11TH ICCRTS
COALITION COMMAND AND CONTROL IN THE NETWORKED ERA

The Impact of Instant Messaging on Team Performance, Subjective Workload, and Situation Awareness in Air Battle Management

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Program Objective

To evaluate the impact of collaboration technologies on team performance, workload, and situation awareness, for tactical air battle management teams

Tactical ABM Teams

Teams of Teams

Collaboration Technologies

- **Instant Messaging (Chat)**
- **Virtual Whiteboards**
- **File and Application Sharing**
- **Video Conferencing**
- **Data Capture and Replay**
- **Opinion and Polling Tools**
- **Automated Workflow Tools**
- **Content/Knowledge Management Tools**

Experiment Objective

- To evaluate the effects of instant messaging (chat) on team performance, situation awareness, workload, and communication effectiveness in a tactical air battle management team

  - Possible advantages:
    - Near-synchronous text communication.
    - Operator can sustain multiple conversations via different “chat rooms,” without the auditory masking and interference associated with using voice communications.
    - Provides a persistent text record of communication – reducing memory demands encountered in radio communication.

  - Possible Disadvantages:
    - Compared to voice (radio) communication, chat requires additional manual control and visual attention diverted from an operator’s display.

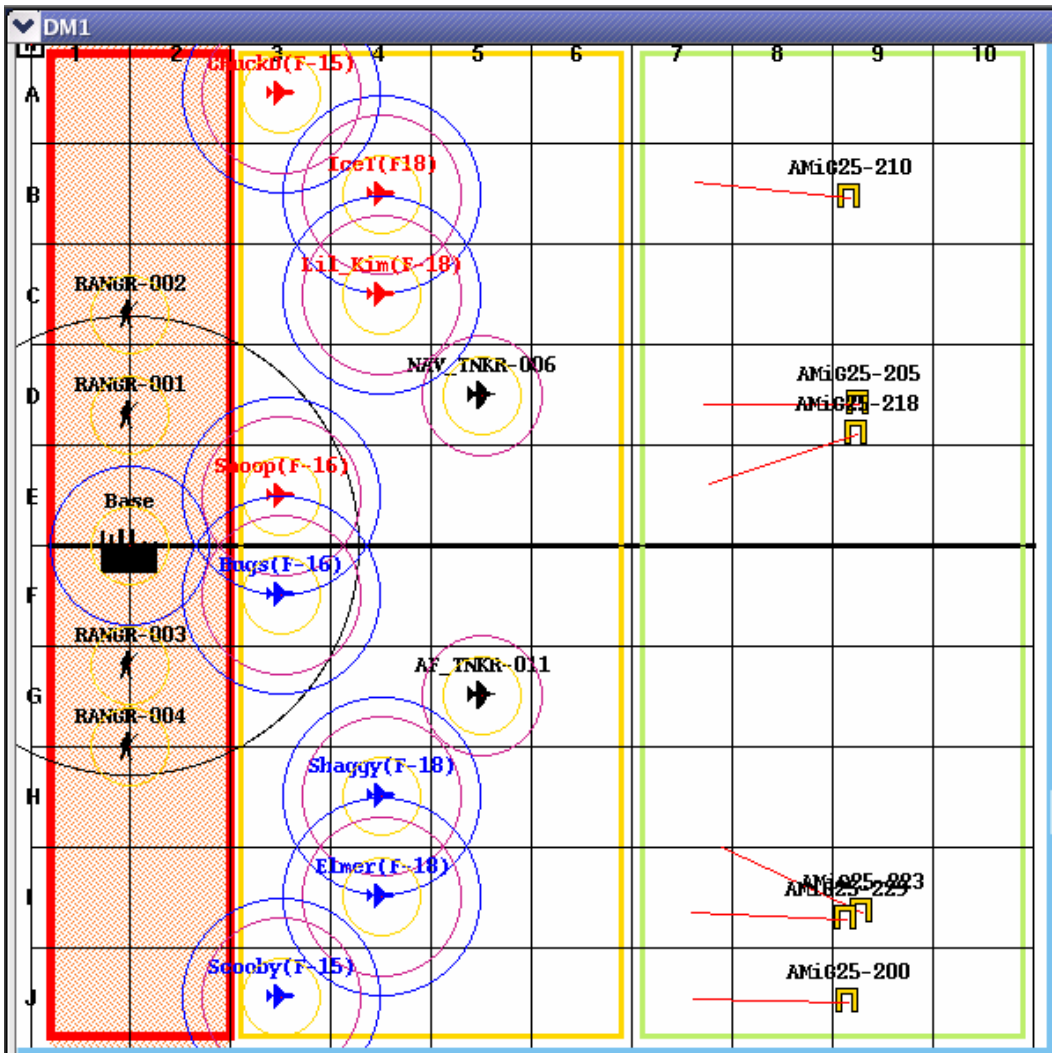
Synthetic Task Environments (STE) for C2 Experimentation

