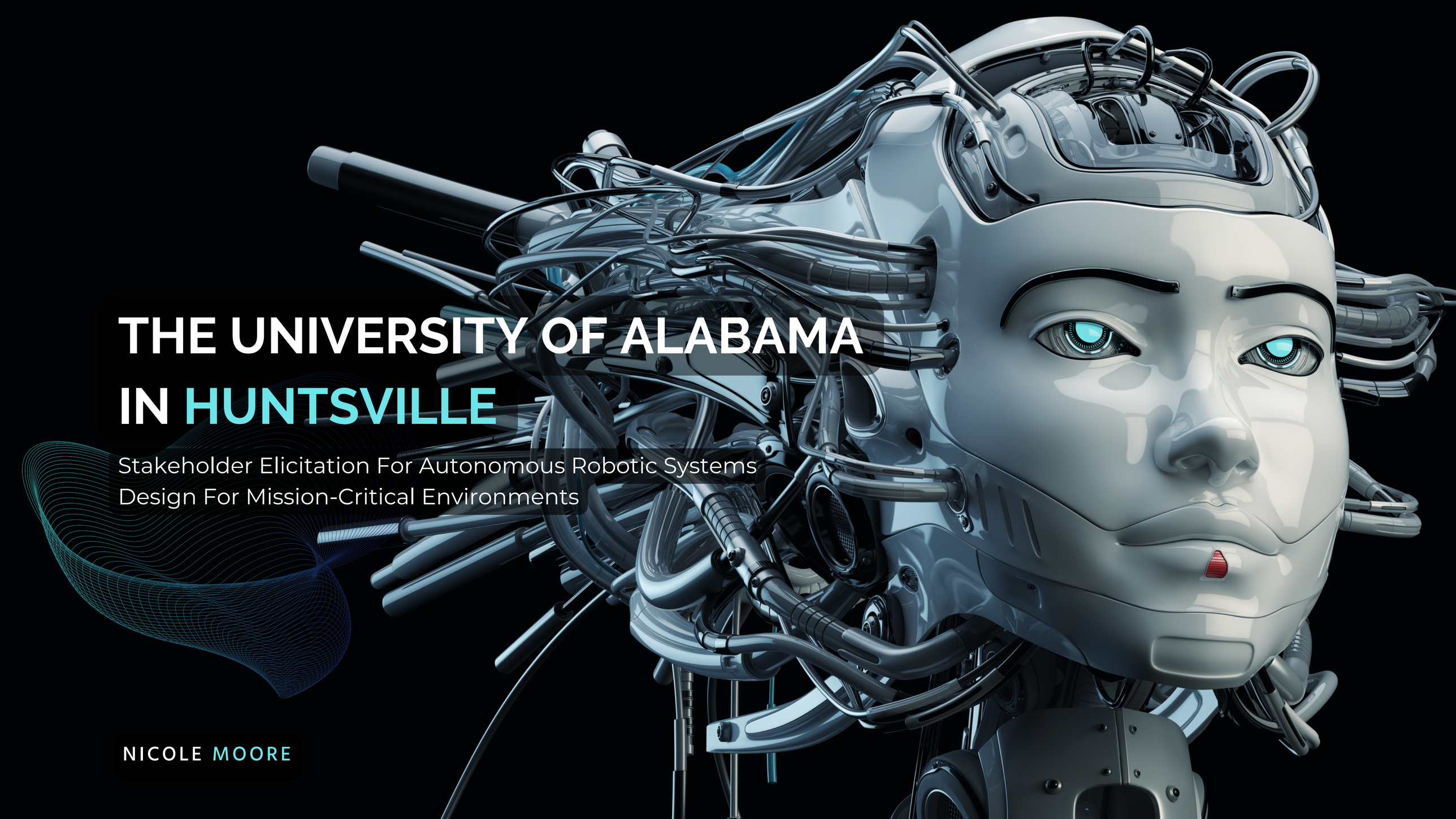
