

# Exploring the Effects of Individual Characteristics on Organizational Performance using the ELICIT Experimentation Platform

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- Introduction to ELICIT
  - Objectives
  - Analysis
    - Propensity to Seek
    - Propensity to Share
    - Sharing Modality
  - Future Applications and Conclusions

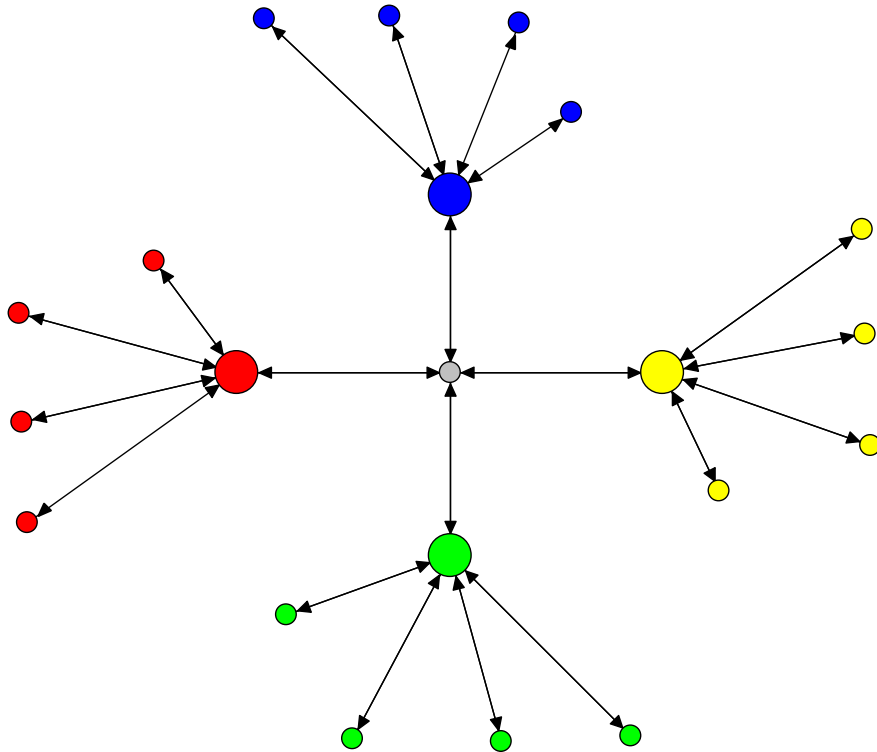
# What is ELICIT?

- ELICIT = Experimental Laboratory for Investigating Collaboration, Information-sharing, and Trust
- U.S. DoD (OASD/NII) Command and Control Research Program (CCRP) sponsored the design and development of the ELICIT platform for experimentation focused on information, cognitive, and social domain phenomena
- Purpose of ELICIT-related Experimentation and Analysis is to investigate the cognitive and social impacts of C2 approach and organizational structure (e.g. information sharing, trust, shared awareness, and task performance)
- Initial applications focus on a comparison of traditional hierarchical and edge C2 approaches

- The goal of each set of participants is to build situational awareness and identify the who, what, when, and where of a pending attack
  - Participants can share factoids directly with each other or post factoids to websites
  - Participants build awareness by gathering and analyzing factoids and interacting with one another
- Participants receive factoids about a future attack
  - Factoids fall into four task categories: who, what, when, and where
  - Factoids are periodically distributed to the participants
  - No one is given sufficient information to solve their assigned problem without receiving information from others
- The receiving, sharing, and posting of factoids and the nature of the interactions between and among participants can be constrained

