# Quantification of subjective information assessments in C2 decision option selection

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# BACKGROUND

- **In the past…**
  - **a major cause for a lack of consensus in a group decision making task was that all participants did not have the same information.**

- **Today…**
  - **A major cause is differing subjective assessments (importance, impact) of the same information.**
    - **Particularly true in multicultural/coalition groups**

- **Decision Making Constructs in a Distributed Environment (DCODE) is a decision support system for the elicitation, display, sharing and comparison of individual subjective information assessments.**

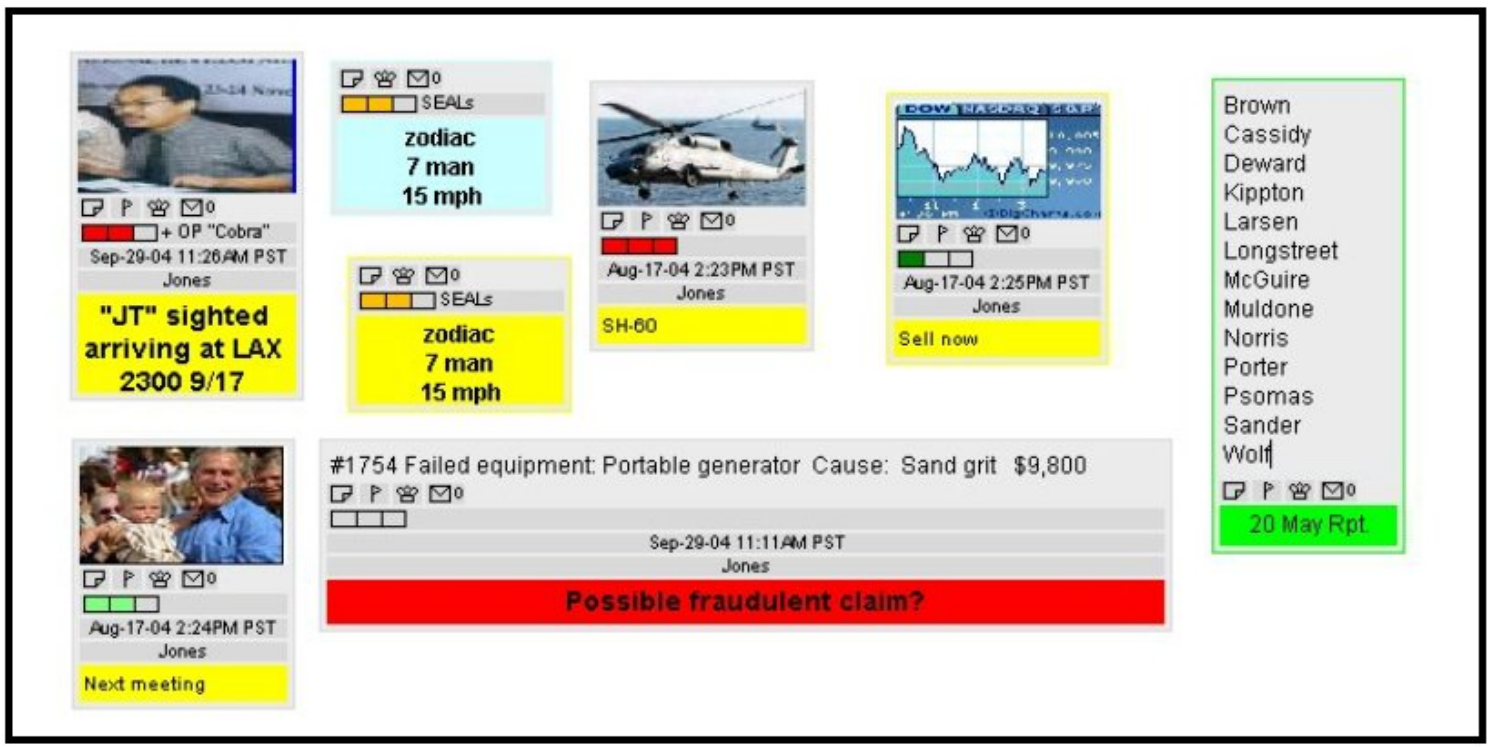
# Decision Making Constructs in a Distributed Environment (DCODE)

