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Command & Control in Virtual Environments: Tailoring Software Agents to Emulate Specific People

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Overview

- ELICIT Experiment Platform
- abELICIT Sensemaking Agent
- Validation Approach
- Validation Results
- Future Work

ELICIT Introduction

ELICIT-Experimental Laboratory for Investigating Collaboration, Information-Sharing, and Trust

- Part of the Command and Control Research Program (CCRP)'s network-centric warfare initiative
- Engaged in developing and testing principles of organization that transfer power and decision rights to the edge of the organization
- Needed to frame testable hypotheses about the relative effectiveness of edge organizations in comparison to other methods of organization through a series of real-world simulations
- Facility was created to run these experiments

Base Experiment

- Hypothesis testing experiment
- Live subjects, multi-user
- Run in edge or traditional hierarchy mode
- Experiment software records all actions for analysis

Experiment Task

- dentify the who, what, where and when of
an adversary attack
- Task scenarios are anonymized
- Participants are anonymized
- Participants periodically receive factoids
about the situation
- No one person has all the information
needed
- Task success requires communication
- All communication is through the experiment
software

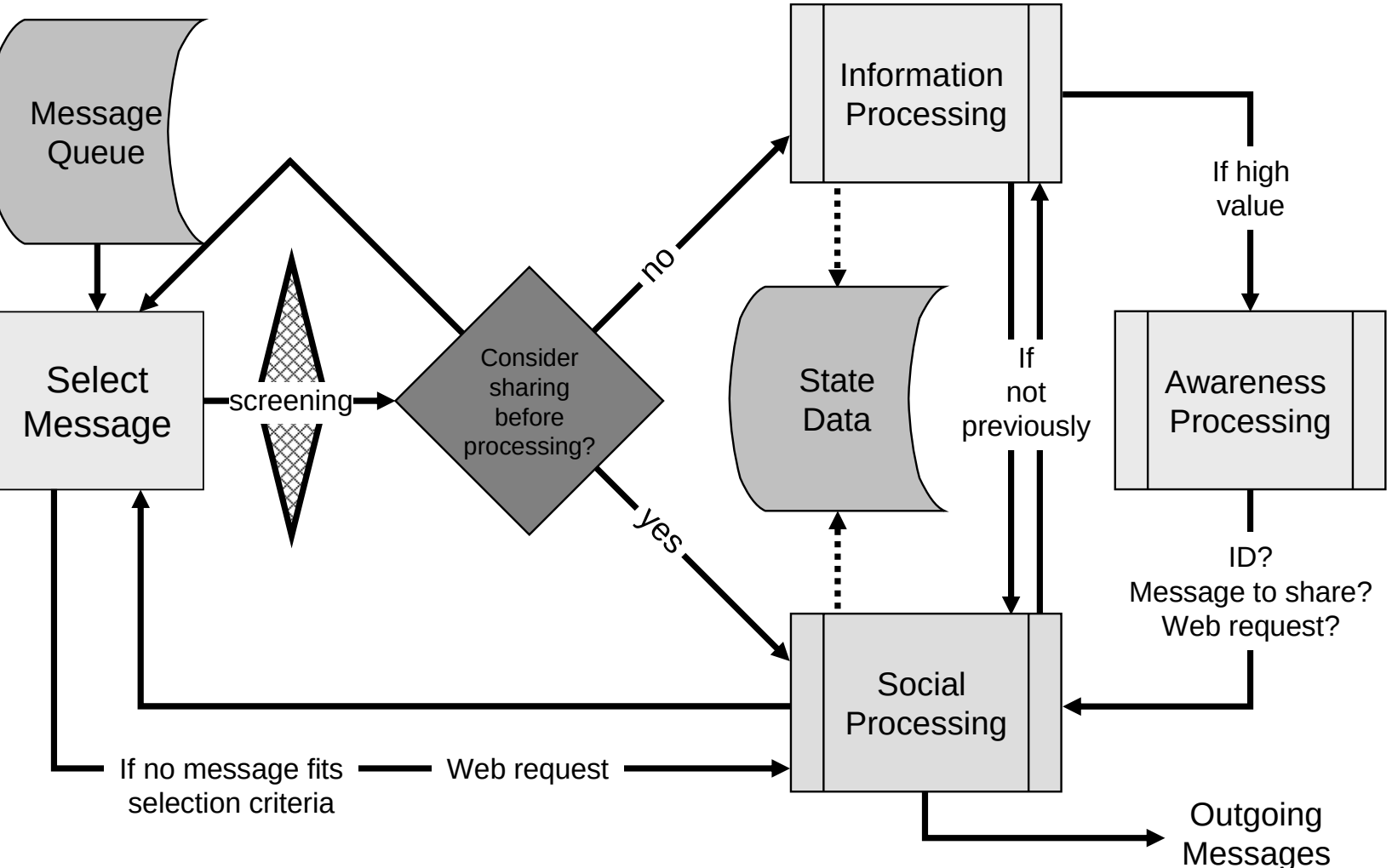
abELICIT

- Agent based ELICIT allows agents to participate with or without humans
- Agents can perform all the baseline ELICIT capabilities
- Developed configurable “Sensemaking” agent

Sensemaking Agent

- Able to take place of human participant
- Forms mental model of situation
- Behavior varies with scenario
- Looks like a human to human participants
- Has configurable personalities

Sensemaking Agent Logic Flow



The Challenge

How do you know if the agent(s) behave(s) like human(s)?

Validation Approach

- Select live participant run
- Configure individual Sensemaking agents to model each participant
- Iteratively
  - Make agent run
  - Compare to human run
  - Adjust the agent configurations

Targeted Human Run

- Part of NPS experimentation campaign
- 1 of 3+ experiment sessions
  - —Conventional, thin, textual ELICIT interface
  - —Face-to-face interactions
  - —Partial immersion in SecondLife
- Same Hierarchy organization
  - —Same people, same roles, different environments
  - —Similar but different factoid sets
  - —Participant surveys for agent tailoring
  - —Results for agent calibration

Key Configuration Variables

- essageQueueNewerBeforeOlder
- hareBeforeProcessing
- meBeforeFirstIdentify
- inSolutionAreas
- asSeenEnoughToIdentify
- lConfidencelevel
- ropensityToShare
- hareModalChoice
- hareWith
- hareWithWebSites
- ropensityToSeek
- inTimeBetweenPulls
- rimary
- econdary
- warenessProcessingThreshold

Modeling Approach

- Human survey responses and the ELICIT transaction log used to design individual agents whose behaviors match those individual people
- The agent trial uses the same organization structure, names, roles, and task areas
- Actions within the agent transaction log measure agent behavior and are compared to human actions across several variables to evaluate the relative fit of each agent design
- Adjustments made to tune the agent parameters
- Iterative process continues until the differences are minimal and further tuning does not improve results

Validation Results

Six iterations are required to tailor the software agents to reduce differences sufficiently and hence emulate the performance of their human counterparts

Only small differences are observed, reflecting substantial agent tailoring, and a design that appears to mimic the actions performed by participants in the human trial

Conclusion

- Have demonstrated specific ELICIT agents can be configured to emulate the behavior of specific individuals participating in an ELICIT experiment
- This is a key milestone in the evolution of the ELICIT platform
- Opens door to increased use of abELICIT in training and experiments

Future Work

C2 in virtual environments

- Use new ELICIT functionality to perform sensitivity analysis of parameters
- Develop an expedited testing process where we could analyze very large data sets in a timely fashion.

Questions

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