From Master Chef to Ethical Advisor in Future Air Operations Centers:

Examining trust in AI teammates in leadership and peer roles at the United States Air Force Academy

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WARFIGHTER EFFECTIVENESS RESEARCH CENTER
UNITED STATES AIR FORCE ACADEMY

Image Generation with Midjourney - Tool

Threat of AI Cyber Attacks - Tool

AI Pilot X-62A Vista Fighter Jets - **Teammate?**

Text Generation with ChatGPT - Tool

Tesla Full Self Driving - Tool

Space Force Experimenting with AI to Predict Satellite Failures - Tool

Trusting AI: Integrating Artificial Intelligence into the Army's Professional Expert Knowledge

(Pfaff et al., 2023)

With the development of Artificial intelligence, there is the opportunity for **greater situational awareness and prevention of fatigue and cognitive impairments.**

Building trust:

- Trust requires artificially intelligent teammates to be effective in…
  - Predictability- completing the intended purpose
  - Making understandable decisions with intelligible reasoning
  - Mitigating harm to noncombatants

Hurdles to trust:

- Accuracy
- Safety
- Objectivity
- Reliability
- Resiliency
- Security
- Accountability

Team Structure and Team Building Improve Human-Machine Teaming With Autonomous Agents

(Walliser et al., 2019)

Teamwork relies on social interaction, raising the need for artificially intelligent teammates to be social when interacting with humans.

Building trust:

- Trust is higher when the artificial intelligent agent is viewed as a teammate and not a tool
- Team building exercises build **social interaction** amongst team members
- Team building improves overall success in a task for both artificially intelligent teammates and human teammates
- Team building also lessens the effect of different team composition


OVERCOOKED! 2
Testbed 1

Research Questions + Hypotheses

How do humans interact with AI vs human expert teammates?

RQ 1: Can an AI be perceived as a similarly trustworthy teammate as a human?

We hypothesize, ***yes***

RQ 2: Will an AI be perceived as capable of carrying out the same tasks?

We hypothesize, ***yes***

RQ 3: Will a participant communicate differently with an AI vs human teammate?

We hypothesize, ***yes***

Experimental Design and Set-Up

2x2 mixed nested design using the CHAOPT testbed (Bishop et al., 2020)

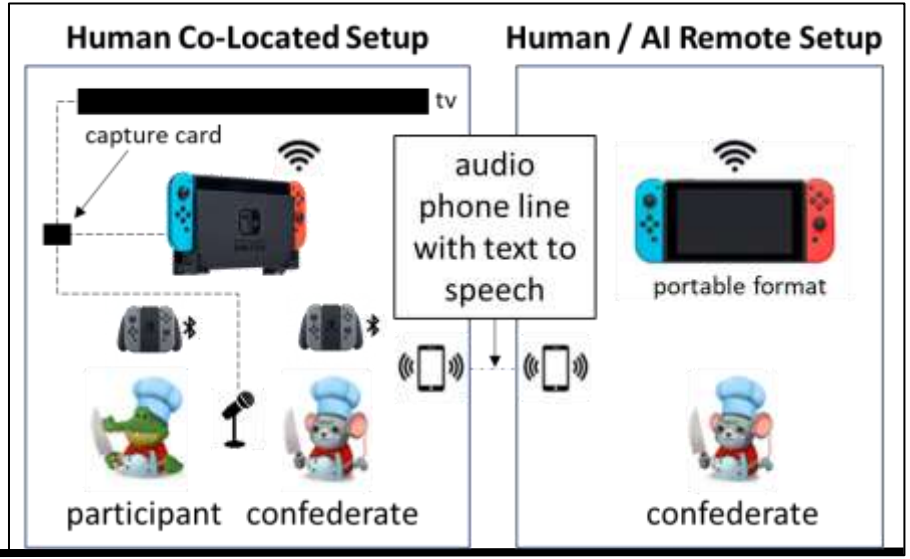
- Human teammate 1 - Teammate leads first
- Human teammate 2 - Participant leads first
- AI teammate 1 - Teammate leads first
- AI teammate 2 - Participant leads first

