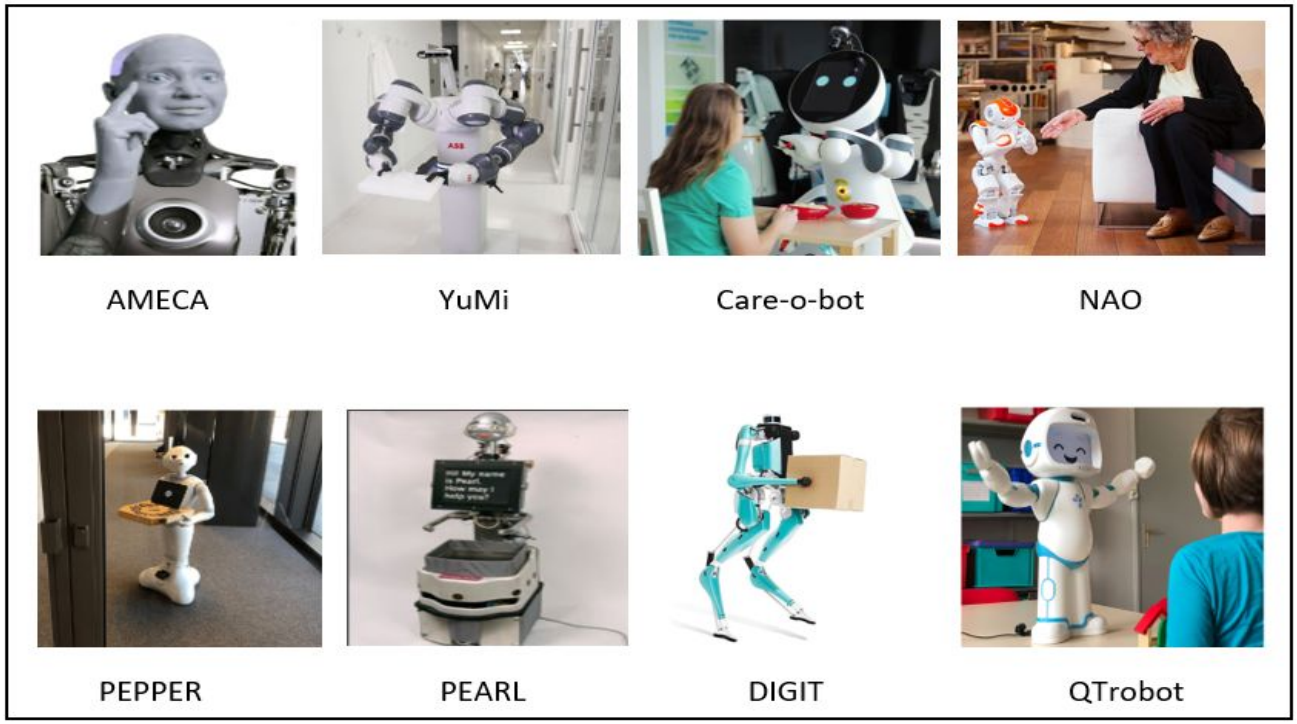
Aim of the Study

We aim to establish that the appearance of a robot impacts

human-robot interaction and

how humans perceive their privacy is affected.