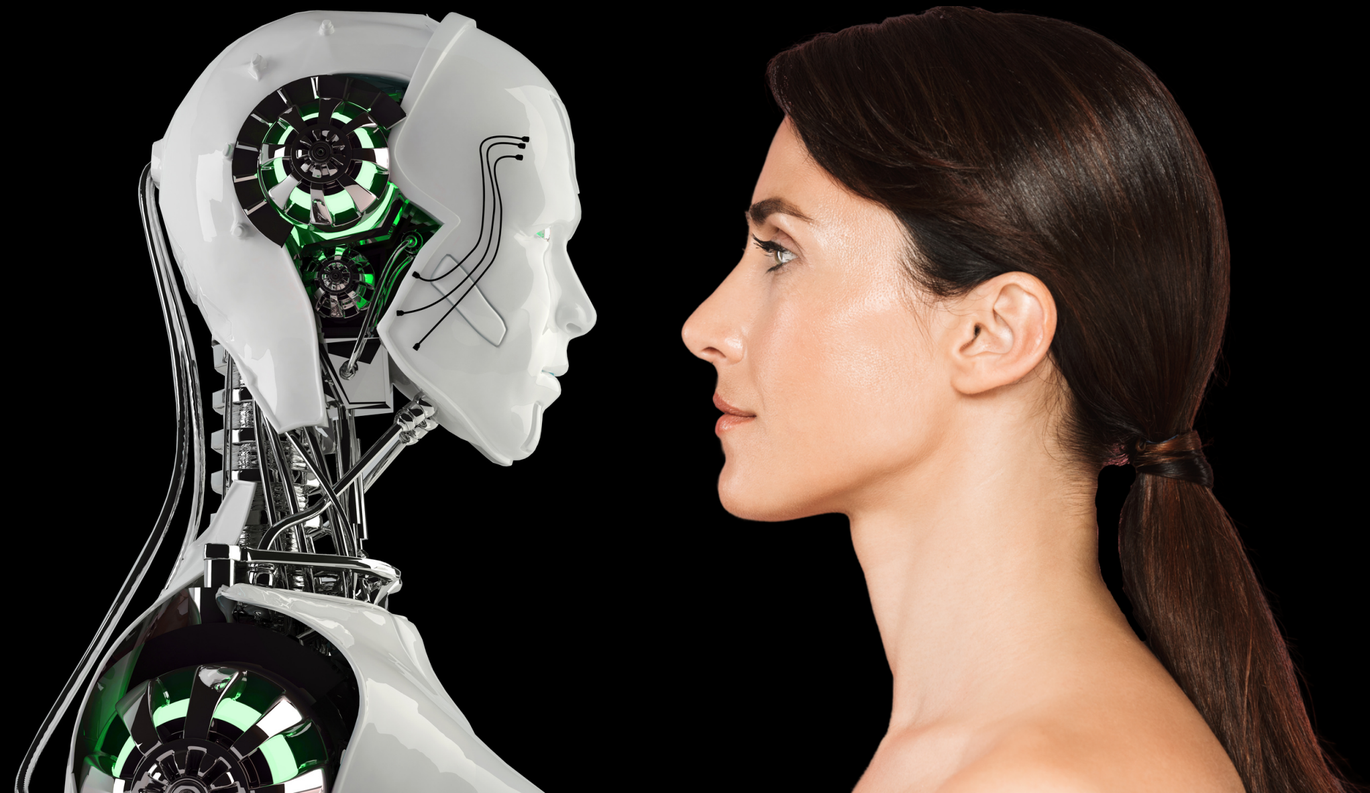


THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Stakeholder Elicitation For Autonomous Robotic Systems Design For Mission-Critical Environments

NICOLE MOORE

STAKEHOLDER PREFERENCES



Stakeholders

A firm's investors, customers, and employees.

(Pirson & Milhotra, 2011)

Preferences

Existing values that are constructed and can be elicited

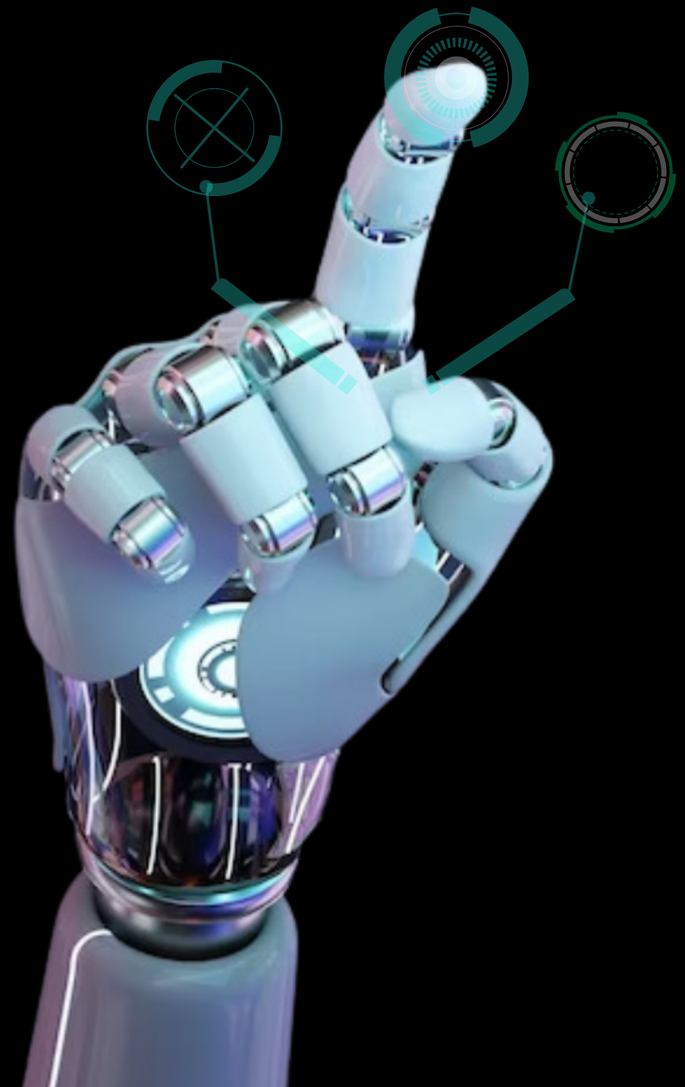
(Tversky & Thaler, 1990)

Preference Formation

- Contextual predispositions
  - Prior information obtained regarding the choice
- Framing of the decision
- Prior biases (Desai & Krajbich, 2022)
- Personal subjective values
- Confidence within the choice

(Lee & Daunizeau, 2020)

PREFERENCE ELICITATION METHODS



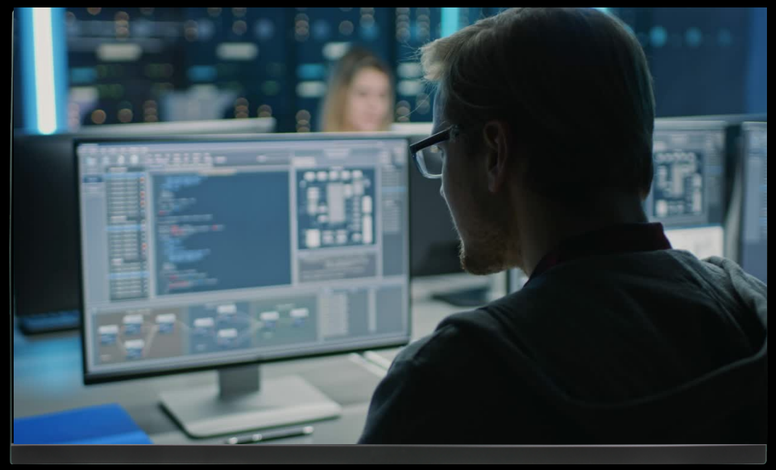
Preference Elicitation

- Process in which a model is developed to identify which preferences the stakeholders favor best.
- What is gained (i.e. implicitly/explicitly) through a utility function? (Zintgraf et al., 2018)

Methods

- relative comparisons between items
  - scoring or ranking
  - clustering by similarity
  - conducting interviews

MISSION-CRITICAL ENVIRONMENTS



Mission-Critical Environments

- Critical job functions that impact military agency performance (Weger et al., 2022)
- Can result in:
  - Loss of life
  - Financial loss
  - Serious injury to personnel