- **A C2 Synthetic Task Environment (STE) is a simulation that captures the important aspects of a Command and Control task**

- **STEs are used to create complex collaborative environments within a controlled laboratory setting.**

The Tanker Scenario

The Tanker Scenario STE



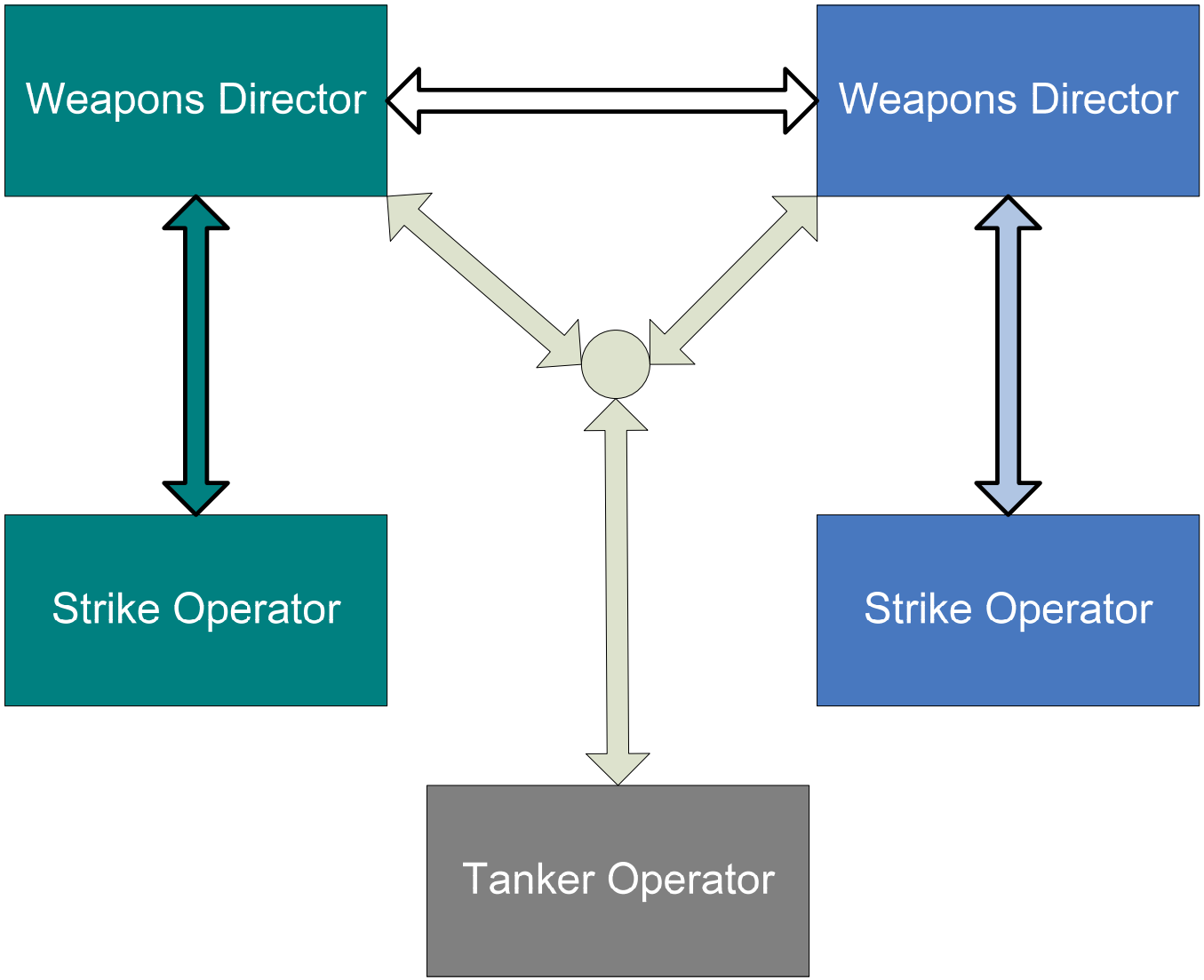
The Tanker Scenario is a real-time, communication-intensive, decision-making and execution task.