**DCODE is a component of MIT's Electronic Card Wall (EWall) project, and has been developed by SPAWAR Systems Center in San Diego.**

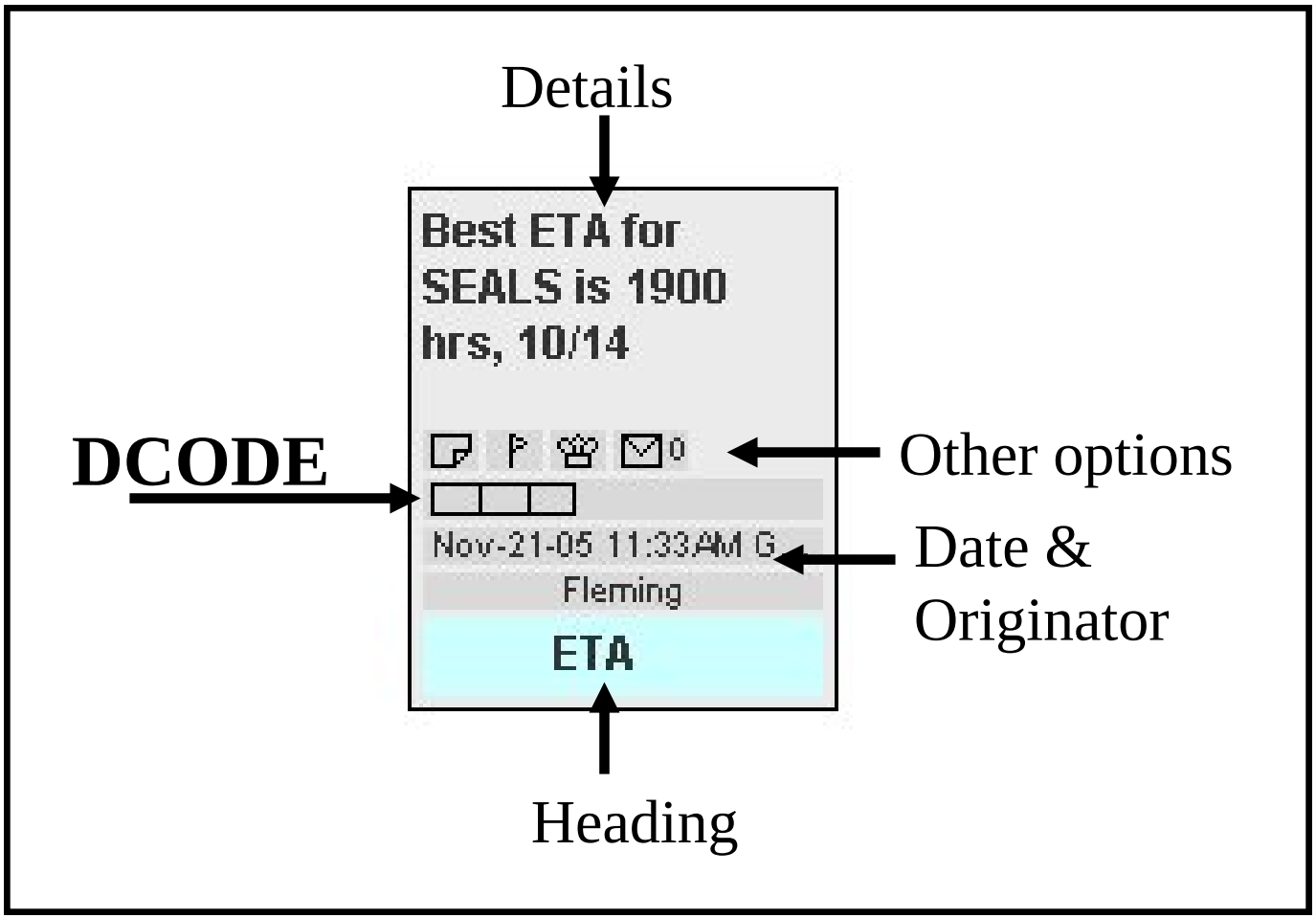
**DCODE Overall Objective: the development of a decision support tool for reducing the problems involved with the storing, sharing and integration of subjective information assessments.**