PREFERENCE

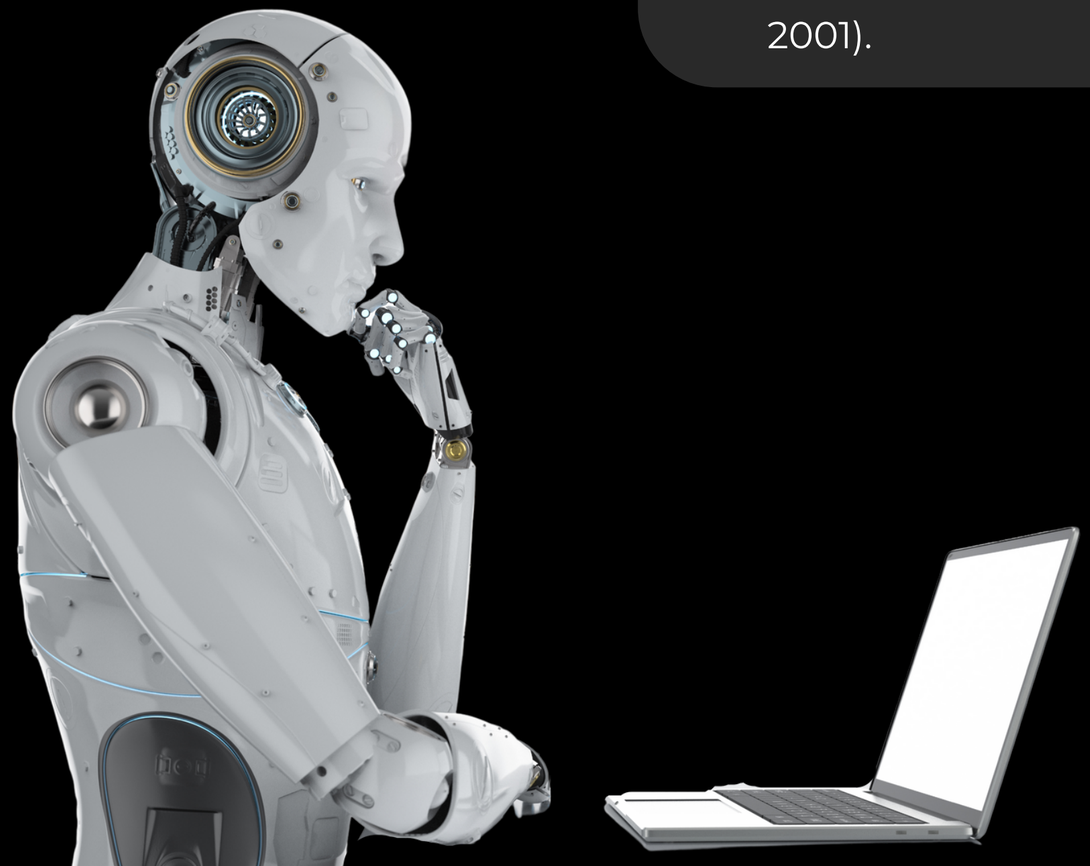
FAMILIARITY & TRANSPARENCY

Familiarity

- Mere Exposure Effect (Liao et al., 2011)
- Habituation Paradigm (Houston-Price & Nakai, 2004; Zajonc, 2001).

Transparency

- Prevalent for autonomous system adoption
  - Transparency
  - Reliability
  - Performance



HUMAN ROBOT INTERACTION

Human-Like Features in Robot Design

- Warmth & Competence
- Female Robots
  - Higher on communal dimension (e.g., friendly, polite, affectionate)
- Male Robots
  - Higher on agentic dimension (e.g., assertive, determined, authoritative)

(Carpinella et al., 2017)

Communication Type

- Verbal Communication
- Female Voice
  - Acoustic parameters; emotional prosody (Sokhi et al., 2005)