The Tanker Scenario

- A team of two weapons directors must plan and communicate with each other, their strike packages, and two refueling tankers, to coordinate attacks, defend friendly assets, and refuel fighter aircraft.

- The Team
  - Weapons Directors
  - Strike Package Operators
  - Tanker Operator

Team Arrangement



Scenario Objectives

- **Destroy as many hostile targets as quickly as possible**
- **Prevent hostile targets from entering friendly territory**
- **Protect the Tankers, Air Base, and Infantry**
- **Keep as many fighters airborne for as long as possible**

Experimental Design

- **Participants:**
  - **Weapons Directors: Twelve individuals (6 males, and 6 females) participated in the experiment in six teams of two individuals.**
  - **“Operators” played the role of strike and tanker pilots**

- **Procedure**
  - **Each team completed twelve 10-minute tanker scenarios**
  - **Collaborative technology and task difficulty were manipulated**

Independent Variables

- **Communication Modality**
  - **Voice (Radio)**
  - **Chat Messaging**
  - **Voice & Chat combined**
- **Task Difficulty**
  - **Number of fighter assets managed by WDs (4 or 8).**
  - **Number of enemy targets present in the scenario (4 or 6)**

- **2 (Number of Targets) × 2 (Number of Assets) × 3 (Communication Modality) within-subjects design**

Dependent Measures

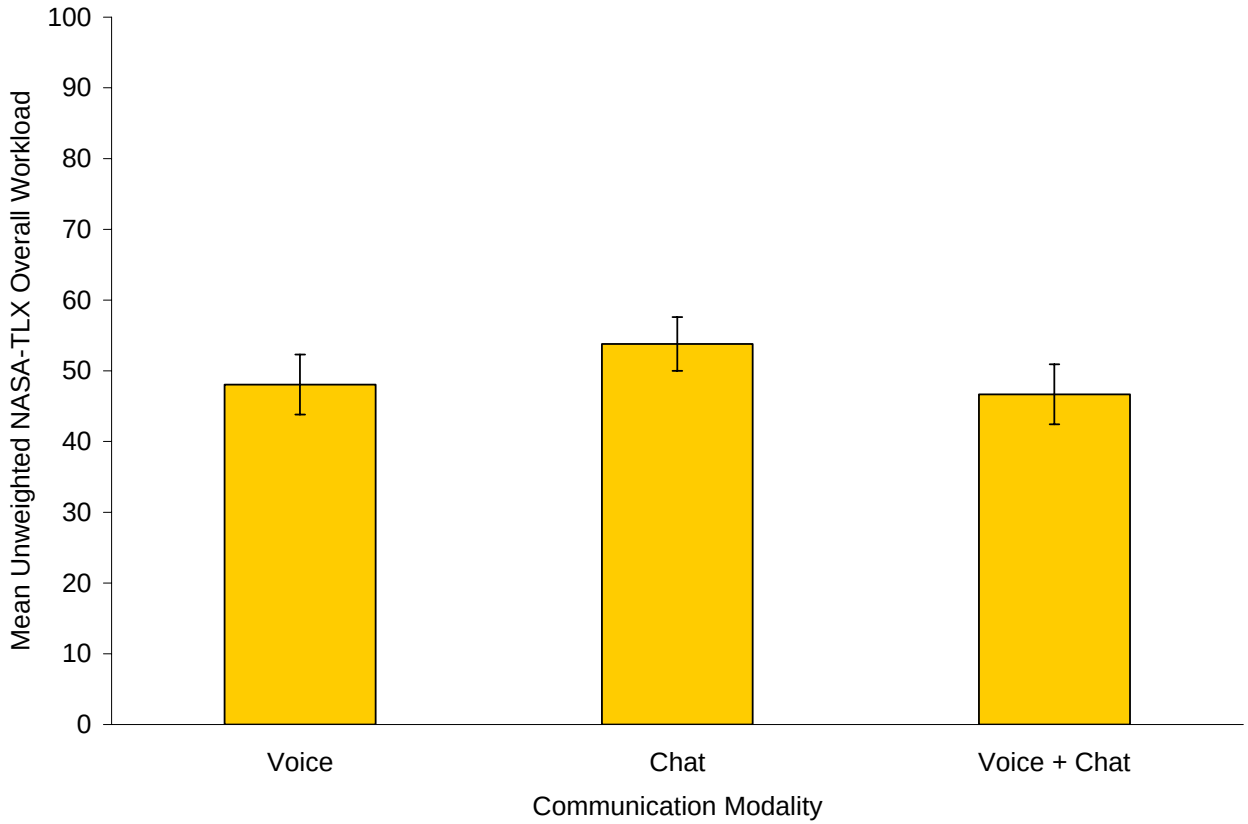
1. **Team Workload**
   - **NASA-TLX (modified for 'team' workload)**
   - **Team Workload Scale**
2. **Situation Awareness**
   - **Situation Awareness Rating Technique (SART)**
3. **Team Performance Score**
   - **Percentage of targets prosecuted**
   - **Percentage of incursions**
   - **Percentage of assets destroyed**