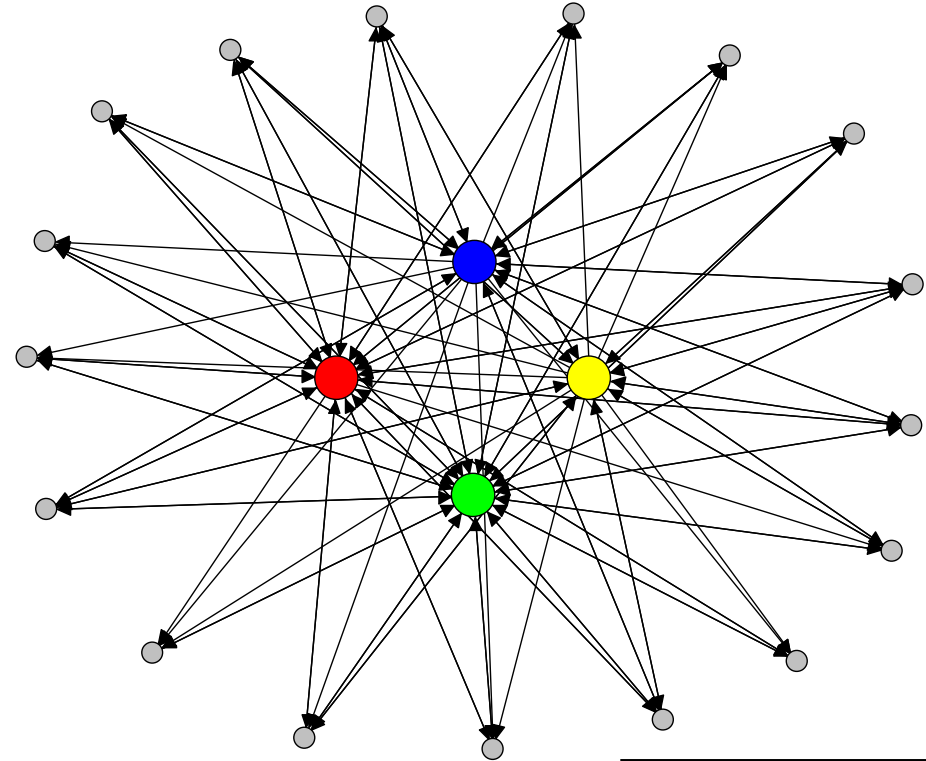
- Sixty-eight (68) total factoids:
  - 17 when; 17 where; 17 who; 17 what
  - Factoids may be expert, key, supportive, or nonessential
- Factoids are distributed in three waves
- Each participant receives 4 factoids through distribution
  - 2 factoids at start
  - 1 factoid at 5 minutes
  - 1 factoid at 10 minutes
- 17 participants make up an organization
- C2 approach for this series of experiments were designated prior to the start of the run as
  - Hierarchy or Edge

## Hierarchy

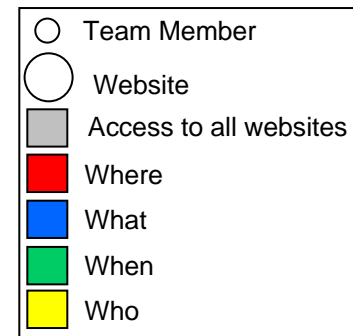



- The commander (gray) can access/post to all four websites
- All other participants can only access/post their group's website

## Edge



- Each participant can access/post to all four websites



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## Objectives

- Characterize human participants according to observed actions
  - Propensity to Seek
  - Propensity to Share
  - Sharing Modality
- Observe correlations among characteristics
- Inform agent design to support less costly, more efficient ELICIT experimentation

## Approach

- Use data sets from 25 trial runs generated from the ELICIT experimentation platform
- Isolate those facts received by participants through distribution and analyze corresponding actions



- An ELICIT experiment produces a transaction log which records all actions performed by participants using the software during the trial, timestamps each action, and documents metadata pertaining to the experiment itself (date, time, number of participants, factoid set, etc.)
- The transaction logs are text files which can be manipulated and parsed using data scripts to conduct statistical comparisons
- The human log files were parsed and analyzed using Python scripts, JMP and Excel