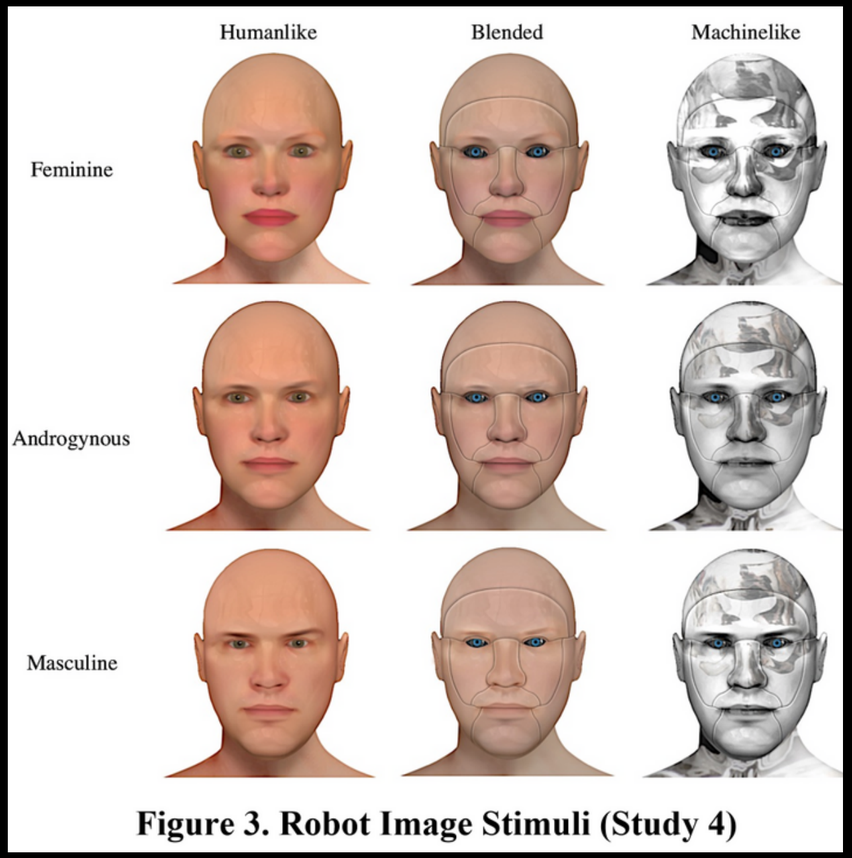


Figure 3. Robot Image Stimuli (Study 4)

(Carpinella et al., 2017)

USER-ROBOT
TRAINING METHODS

Methods

- Learner-centered approach
  - User is active engager (Wiltshire & Fiore, 2014)

Cognitive & Behavioral Components

- Cognitive processes in learning/training:
  - Memory, attention, decision-making, social, and emotional processes
- Accelerated learning methods
  - Simulation training

RESEARCH QUESTIONS

1: What preferences do stakeholders hold regarding the abilities a fully autonomous robot should possess to handle combat situations?

2: What potential barriers or apprehensions would stakeholders have when using an automous robot?

3: Would stakeholders want an autonomous robot to look more animal-like (e.g., quadrupedal), human-like (i.e., humanoid), or machine-like (e.g., autonomous mobile robot (AMR))?

4: What are stakeholder preferences regarding vocal tone for autonomous robotic systems?

5: What training methods would stakeholders prefer for autonomous robotic system familiarization?

METHODOLOGY

Design

- Structured Interview w/ Open-ended questions
  - Express preferences in detailed, comprehensive format
  - Elicit unbiased responses

Materials

- Private laptop/tablet/ or personal device
- Google Meets
- Qualtrics
- SPSS

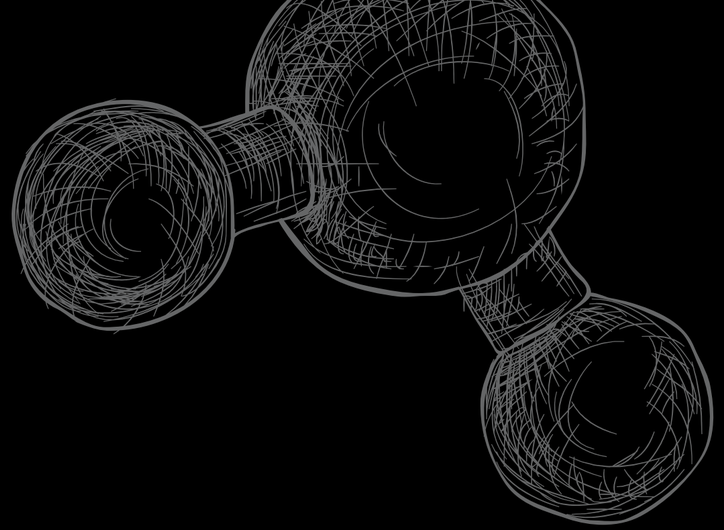
Participants

- *N* = 5 Individuals from various job occupations
  - Dynetics, Naval Postgraduate School, U.S. Navy, and Acomb Ostendorf & Associates (AOA)