Results:
NASA-Task Load Index (TLX)

Subscales	
1	Mental Demands
2	Physical Demands
3	Temporal Demands
4	Performance
5	Effort
6	Frustration

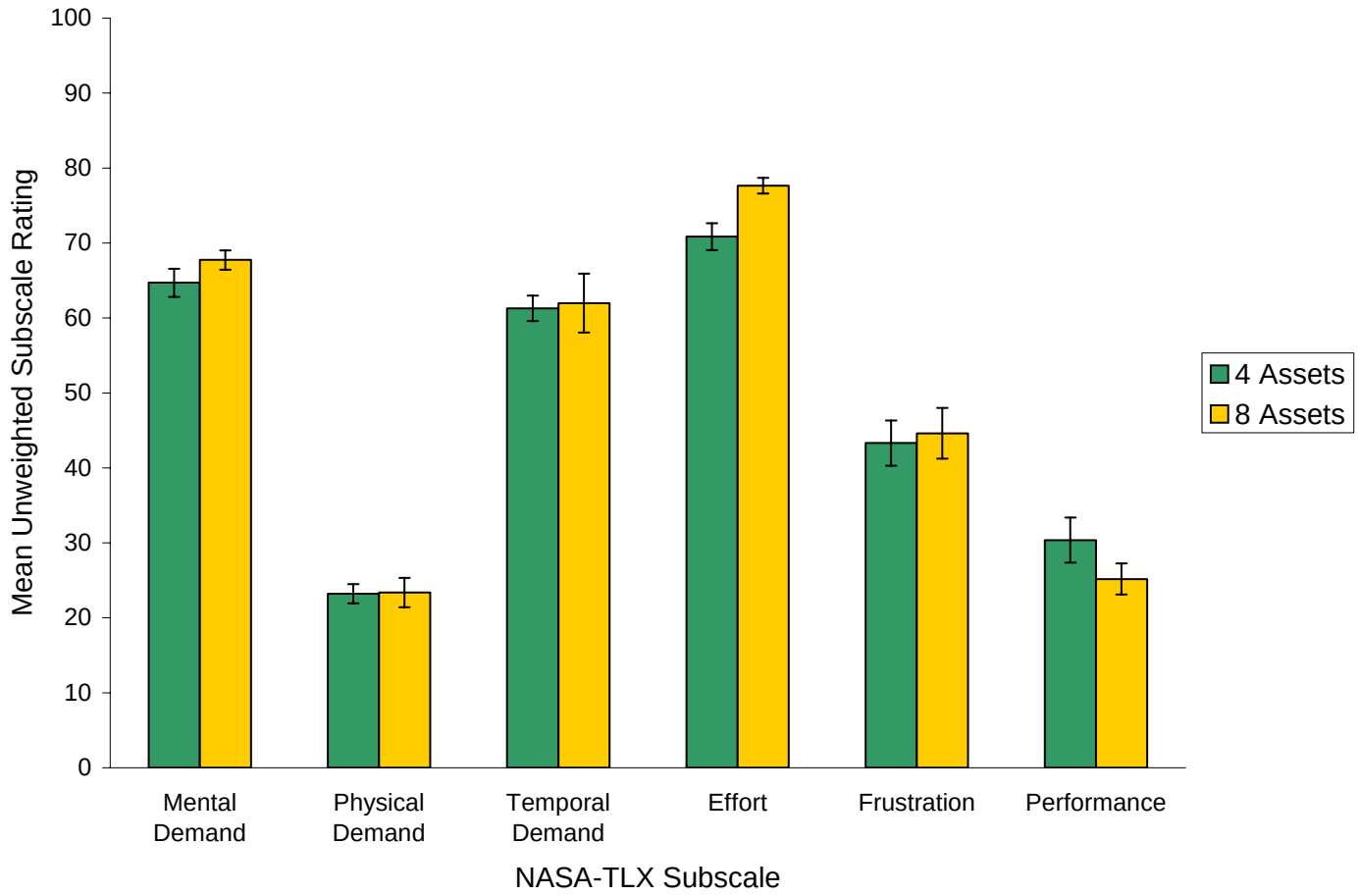
Results: Team NASA-TLX

- **TLX as a function of Communication Modality**
  - **Workload ratings were highest in the Chat condition**



