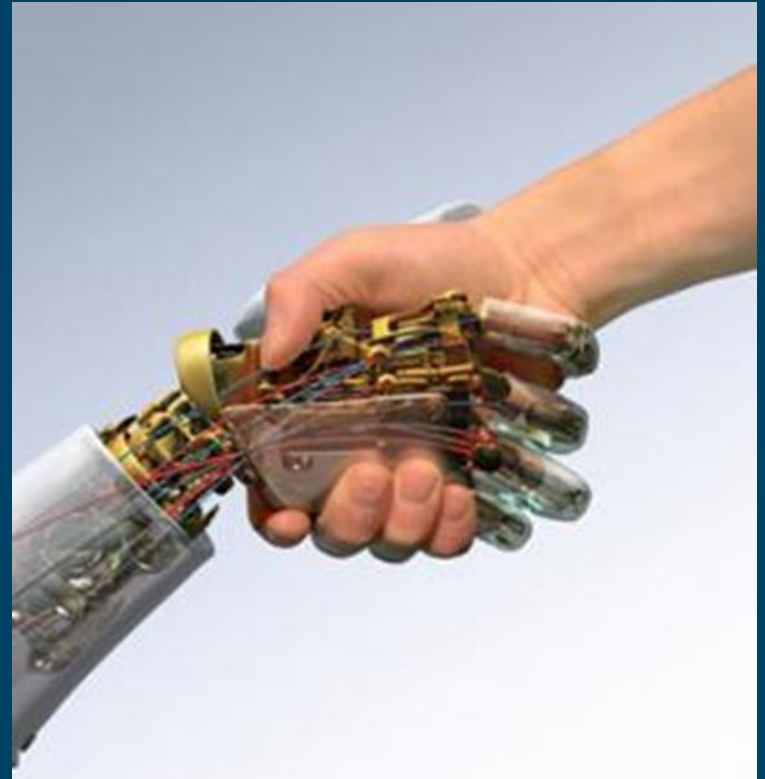# The Role of Dialog in Augmented Intelligence

Murray Campbell
Distinguished Research Staff Member
IBM T.J. Watson Research Center

IBM

- Augmented Intelligence?
- Augmented Intelligence + Communication
- Communication = Dialog (sometimes)
- Augmented Intelligence + Dialog = Interesting Research Challenges

Augmented Intelligence

- Humans + Computers can achieve better performance than either alone

- When might this be true?
  - They are complementary
    - Gaps in computer capabilities are covered by human capabilities
    - Gaps in human capabilities are covered by computer capabilities
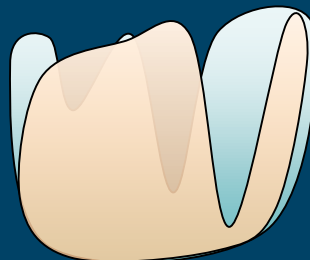 - The benefits of collaboration outweigh the costs of communication
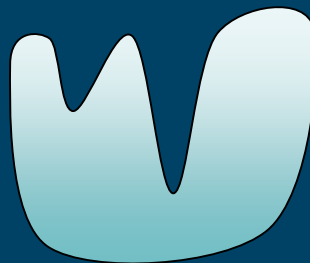
Computer Capabilities
Gaps: Creativity, goal setting, commonsense reasoning, rare cases, etc.

Human Capabilities
Gaps: Memory, attention, large scale search, stamina, etc.
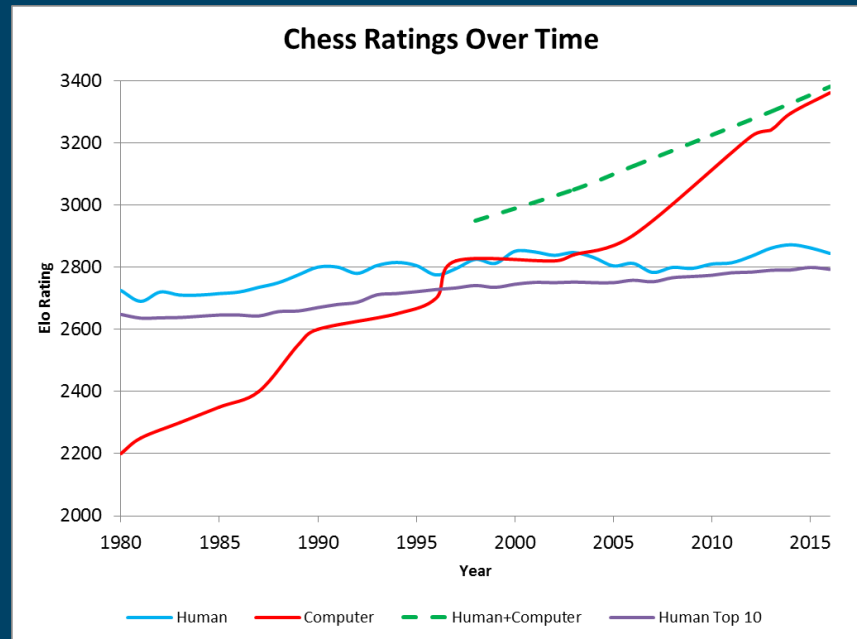
Augmented Intelligence
Gaps are covered

Augmented Intelligence Examples

- Aircraft autopilot
- Legal discovery
- Healthcare
  - IBM Watson and University of North Carolina Cancer Center study
  - 1000 cancer patients
    - 99% match on recommended treatment
    - 30% had valid alternative treatments missed by physicians (current clinical trial, recently approved, etc.)
- Computer chess
  - The gap is narrowing
  - But it is taking a long time

Chess Ratings Over Time

Legend: Human — Computer — — Human+Computer — Human Top 10

When can dialog be useful for Augmented Intelligence?