Agent - Between subject

Order of leadership - Between subject

Leadership - Within subject

Task Load - Within subject



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Sample Overcooked Video

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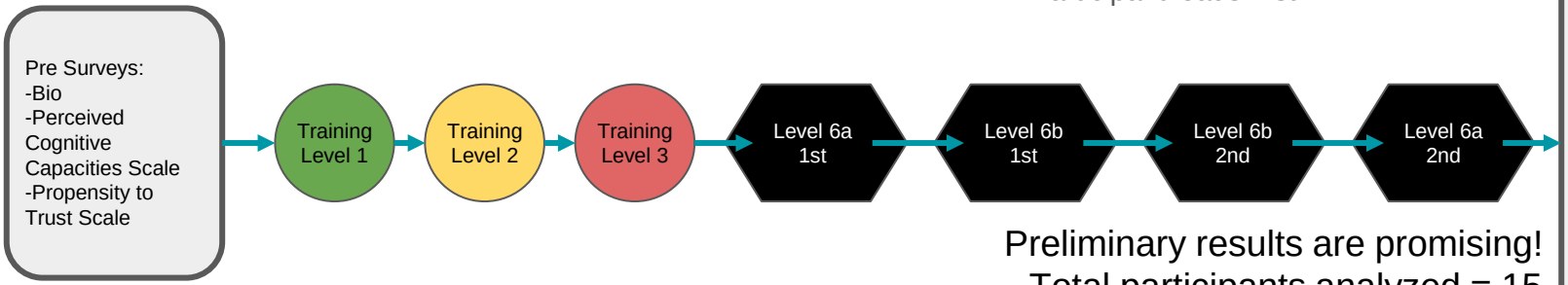
Task and Procedure

HT1 - Teammate leads first
HT2 - Participant leads first