Results: Team NASA-TLX

- **Team effort increased with the number of assets managed by the WDs**

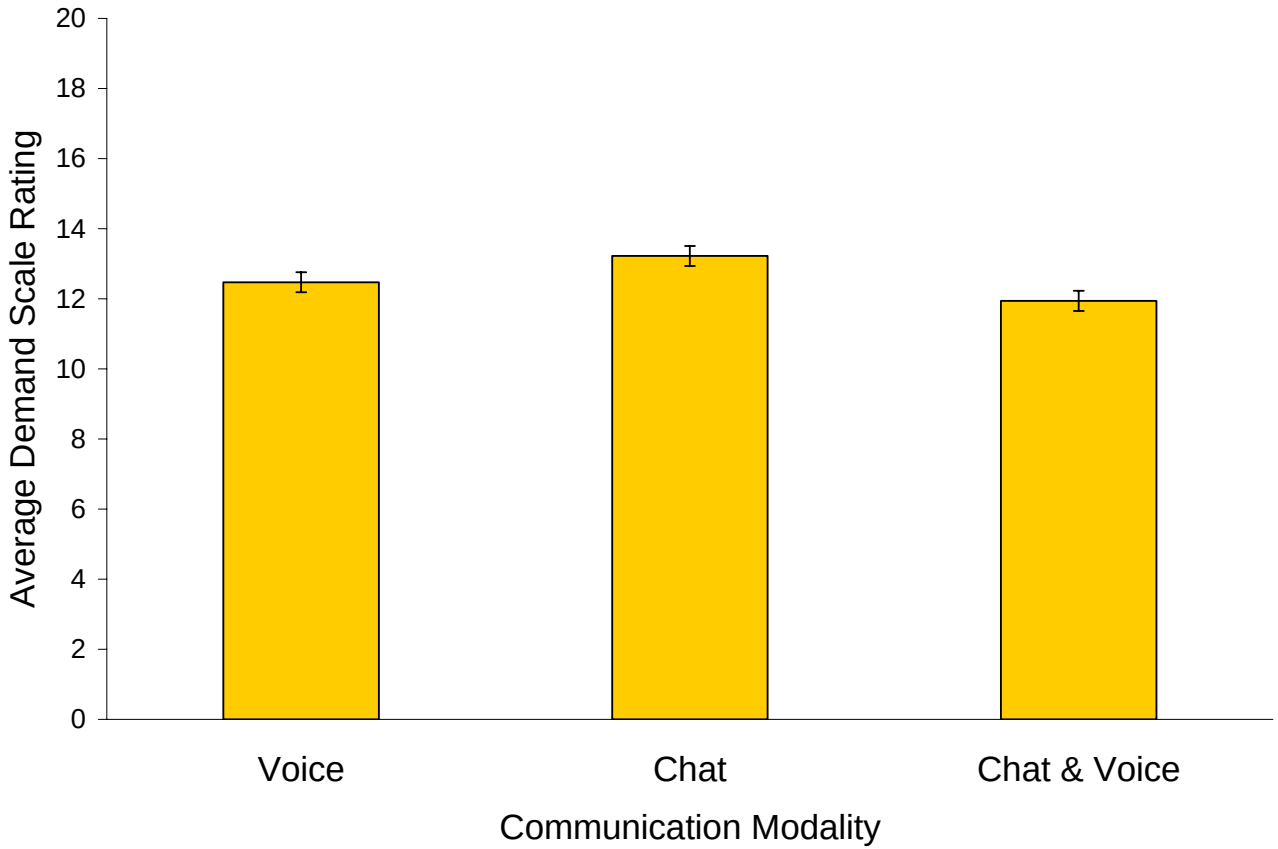


Results:
Team Workload Scale

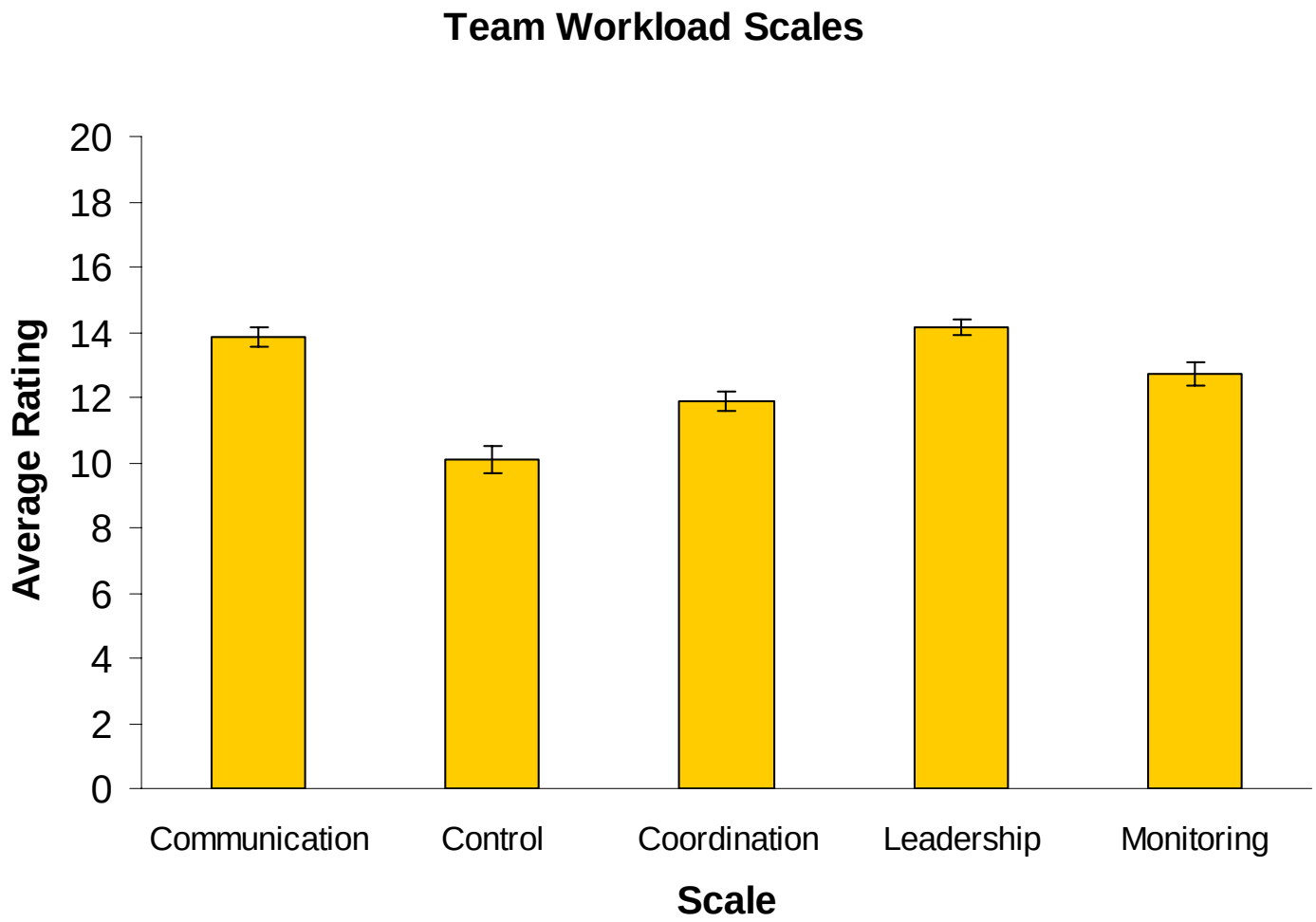
Scale	Description
Communication Demand	The demands associated with communication between team members.
Monitoring Demand	The demands associated with monitoring of other team members during the scenario.
Control Demand	The demands associated with correcting of other team members during the scenario.
Coordination Demand	The demands of adjusting/coordinating activities during the scenario.
Leadership Demand	The demands associated with leadership activities throughout the scenario.