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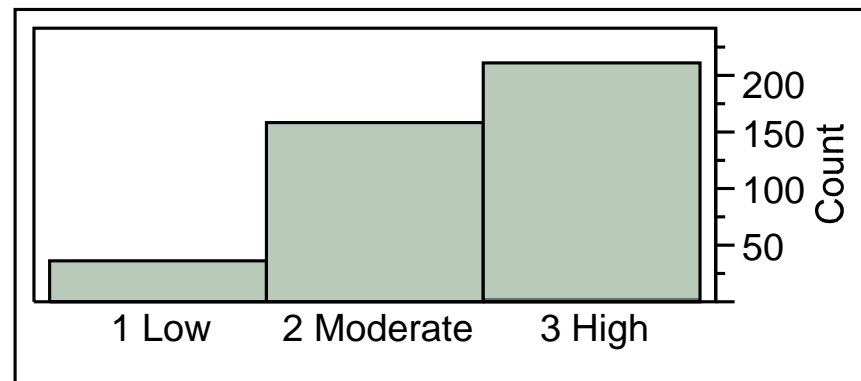


- Propensity to Seek characterizes how often an individual searches for information by visiting a website
  - It does not indicate what sort of material is seen or how much material the individual viewed upon visiting the website
- For each run, subjects were assigned Propensity to Seek setting associated with their website revisit times
- Individuals can be assigned to the following three settings: High, Moderate, and Low

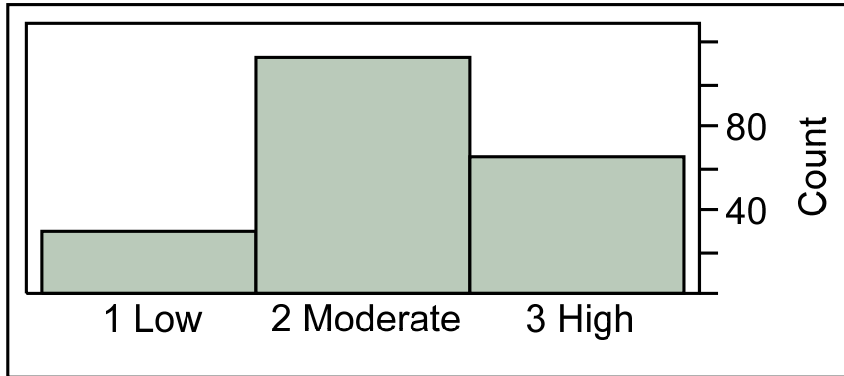
# Propensity to Seek Settings

- Settings assigned using clustering analysis
- Clustering is a statistical technique that provides a method to group similar values and see how data clumps together

Setting	Count	Mean (Revisit Time)	Prevalence	Cluster Interval
High	202	70.958833	53.30%	$p < 120$
Moderate	151	169.084318	39.84%	$120 \leq p < 260$
Low	26	349.325779	6.86%	$p \geq 260$



## Propensity to Seek

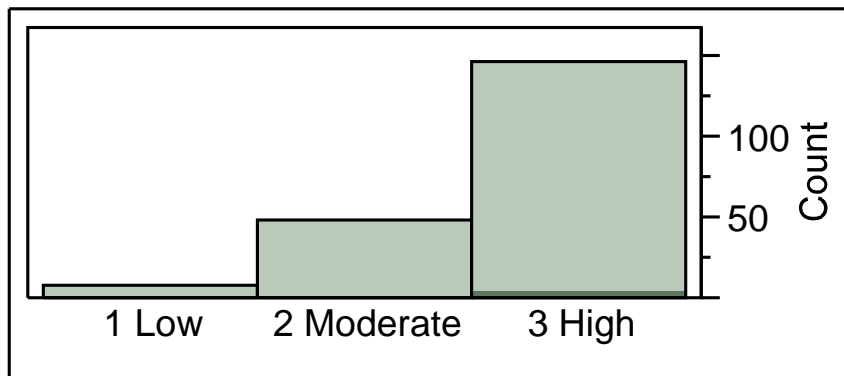


## Edge Organization

### Frequencies

Level	Count	Prob
1 Low	28	0.13793
2 Moderate	111	0.54680
3 High	64	0.31527
Total	203	1.00000