AI1 - Teammate leads first
AI2 - Participant leads first



Preliminary results are promising!
Total participants analyzed = 15
HT1: n = 4
HT2: n =4
AI1: n=4
AI2: n=3

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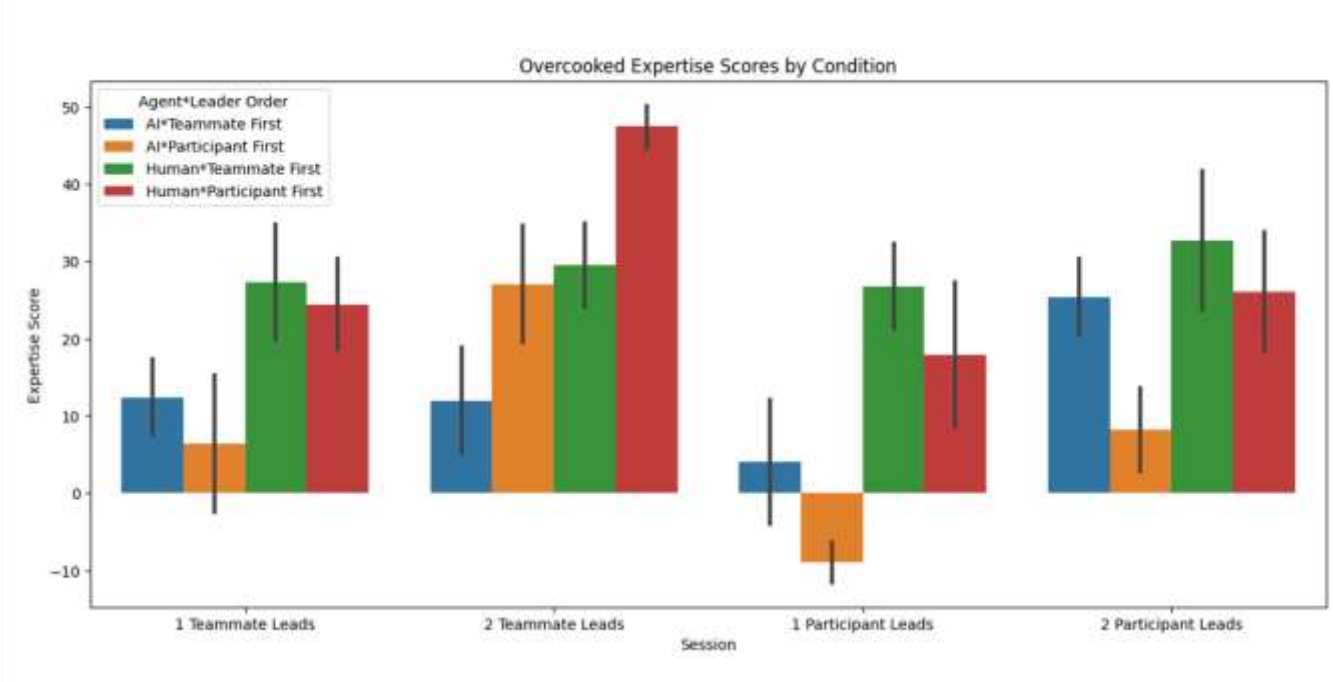
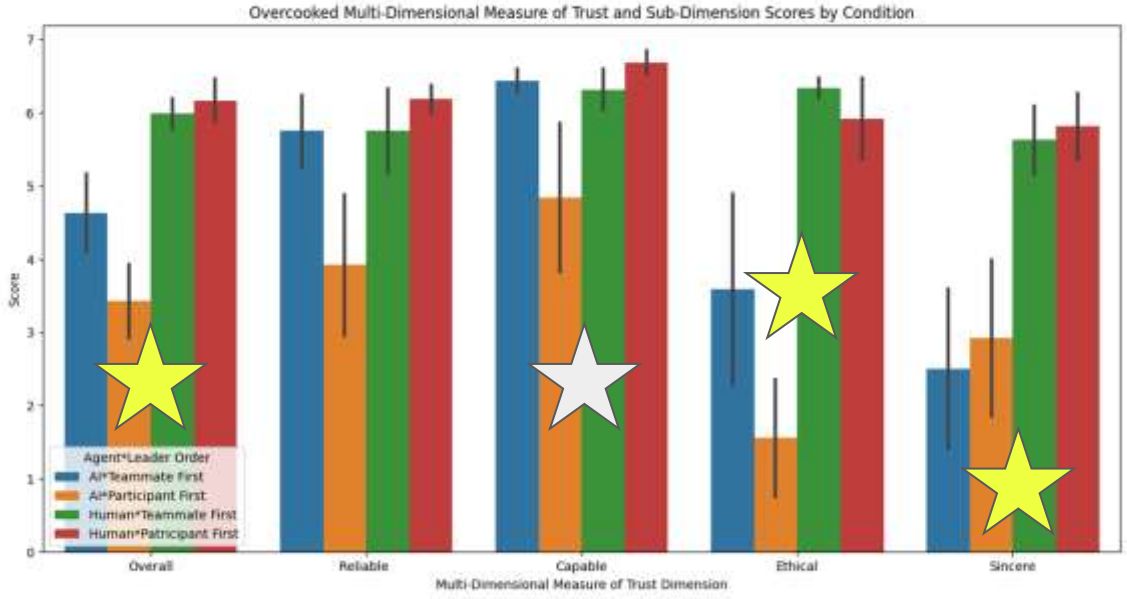
Performance in a given session was impacted by leader and leader order