Results: Team Workload Scale

- Team Workload Scale as a function of Communication Modality
  - Ratings were highest on average in the Chat condition

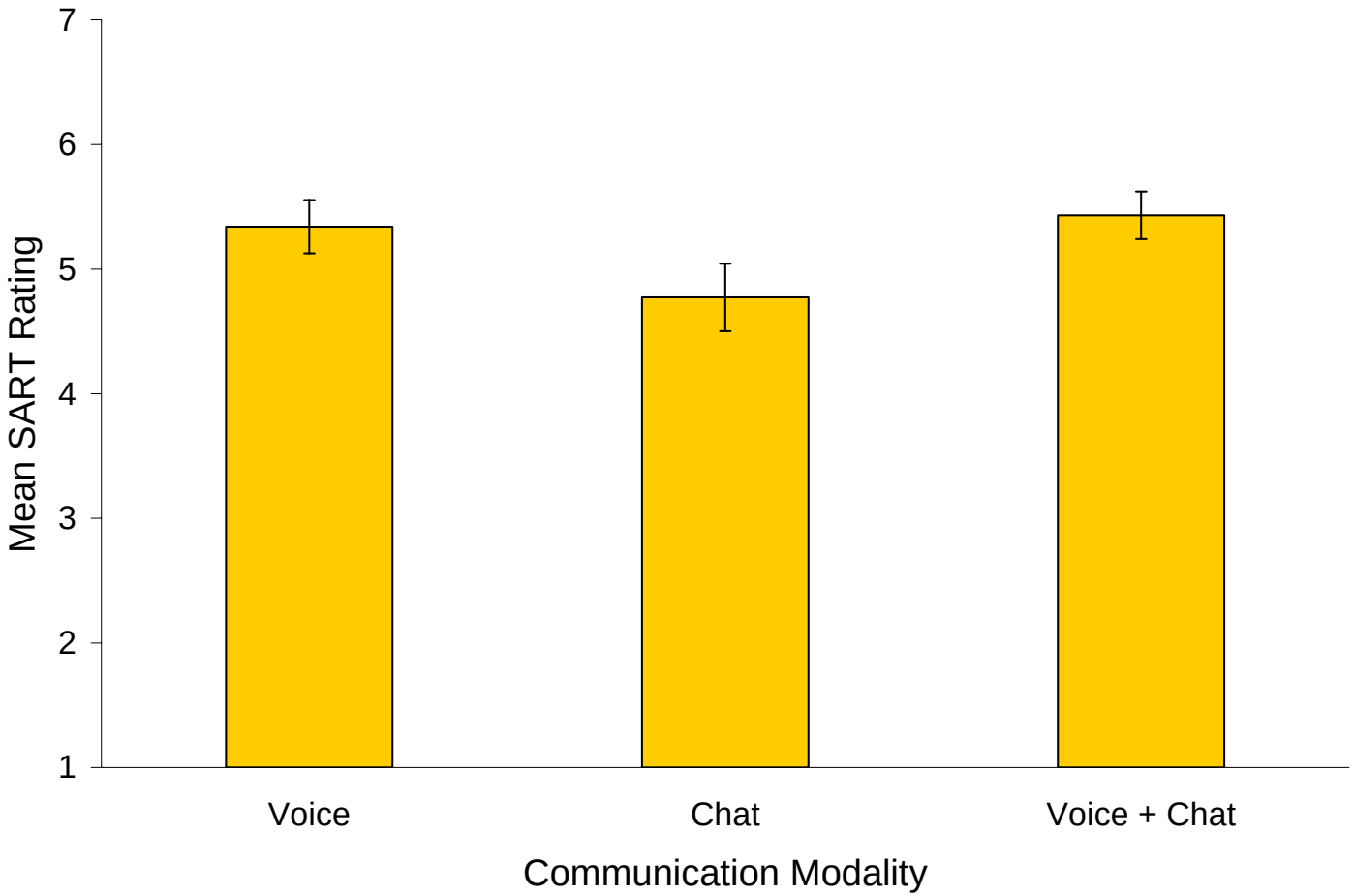


Results: Team Workload Scale



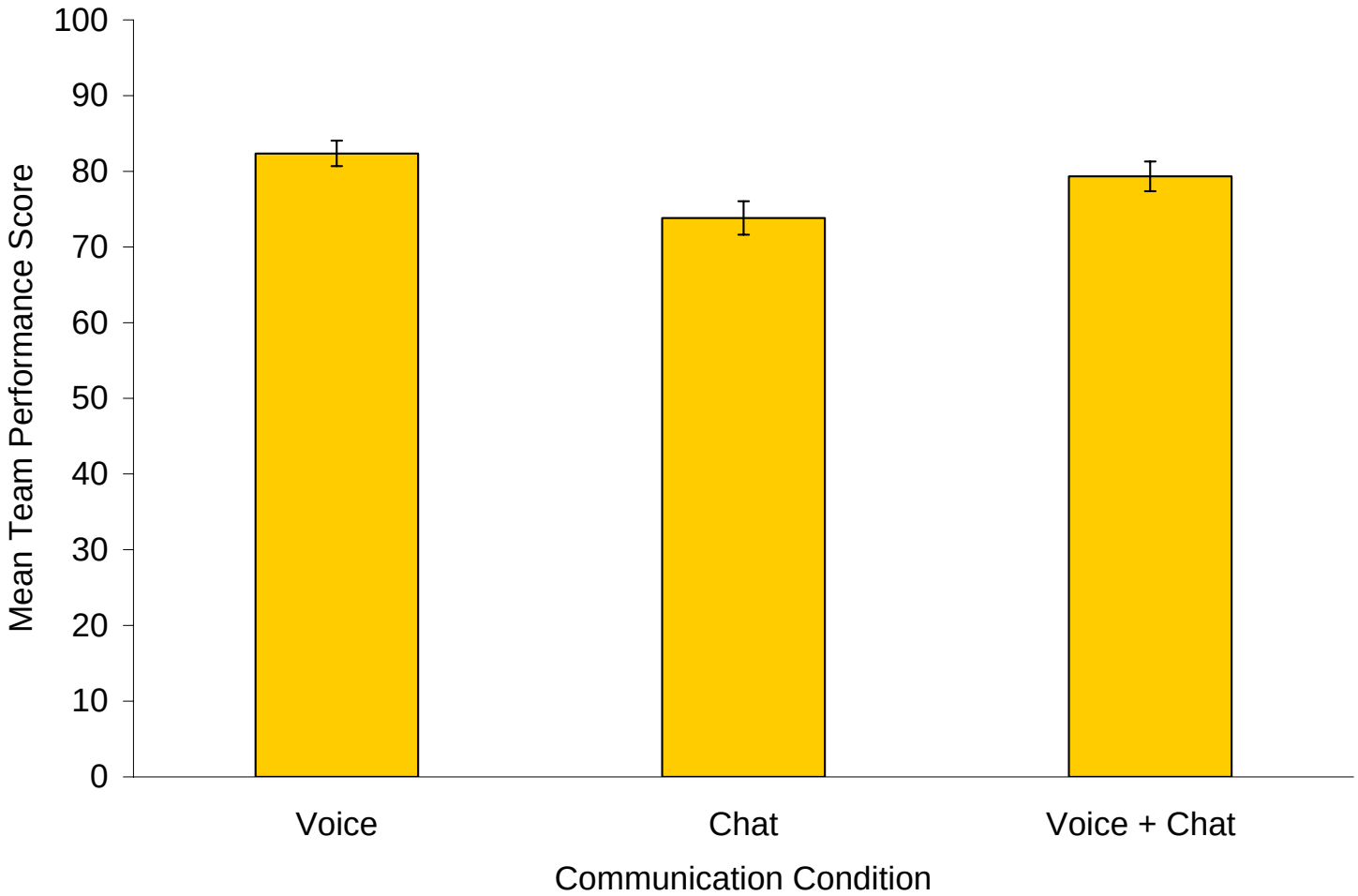
Results: Situation Awareness

- SART ratings as a function of Communication Modality
  - SART rating lowest for Chat.



Results: Team Performance

- Team performance as a function of Communication Modality
  - Team performance was lowest for Chat.



Results: Team Performance

- Team performance score as a function of the number of Assets and Targets

Summary

- For the simulated ABM task, the use of chat alone resulted in:
  - poorer team performance
  - higher TLX ratings
  - higher team workload scale ratings
  - lower situation awareness

– When use of chat was limited, performance was as good as voice alone.

Summary

- **Next up:**
  - **Communication analysis**
  - **Virtual Whiteboards**

Questions?

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