Measures

- Interview Questionnaire
  - Structured, open-ended questions
- Inductive Content Analysis (Kyngäs et al., 2020).
  - Prevalent themes in responses

PROCEDURE

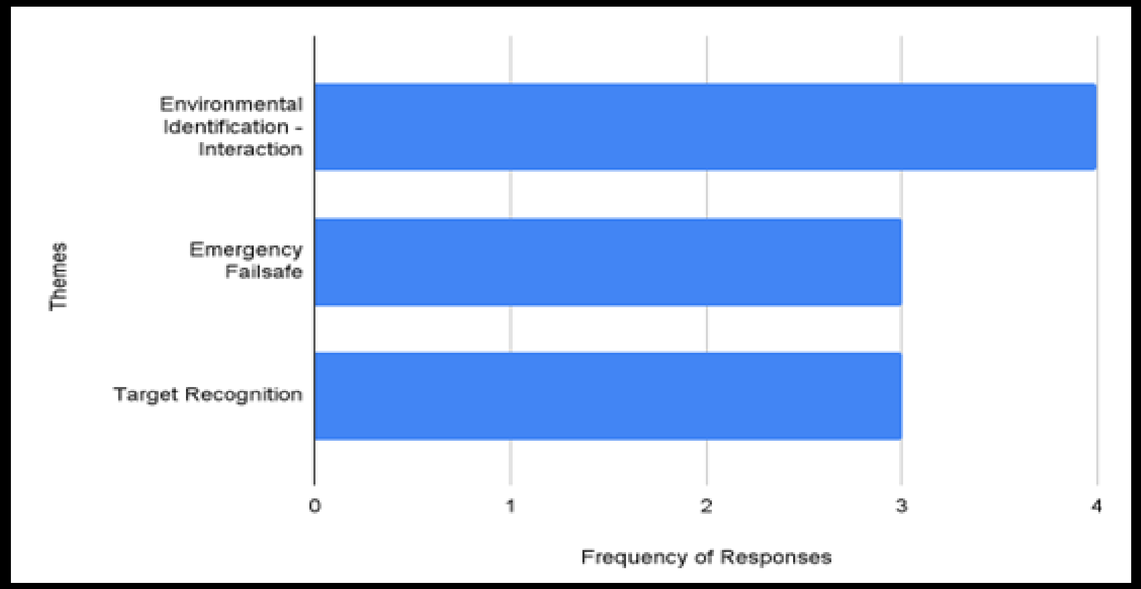


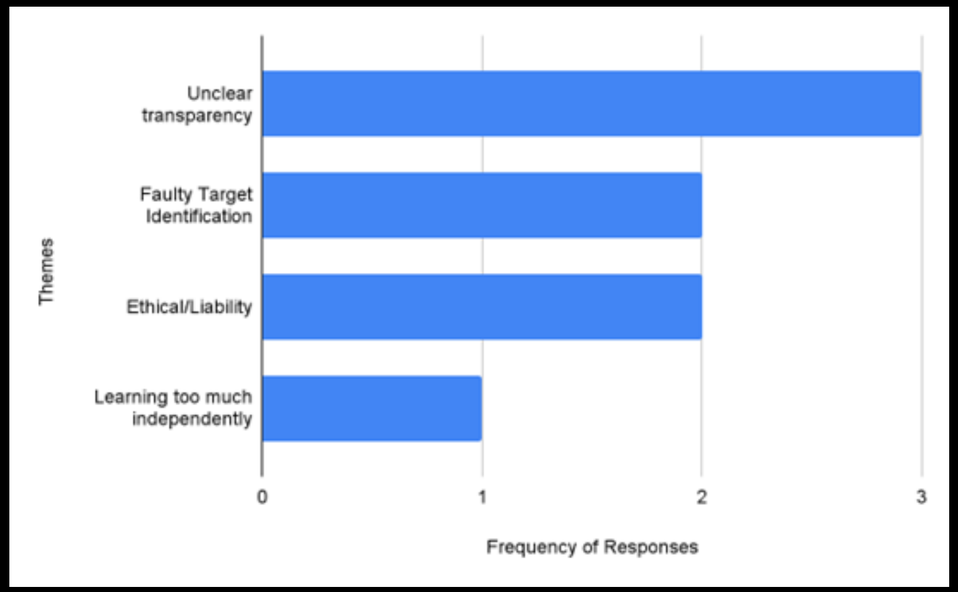
1. **Consent**
   ~ 5 minutes
2. **Interview Questions**
   ~ 20 - 30 minutes
3. **Demographic Questions**
   ~ 10 minutes
4. **Debriefing**
   ~ 5 minutes
5. **Release of Participants**
   ~ 50 minutes total time