Overall trust was affected by teammate

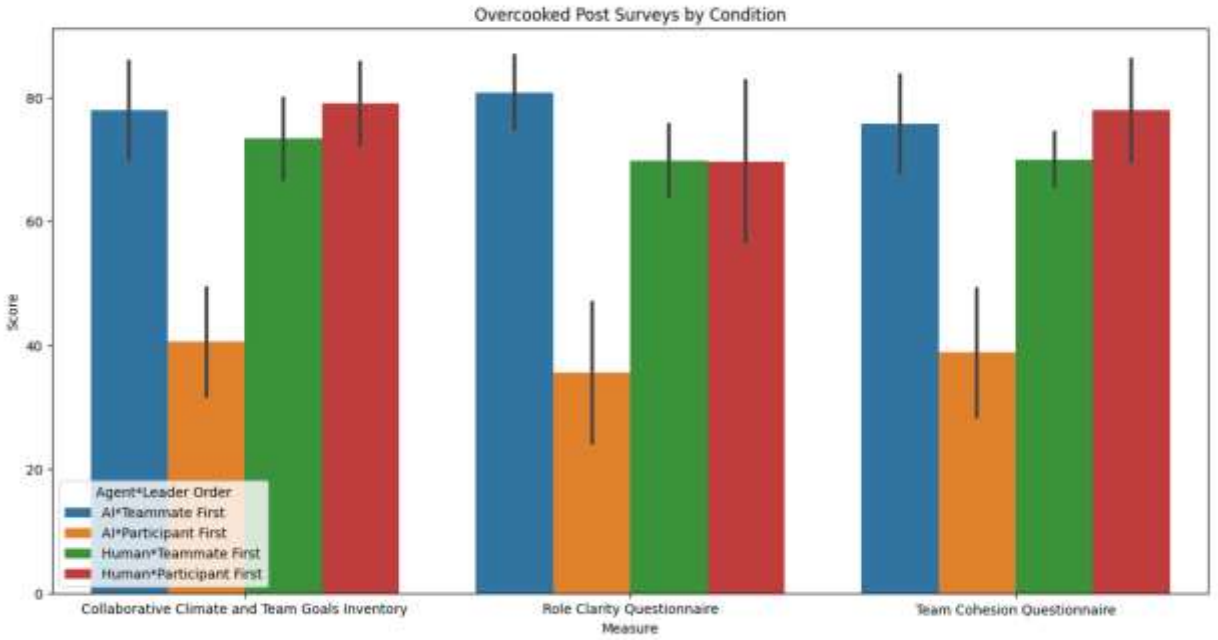


Trust Subscales:

- **Reliable - not affected by teammate or leader order**
- **Capable - affected by teammate and leader order**
- **Ethical - affected by teammate**
- **Sincere - affected by teammate**

Participants felt more connected with the AI teammate who led first

- Role clarity was impacted by order and agent
- Team cohesion and climate were impacted by order and agent
  - Both measure similar concepts, demonstrating internal validity of our study



Simulated High Stakes Military Environment

Research Questions + Hypotheses

How do humans respond to AI teammates in high stake environments?

RQ 1: Will participants perceive AI positively when it is advising and assisting human decision-making during moral dilemmas?

We hypothesize, ***yes***

RQ 2: Will the use of AI in a command and control scenario increase effectiveness?

We hypothesize, ***yes***

RQ 3: Does the role of peer vs. senior change the amount of influence AI has in the scenario?

We hypothesize, ***yes***

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Task and Procedure

In a multi-domain wargaming scenario…

Moral Dilemma = Area of interest for potential strike with civilians

→ Participants decide whether to strike w/out advice

→ Advisor or assistant gives advice on importance of ethical ramifications and mission success

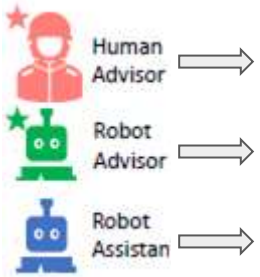
→ Participants decide to stick with or change their initial decision based on the advice given

Design of Conditions:

C1) Human Advisor (n = 20) in senior advisor role

C2) Furhat Robot Advisor (n= 9) in senior advisor role

C3) Furhat Robot Assistant (n = 31) in junior assistant role



Sample Furhat Video

https://drive.google.com/file/d/1irIPhJUL14cy5g1hReJtlMIU25c7Jn6U/view?usp=share_link

