

Matthew Marge¹, Claire Bonial¹, Kimberly A. Pollard¹, Ron Artstein²,
Brendan Byrne¹, Susan G. Hill¹, Clare Voss¹, and David Traum²

¹U.S. Army Research Laboratory, ²USC Institute for Creative Technologies

Email: matthew.r.marge.civ@mail.mil

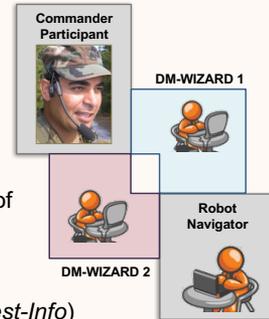
USC Institute for Creative Technologies

Objectives

- Collect human-robot dialogue training data that is computationally tractable without sacrificing naturalness
 - Task: Commander (naïve participant) instructs a robot in a remote location to navigate through an indoor environment, under network constraints
- Recruit multiple wizards to stand in for a robot's dialogue manager
 - Understand and collect natural diversity in their decisions
 - Impose some guidelines to encourage consistent strategies in communications
- Novel step within WOZ method: conduct *control sessions* to study consistency of two individual wizards, identify opportunities to align behavior

Experiment

- Trained two individuals for DM-Wizard role with guidelines
- Conducted *control session* study for each wizard:
 - Subject both DM-Wizards to series of identical challenging situations (e.g., "Move forward a little bit")
 - Annotate and tally dialogue moves (*Clarify, Describe, Feedback, Request-Info*)
 - DM-Wizards met to discuss their differences (*Adjudication*)
 - Conducted two sessions with naïve participants to identify post-adjudication changes in wizard behavior



Results

Control Sessions

Dialogue-Move	DM-Wizard 1	DM-Wizard 2
<i>Clarify</i>	13%	13%
<i>Describe</i>	25%	41%
<i>Feedback</i>	50%	33%
<i>Request-Info</i>	13%	13%
Total #D-Moves	127	157
Total Commands	72	72

Notable results:

- Comparable *Clarify* and *Request* moves
- DM-Wizard 1 gave more *Feedback* to Commander
- DM-Wizard 2 described more situations and plans (*Describe*)

- DM-Wizard 1** took a strategy of providing feedback
 - Greater use of acknowledgments and status updates ("Executing...")
- DM-Wizard 2** would describe situations and plans
 - Echoing back plans ("I will look for shovels.")

Adjudication

- Adjudication process: Revealed lack of full agreement
 - Robot's capabilities; handling requests for help
- Updated DM-Wizard guidelines
 - Given problematic command: describe situation, suggest alternate plans
 - Balance language variation and consistent decision-making

Post-Control Pilot Sessions

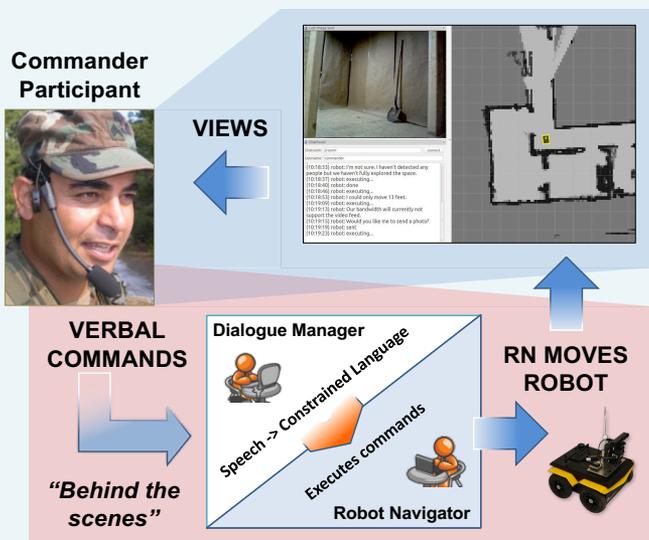
Dialogue-Move	DM-Wizard 1	DM-Wizard 2
<i>Clarify</i>	14%	9%
<i>Describe</i>	18%	29%
<i>Feedback</i>	59%	48%
<i>Request-Info</i>	9%	14%
Total #D-Moves	144	144
Duration	20 minutes	20 minutes

Notable results:

- Both DM-Wizards agreed on usefulness of *Feedback*
- Reduced usage of *Describe* compared to control session
- Feedback* (e.g., "sent" and "done") more frequent than *Describe* moves (e.g., "I will back up two feet.")

Conclusions

- Control sessions revealed variation in DM-Wizard strategies; guidelines provided effective way to align
- Experiments constrained responses into tractable set
- Path forward: Continue multi-phase plan
 - Develop DM-Wizard interface



Two experimenters represent separable, automatable functions. The Dialogue Manager (DM-Wizard) is the "brains" of the robot's natural language interactions. The Robot Navigator (RN) teleoperates the robot based on distilled instructions from the DM-Wizard.

Overall Approach

- Wizard-Source collection of dialogue data for components ultimately to be automated
- Deploy multi-phase development methodology
 - Phase 1: Exploratory collection of dialogue data (completed)
 - DM-Wizard uses free response to communicate
 - Phase 2: Automate some of DM-Wizard labor
 - DM-Wizard communicates via a graphical interface that automates command handling and response generation
 - Phase 3: Automate DM-Wizard entirely
 - Dialogue manager will be trained from wizard decisions
- What effect does having multiple DM-Wizards have on dialogue data collection? How consistent are they in following guidelines?