## Propensity to Seek



## Hierarchy Organization

### Frequencies

Level	Count	Prob
1 Low	6	0.03061
2 Moderate	46	0.23469
3 High	144	0.73469
Total	196	1.00000

- This metric is calculated based on:
  - Number of posts an individual performed on factoids received through distribution
  - Number of shares an individual performed on factoids received through distribution
  - Subject's team size (dictated by organization type)
  - Number of participants that have access to a given website (Post Reach)
- The formula used to calculate an individual's propensity to share is:

$$\text{Propensity to Share} = \frac{(\# \text{ of posts})(\text{post reach}) + (\# \text{ of shares})}{\left( \begin{array}{c} \# \text{ of websites} \\ \text{accessible by subject} \end{array} \right) (\text{post reach}) + (\text{team size} - 1)}$$

Post reach and team size are constant by role and organization type.

## Edge Organization

$$\text{Member} = \frac{(x)(16) + (y)}{(4)(16) + (16)}$$

## Hierarchy Organization

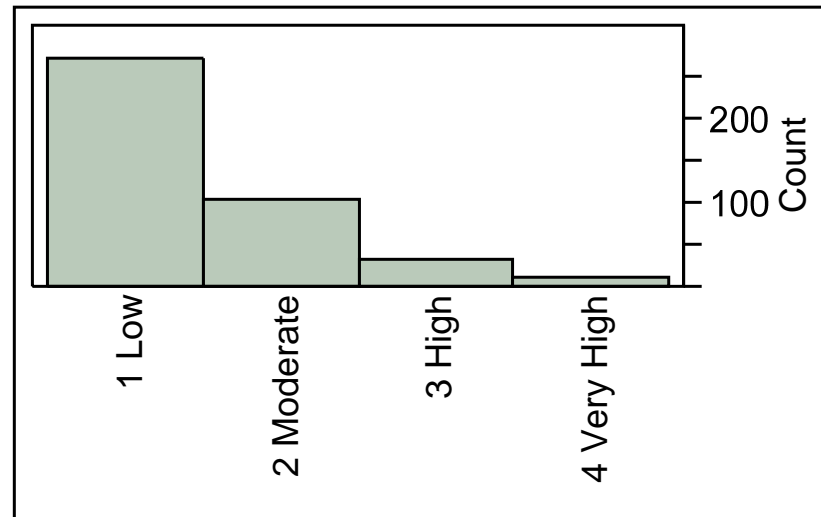
$$\text{Coordinator} = \frac{(x)(4) + (y)}{(4)(4) + (4)}$$

$$\text{Leader} = \frac{(x)(4) + (y)}{(1)(4) + (4)}$$

$$\text{Member} = \frac{(x)(4) + (y)}{(1)(4) + (3)}$$

# Propensity to Share Settings

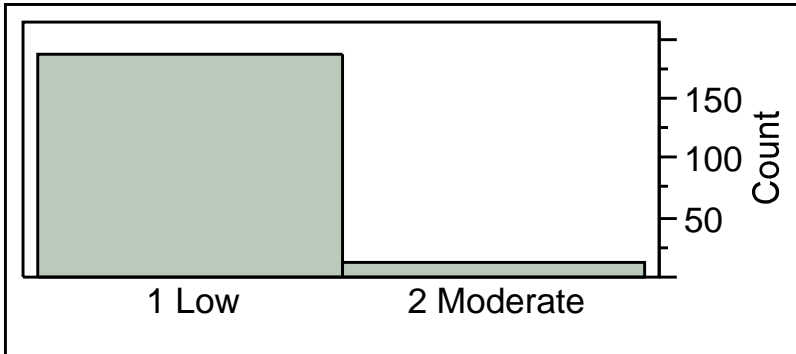
Setting	Count	Propensity to Share	Prevalence	Cluster Interval
Low	229	0.24835075	63.43%	$p < 0.47$
Moderate	96	0.70352958	26.59%	$0.47 \leq p < 0.97$
High	28	1.2348852	7.76%	$0.97 \leq p < 1.96$
Very High	8	2.38169643	2.22%	$p \geq 1.96$