**The use of DCODE in the quantification and sharing of these subjective assessments can improve the quality of group decision making and significantly reduce the time devoted to conflict resolution and team consensus building.**

EWall cards are small iconic representations of relevant information items and include a series of information parameters. They can be configured in a variety of formats.

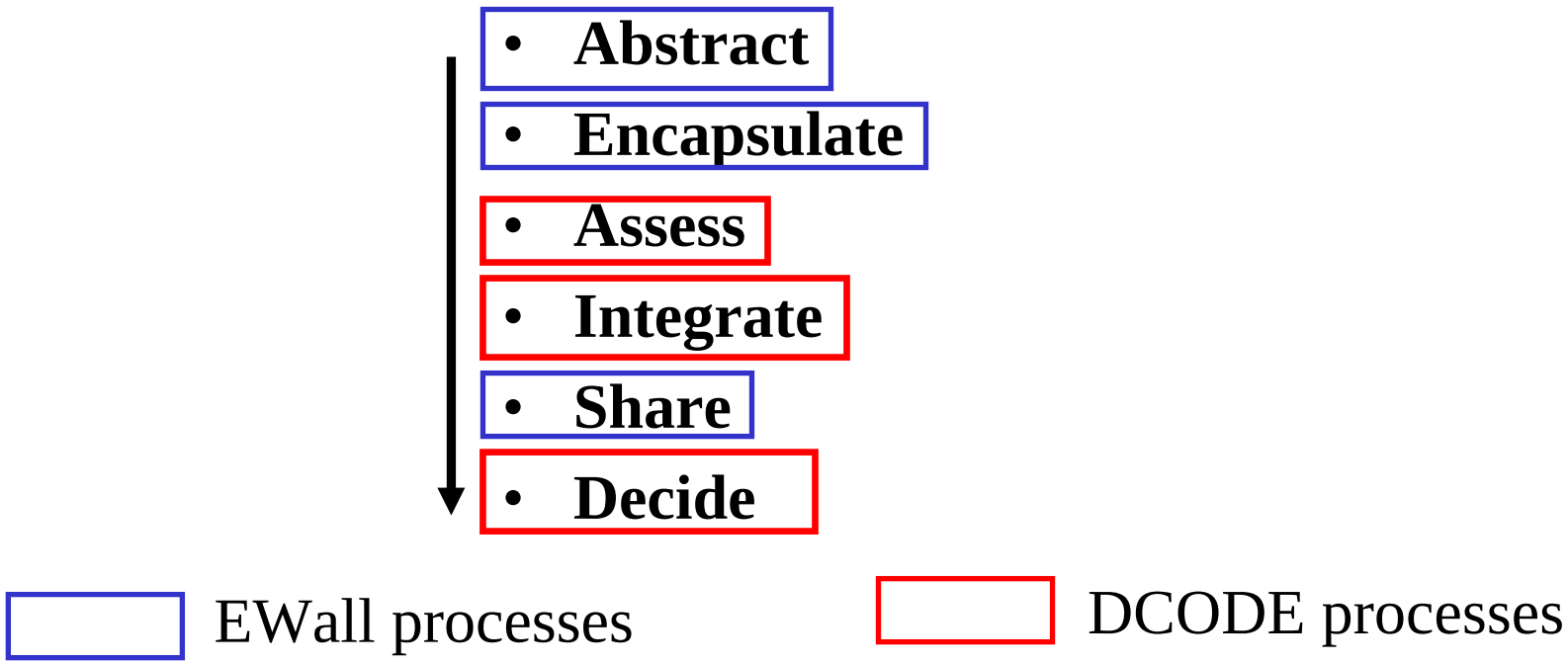


# EWall Card


Details
Best ETA for SEALS is 1900 hrs, 10/14
DCODE
Other options
Nov-21-05 11:33AM G
Fleming
Date & Originator
ETA
Heading