Robots used in Study



Humanoid Robots

Robots Used in our Study

AIBO – Dog Robot

Aflac Duck

PARO- Seal Robot

TABBY- Cat Robot

Zoomorphic or animal-like robots

SPOT Robot - Animal-like Limbs

RIBA Robot - Bear-like face

Kabochan Robot - Human-like

Other robots

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Research Hypotheses

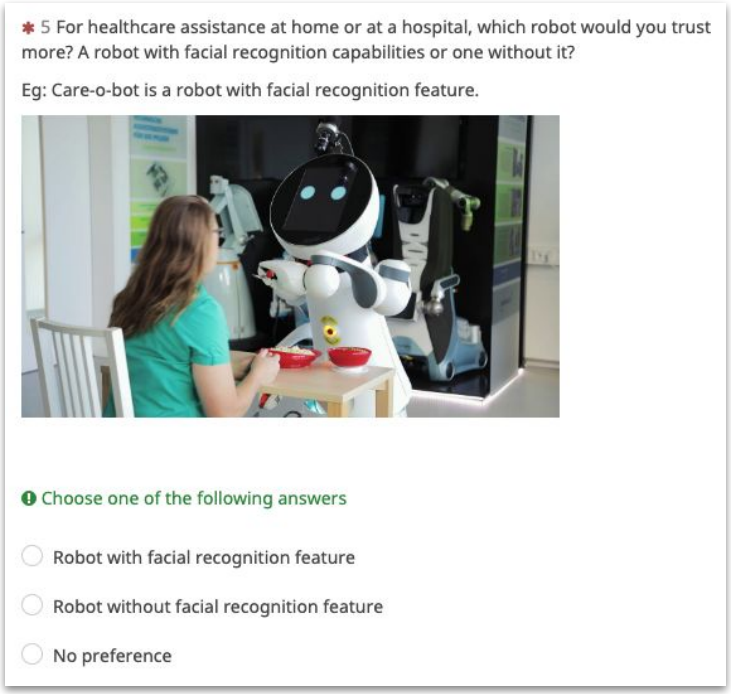
Robot Features	Robot Appearance	Human Characteristics	Privacy Measures
People prefer a personalized robot interaction at hospitals, even though facial recognition might be a violation of personal privacy	People prefer interacting with robots that have human-like facial features	The willingness to interact and trust an animal-like robot over humanoids depends on a person's age and gender	People prefer animal-like robots with a well-defined privacy policy for medical assistance
Trust is affected by the presence of sensors (e.g.: camera, microphone, etc) on robots	People trust humanoid robots over animal-like robots to deliver necessary items and movement assistance	Older People prefer to interact with child-like robots over animal-like robots	People do not trust robots that transfer their data to third parties or other intelligent devices
People prefer to interact with zoomorphic robots that are lively and communicative	People prefer animal-like robots over humanoid robots as therapy robots	Parents prefer that their children interact with animal-like robots over humanoid robots	
People prefer to interact with and trust a robot with speech capabilities over robots that can only communicate through text	People are less likely to share personal information with a doctor in the presence of a humanoid robot than with an animal-like robot	People with pet's trust animal-like robots more than humanoid robots	