# Propensity to Share Distributions

## Propensity to Share

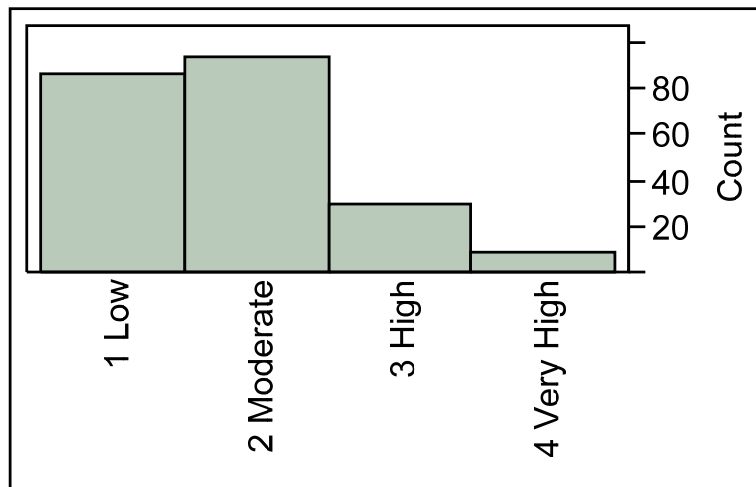


## Edge Organization

### Frequencies

Level	Count	Prob
1 Low	183	0.95313
2 Moderate	9	0.04688
Total	192	1.00000

## Propensity to Share



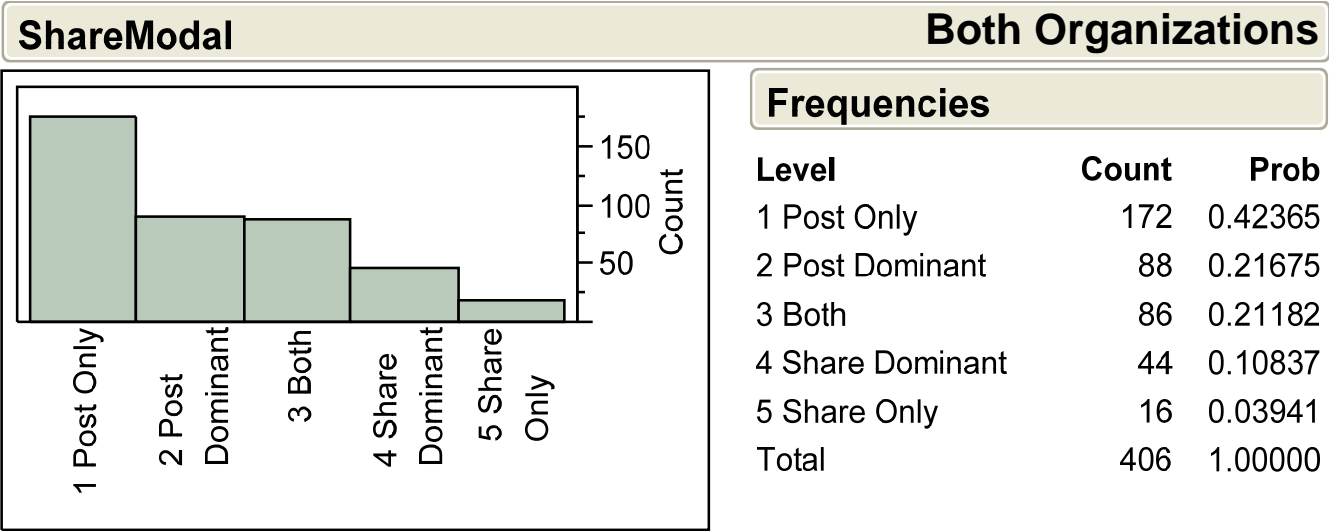
## Hierarchy Organization

### Frequencies

Level	Count	Prob
1 Low	85	0.39720
2 Moderate	92	0.42991
3 High	29	0.13551
4 Very High	8	0.03738
Total	214	1.00000