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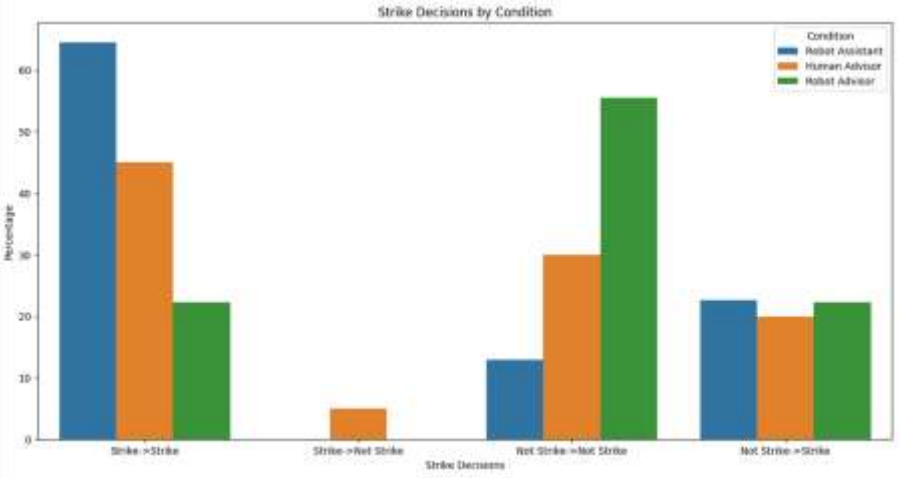
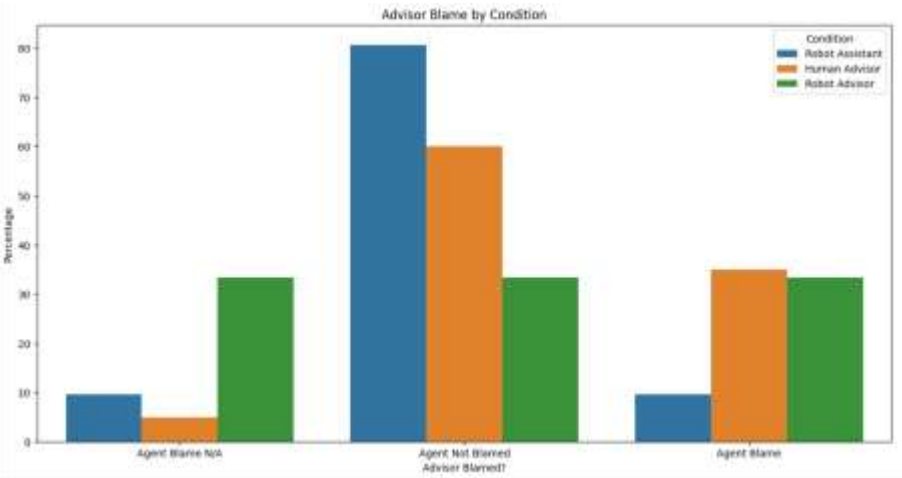
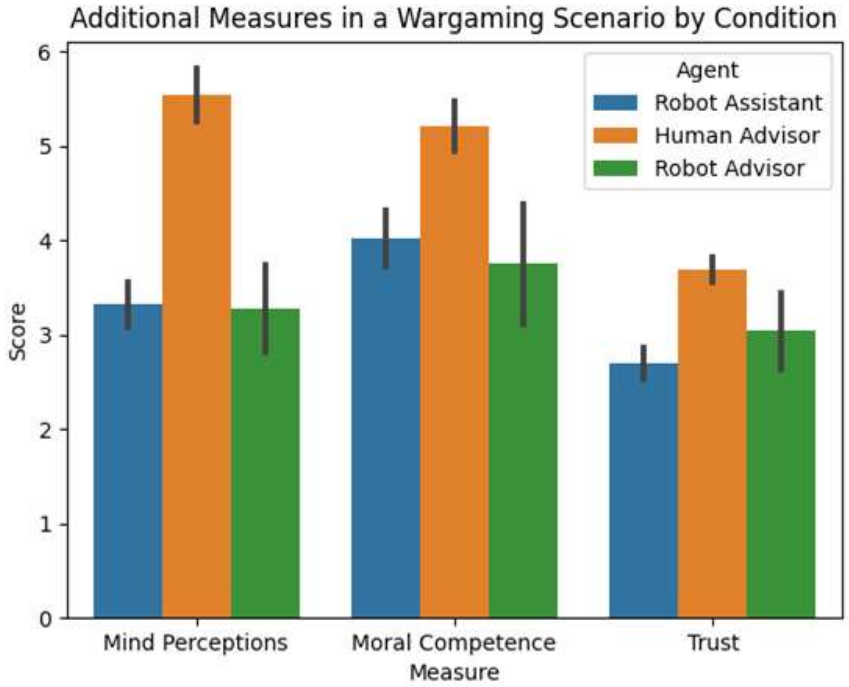
Decision to Strike and Whether the Agent was Blamed





Humans were seen as more capable of using a mind, more morally competent, and more trustworthy



