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

SCRTS 15

2 June 2010

Danielle Wynn, Mary Ruddy, Dr. Mark E. Nissen

sponsored by The Center for Edge Power

US Naval Postgraduate School

Overview

ELICIT Experiment Platform

mbELICIT 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

Multiple subjects, multi-user

Run in edge or traditional hierarchy mode

Experiment software records all actions for analysis

Experiment Task

Identify 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

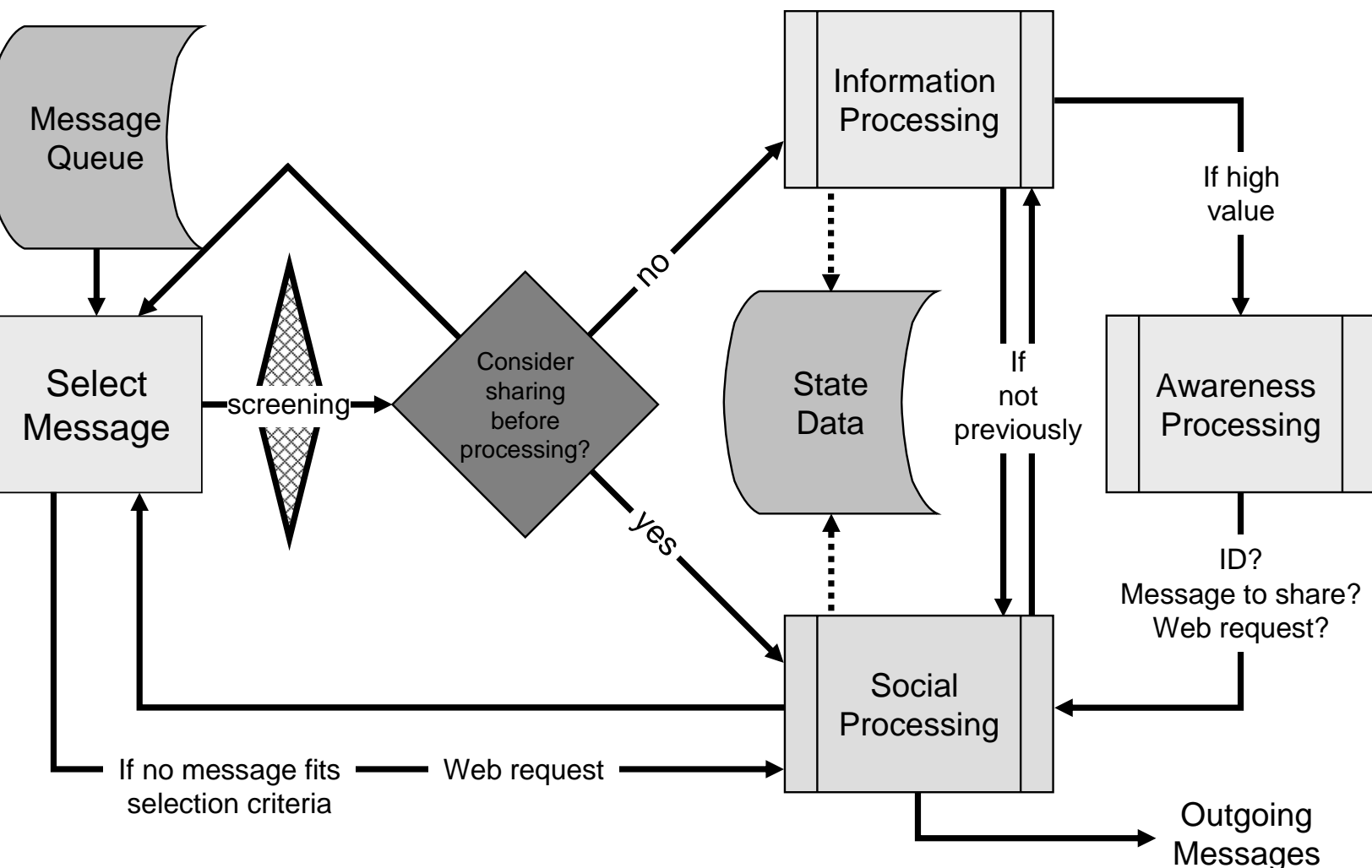
forms mental model of situation

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
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

messageQueueNewerBeforeOlder

shareBeforeProcessing

timeBeforeFirstIdentify

minSolutionAreas

hasSeenEnoughToIdentify

Confidencelevel

propensityToShare

shareModalChoice

shareWith

shareWithWebSites

propensityToSeek

minTimeBetweenPulls

primary

secondary

awarenessProcessingThreshold

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

?