EXAMPLE QUESTION

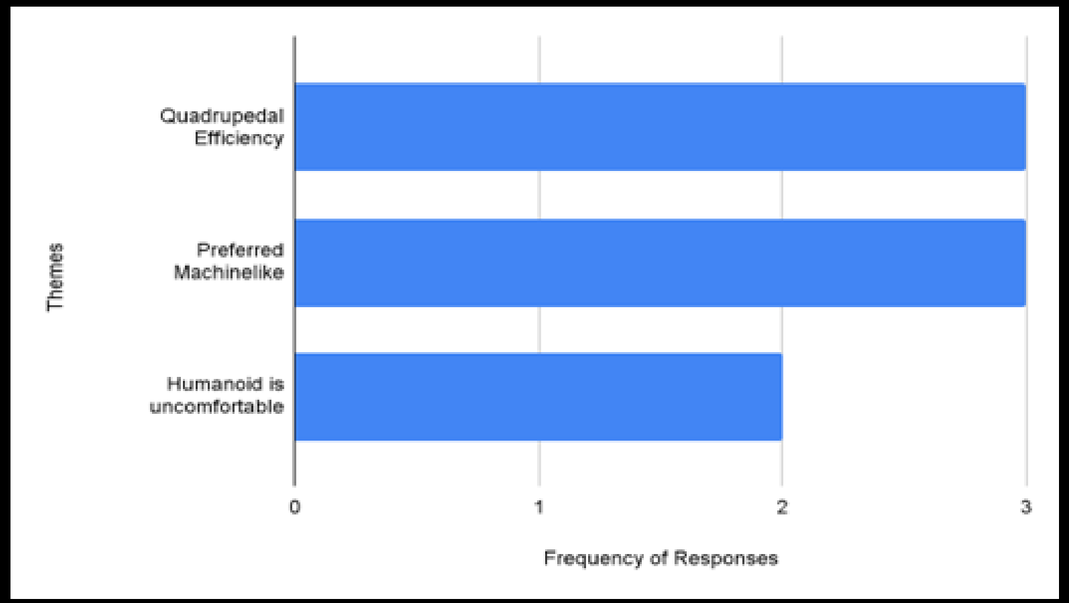
Would you want an autonomous robot to look more animal-like (e.g., quadrupedal), human-like (i.e., humanoid), or machine-like (e.g., autonomous mobile robot (AMR))?

