FACT: A Full-body Ad-hoc Collaboration Testbed for Modeling Complex Teamwork

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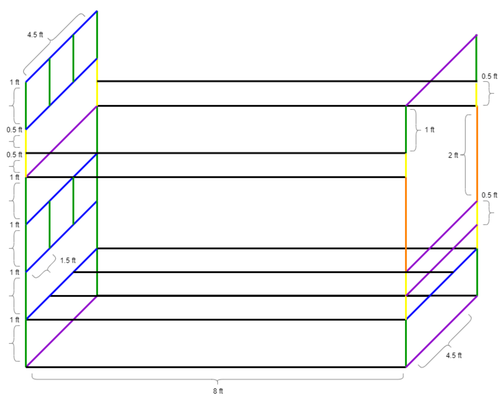
Background

***Full-body Ad-hoc Collaboration Testbed* (FACT)** is a testbed we developed to support investigation of complex teamwork.

FACT contrasts with previous testbeds used for human-robot collaboration research, which have primarily involved:

- Prescribed scenarios
- Dyadic interactions
- Tasks that can easily be completed individually without teaming

FACT



PVC Bunk Bed
Collaborative assembly scenario affords opportunities for participants to engage in *natural*, *large scale*, and *emergent* collaborations

Mobile Data Collection Backpack

Head- & Chest-Mounted Cameras

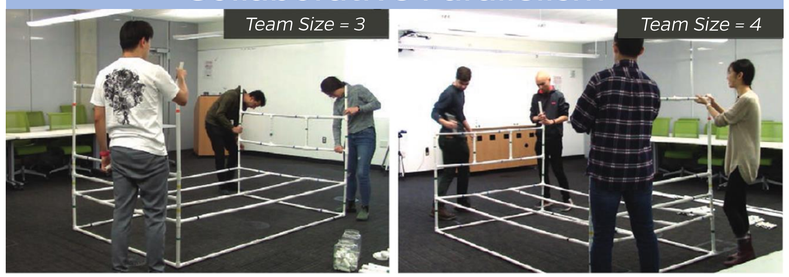
Egocentric Views

Data Collection
Network of sensors enables collection of dynamic egocentric and full-body data

Preliminary Exploration

Study of large scale ad-hoc collaboration using FACT with three one-person teams, two two-person teams, one three-person team, and one-four person team

Collaborative Parallelism

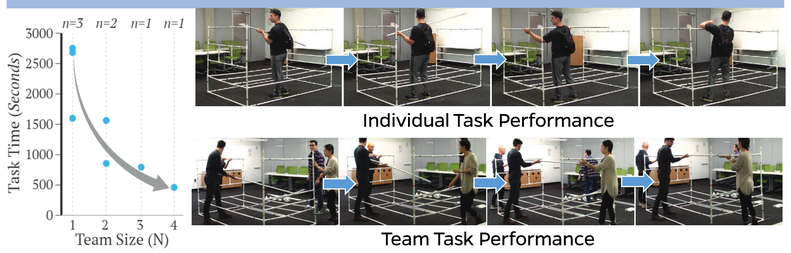


Participants frequently worked on different sub-tasks **in parallel** and formed into **two-person sub-teams**.

Multimodal Communication

Participants employed **multimodal behaviors** (gaze, gestures, speech) to communicate and coordinate.

Benefits of Teamwork



Teamwork **improved task efficiency** and **reduced task difficulties** through teaming and collaborative parallelism.

Future Directions

We aim for FACT to be an initial resource that supports a more holistic investigation of complex, ad-hoc human-robot collaborations. As part of this goal, our future work will focus on developing:

- A **shared dataset** that includes egocentric and full-body manipulation data collected from team-based collaborations using FACT
- A set of **evaluation metrics** to capture aspects of human-robot interaction specific to ad-hoc human-robot collaboration, such as dynamic sub-team formation
- A **simulation counterpart** to FACT in which virtual agents can be deployed to minimize research limitations and restrictions due to complexities of physical manipulation and interaction using real-world robots

Acknowledgments

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Software and parts lists for FACT are available at **https://github.com/intuitivecomputing/FACT**