- Sufficient time to make a decision
- Sufficient complexity to justify an interaction
- Sufficient importance to justify an interaction
- Explainability is important
- Complex goals/preferences of human agent
- Gaps and strengths of agents are at least somewhat understood
- Non-expert human users
- Hands free
- To build trust
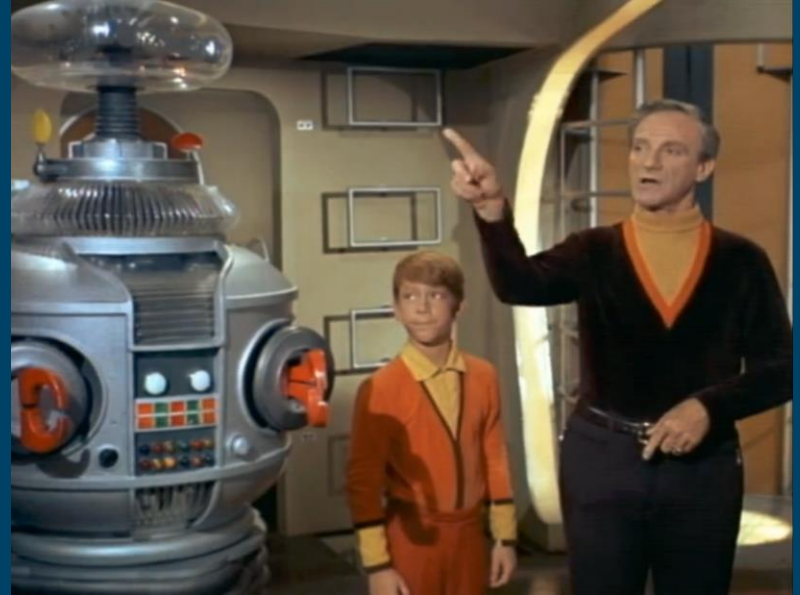
Dialog Challenges

- Scripted approaches to dialog are not easily scaled
    - Learning approaches (Deep Learning, (Deep) RL, Adversarial Learning) are emerging
- Evaluation/measurement/annotation
- Detecting and expressing emotion
- Multi-agent
- Scalable interaction with domain knowledge
- Reasoning

Dialog Challenges

- Scripted approaches to dialog are not easily scaled
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- Scalable interaction with domain knowledge
- Reasoning

Customer: I want to add my wife to our insurance policy.
Agent: Ok, I can help you with that. Is she an immediate family member?

Customer: I bought the wingtip shoes in a size 9 but they're too small, can I exchange for another size?
Agent: Sure, the only size we have left in stock is 8.5, will that be ok?

Learning Simple Reasoning for Dialog

bAbI Task (Facebook)

1. Emma is in the garden.
2. Hannah is in the garden.
3. Hannah picks up the gift.
4. Hannah goes to the kitchen

Question: Where is the gift?
Agent: The gift is in the kitchen.

Blabby task

1. Emma is in the garden.
2. Hannah is in the garden.
3. Hannah picks up the gift.
4. Someone goes to the kitchen.

Question: Where is the gift?
Agent: In statement 4, who went to the kitchen?
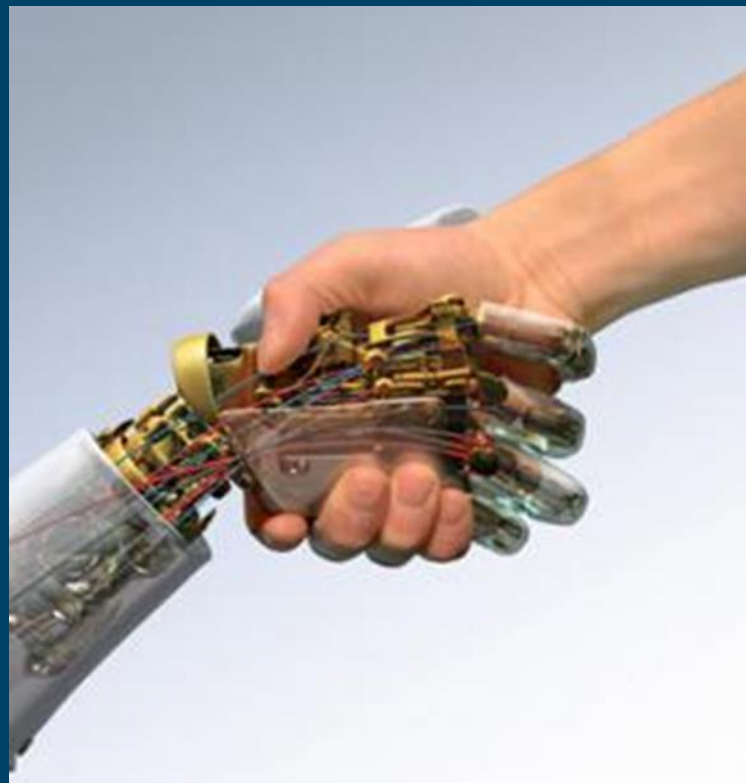Response: Emma went to the kitchen.
Agent: Then the gift is in the garden.

- Given examples of short stories with ambiguities, along with question/answers (toy domain)
- Learns to interact, reason and answer questions about stories it has never seen before
- Can answer almost perfectly on easier (5-6 sentence) stories
- Can answer more than 80% correct on harder 15-20 sentence stories

Conclusion

- Augmented Intelligence systems are likely to be important for the foreseeable future

- In some cases, dialog may be the best communication mechanism for Augmented Intelligence systems

- There are some significant (and interesting) research challenges in using dialog in Augmented Intelligence systems

Thank You