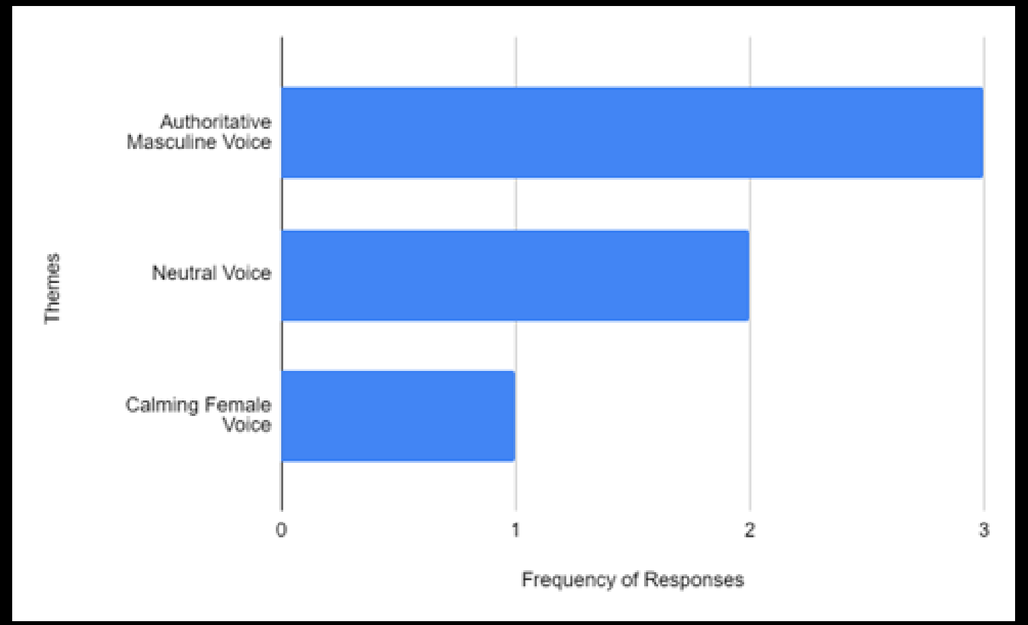
RESULTS

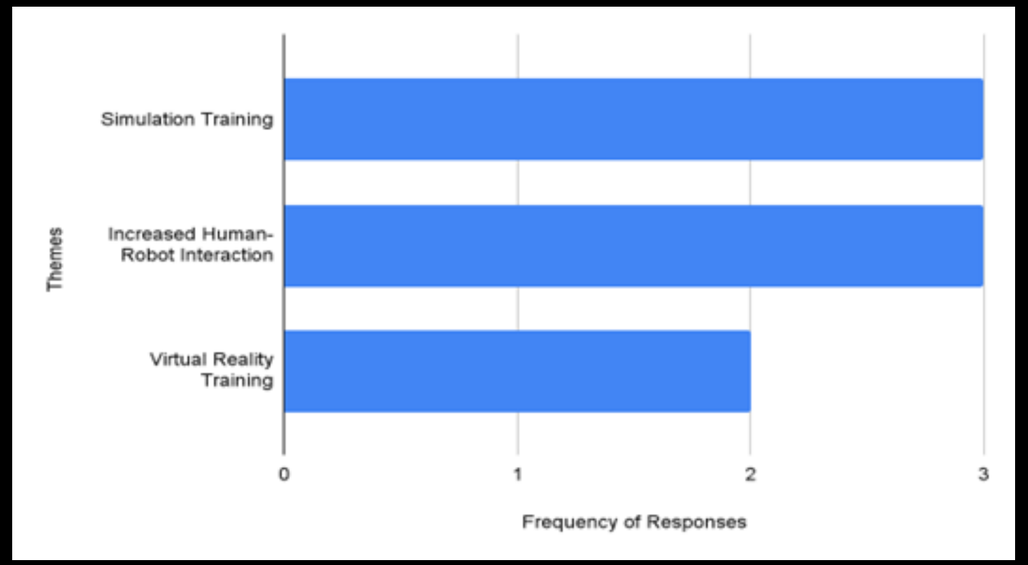

Environmental Identification - Interaction
Emergency Failsafe
Target Recognition
Themes
0
1
2
3
4
Frequency of Responses


Unclear transparency
Faulty Target Identification
Ethical/Liability
Learning too much independently
Themes
0
1
2
3
Frequency of Responses

RESULTS


Quadrupedal Efficiency
Preferred Machinelike
Humanoid is uncomfortable
Themes
0
1
2
3
Frequency of Responses


Authoritative Masculine Voice
Neutral Voice
Calming Female Voice
Themes
0
1
2
3
Frequency of Responses


Simulation Training
Increased Human-Robot Interaction
Virtual Reality Training
Themes
0
1
2
3
Frequency of Responses

WHY IT MATTERS

Robots in the Workplace

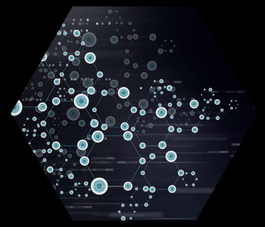
- Growing interest in Industrial & Nonindustrial robots
  - Industrial Robots - perform strenuous tasks to relieve humans
  - Nonindustrial Robots - assistive (e.g. lifting aid) or non-assistive (e.g., entertainment/companion)
- Robots in professional fields
  - Trust in automated decisions

(Busse et al., 2021)

A Future in Technology

- Healthcare Robots
  - Growing demand for caregivers
  - Increased Elderly autonomy with robotic assistance
- Factory/Warehouse Robots
  - Increased efficiency
  - Reduced human injury

(Busse et al., 2021)



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QUESTIONS?

THANK YOU
FOR WATCHING