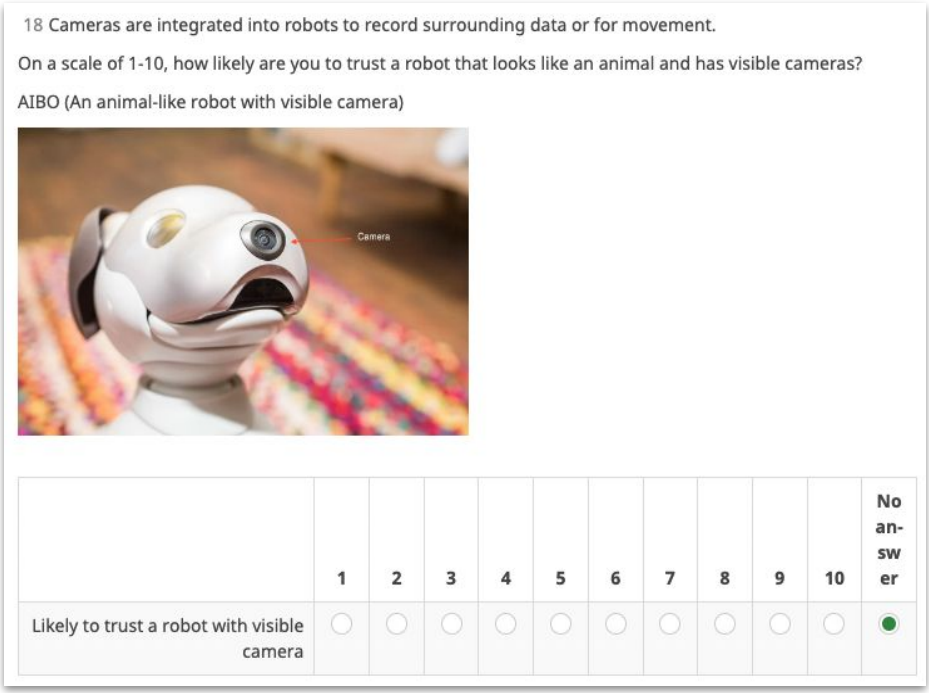
Research Methodology

- Based on the hypotheses, we developed a set of 30 questions.
- The questions were configured in the form of an online survey.
- The survey followed the EU data protection guidelines and was anonymous.

Question Format

- We formed two kinds of questions - choice type & scale type questions.





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Study Results
Robot Features

1. Facial Recognition ✓
2. Speech ✓
3. Touch Sensors ✓
4. Sensors (Camera, microphone) ✗

	Percentage
With Facial Recognition	***67.27%***
Without Facial Recognition	18.18%
No Preference	14.55%

Very Unlikely	***25.45%***
Probably Not	18.18%
About the Same	21.8%
Probably	20%
Very Likely	7.27%

Study Results
Robot Appearance

1. Facial Structure
2. Limbs
3. For Therapy
4. For Companionship

https://www.care-o-bot.de/en/care-o-bot-4.html

Facial Structure and Limbs

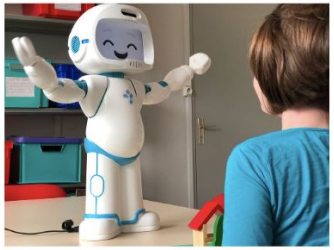
	
Ameca	Pearl

	Participants
Ameca	60%
Pearl	20%
No Preference	20%

Participants prefer the robot that they perceive has greater strength

Spot Robot	Digit Robot	RIBA Robot
		
Least preferred	More prefered than Spot	Most prefered

Robots for Therapy & Companionship

Animal-like Robot (PARO)	Child-like Robot (Kabochan)	Humanoid robot (QTrobot)
		

Zoomorphic robots are trusted more for therapy

Participants remained neutral when asked about robots for companionship during doctor visits

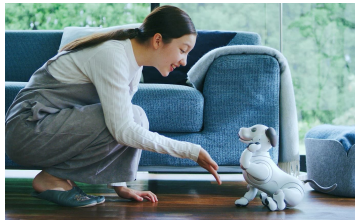
https://www.popsci.com/mit-assistant-robot-gives-nurses-second-opinion/

Study Results
Human Characteristics

	18-25	*26-40*	*>40*
Humanoid	28.4%	37.82%	**41.66%**
Zoomorphic	**46.08%**	**41.66%**	33.33%

Age vs Robot Preference

kabochan - child like robot



AIBO-Sony Robot

	Male	*Female*
Humanoid	**39.81%**	36.11%
Zoomorphic	36.11%	**49.08%**

Gender vs Robot Preference

Study Results
Human Characteristics

- *People with children* prefer their kids interact with zoomorphic robots.
- *People with pets* prefer zoomorphic robots over humanoid robots.

	Preference
Humanoid	18.75**%**
Zoomorphic	**56.25**%

Parents preference for their kids

https://www.yourangel.org.au/nao-robotics-for-kids/ , Paro Robot for Children

Study Results
Privacy Measures

- People prefer robots that are equipped with privacy policies.
- No valid conclusion on data transfer. More awareness is required for better results.

https://robots.ieee.org/robots/pepper/

Study Results

Robot Features	Robot Appearance	Human Characteristics	Privacy Measures
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Conclusion

- There are privacy implications to bringing robots into the healthcare field, but they may be essential beings soon.

- With our study, we prove that humans perceive privacy and trust in robots differently based on their appearance.

- Human characteristics like age, gender, pet ownership also plays a role.

Future Work

- The study could be extended to people who have interacted with a robot before.

- Considering factors like disabilities might lead to different and more precise results.

- Study can also be extended to young children.

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Thank You.