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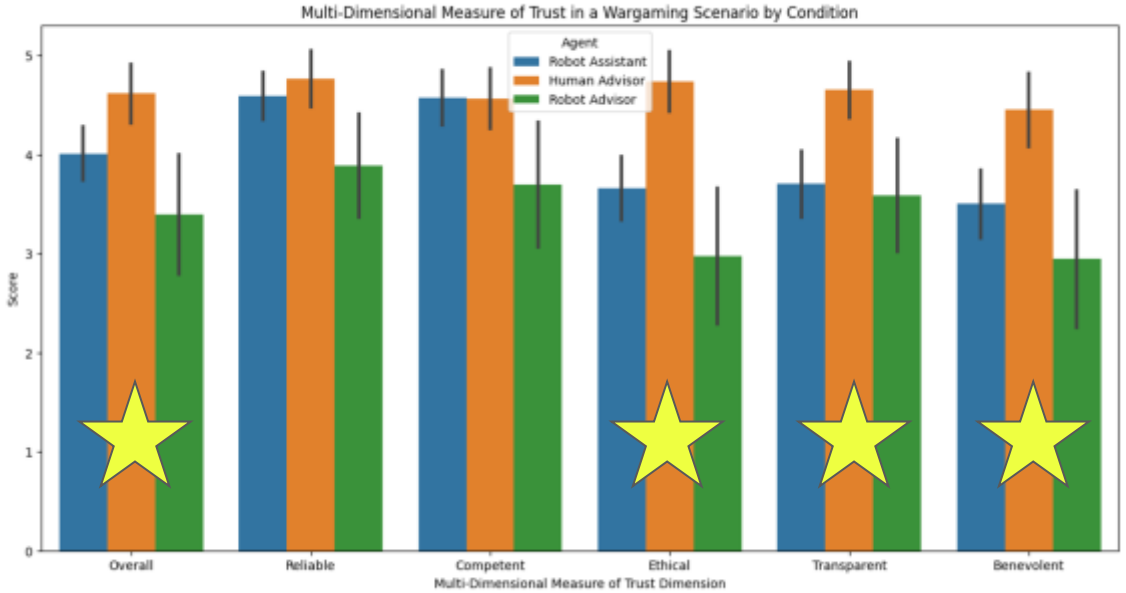
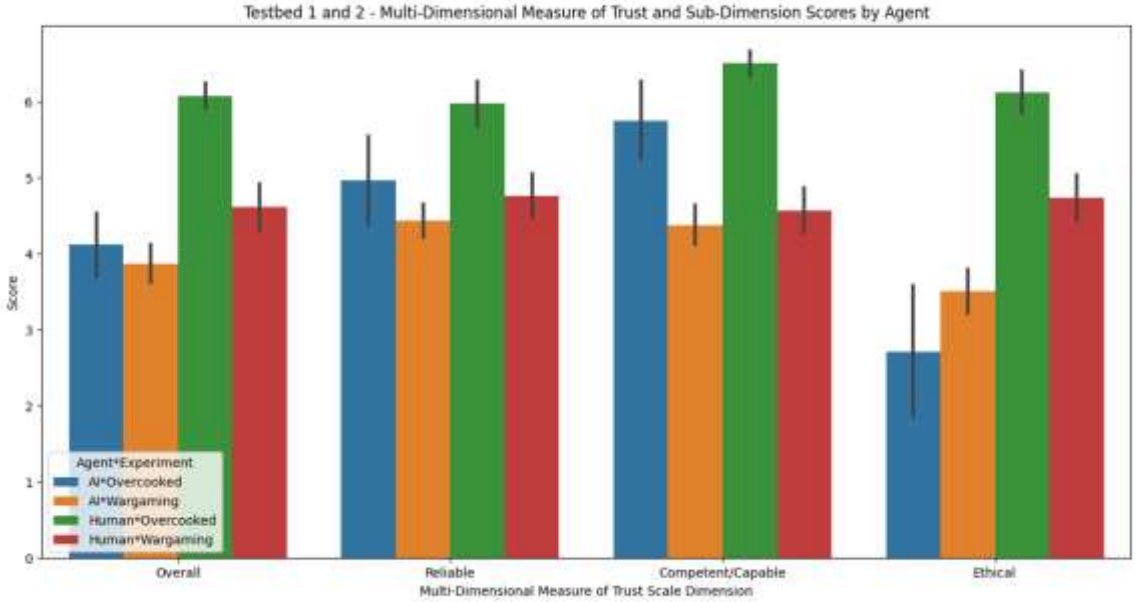
Human Advisors were seen as more ethical, and robot agents in either role were seen as less trustworthy, transparent, and benevolent



Bringing Together Lessons Learned

Across both experiments we saw that overall trust was affected by the agent that a participant was teamed with.



Furthermore, the participants were more likely to view the human as more… than the AI:

- **reliable**
- **competent/capable**
- **and ethical**

These were the three subscales consistent across the two experiments

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Discussion and Implications

Future human-robot teaming missions within a mission centric environment within/or without a high-stakes military environment should look at…

- Providing clarity on the task for their teammate(s)
- Be developed to come across as more human-like to allow for…
  - Improving the perceived morality of the robot
  - Having a more solid connection between the robot and the participants to create a better bond
  - Explaining the programming that went into the robot's decision making to help participants view the robot as more capable

Pfaff et al. also emphasizes the importance of protecting AI from "external manipulation" as well as the question of who would be held accountable for AI error and the capability of the AI explaining their reasoning

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Future Research Directions

Connecting into Wargaming Video Games

Thank you for your attention

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