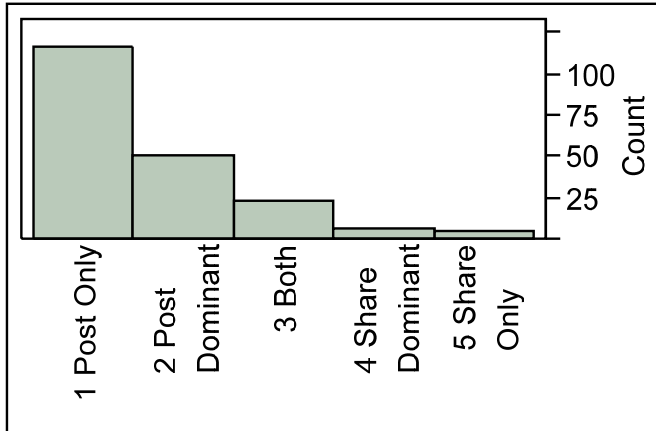
- An individual's sharing modality characterizes the process by which an individual shares information. The Share Modality Settings and corresponding rule set are:
- Share Modality Settings:
  - **Share Only** indicates all sharing observations were direct peer to peer shares
  - **Share Dominant** means that at least one peer to peer only behavior was observed on the distributed facts and no post only behavior observed
  - **Both** indicates that sharing observations include both posting and sharing. In cases where post only and peer to peer only behaviors were observed this setting was assigned.
  - **Post Dominant** indicates that at least one post only behavior was observed and no peer to peer only behavior observed
  - **Post only** indicates all sharing observations were post only

# Share Modality Distribution



# Share Modality Distributions

## ShareModal

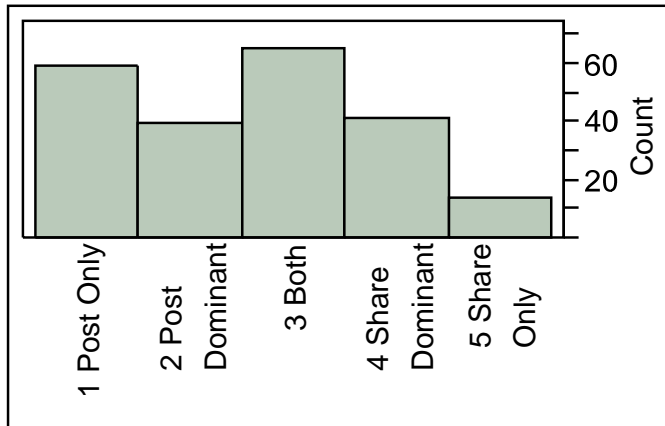


## Edge Organization

### Frequencies

Level	Count	Prob
1 Post Only	114	0.59375
2 Post Dominant	49	0.25521
3 Both	22	0.11458
4 Share Dominant	4	0.02083
5 Share Only	3	0.01563
Total	192	1.00000

## ShareModal



## Hierarchy Organization

### Frequencies

Level	Count	Prob
1 Post Only	58	0.27103
2 Post Dominant	39	0.18224
3 Both	64	0.29907
4 Share Dominant	40	0.18692
5 Share Only	13	0.06075
Total	214	1.00000

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- Members of a hierarchy organization had more variation in their characterizations or settings than members of an edge organization
- Correlations between characterizations – results of Chi-squared tests did not indicate any significant correlations
- Inform software design of agent parameter settings and related experimental variables
- Characterization can be used to better represent typical human actions associated with different organization structures

- Verification and Validation of agent trials
- Thorough testing of archetype structures
- Proposed changes to more closely represent human behavior
- Providing logistical support to Col members as they use the platform for research, education, and training
- Develop configuration generator to streamline creation of agent parameter files
- Develop java based tool to facilitate quick data analysis

# Join the ELICIT Community of Interest at:

<http://www.dodccrp.org/html4/elicit.html>

## Questions or Comments?

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