# DCODE Process

**The use of DCODE as a decision support tool involves to following sequential process for each decision relevant information item:**



# Information Abstraction and Encapsulation

**Mission: Rescue hostages from Islandia**
**Decision Options: Marines; SEALS; Army**
**Factors: Speed (ETA), Covertness, Risk, etc**

**Situation Assessment:**
**Is Carlos still in Columbia?**

CINCPAC email

To: LTCJohnson@cincpac.mil
From: steve.thomas@noaa.gov
Subject: Islandia tides and currents

Hello LTC Johnson

I have been looking at detailed marine charts of Islandia'a reef system. Based on this analysis I would say that only one small section of the reef (coordinate G17) is passable, and then only at PEAK high tide. This will next occur at 1700 10/14. The word of caution is that the soundings are over 25 years old and may have changed (either for the better or the worse) regarding ease of crossing.

V/R
Steve Thomas

Homeland Security email

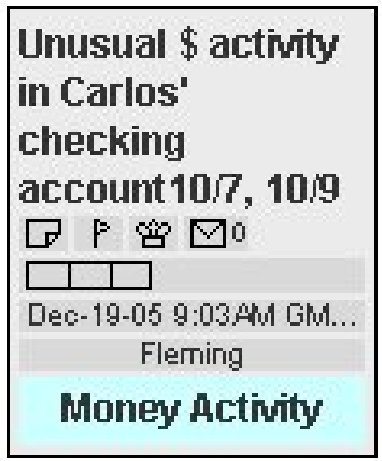
To: joseph.donovan@dea.gov
From: william.kays@omb.gov
Subject: Re: acct. activity

Mr. Donovan

Fred Barnes in Finance Tracking informs me within the last 10 days, $27K was deposited in the referenced account (10/7) and $25K was withdrawn on 10/9. This is unusual activity for this account

V/R
Bill Kays

Information is abstracted, encapsulated but **NOT** Assessed!



# DCODE Information Assessment

**EWall Information Card**

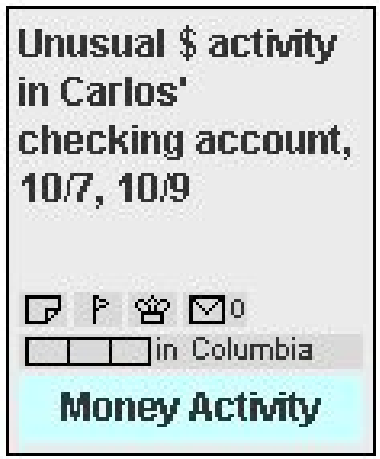
**Which option(s) is impacted?**
**How is it impacted?**
**How important is this item?**
**Quality of the information?**
**Timely?**
**Credible source?**
**Well documented?**

**Information Object (IOB)**

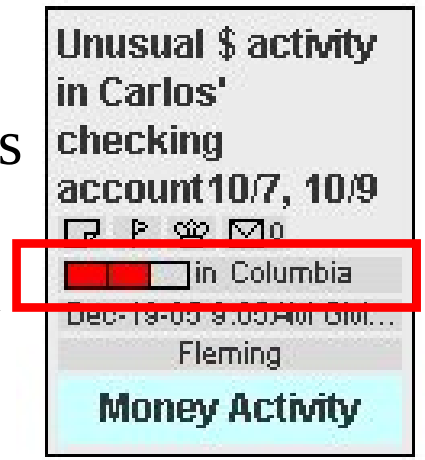
This DCODE coding tells me that this information …

- **Negatively impacts the viability of the using the SEALS option.**
- **Is considered of high importance.**
- **There is some issue with the quality of this information.**

# DCODE Information Assessment (cont.)



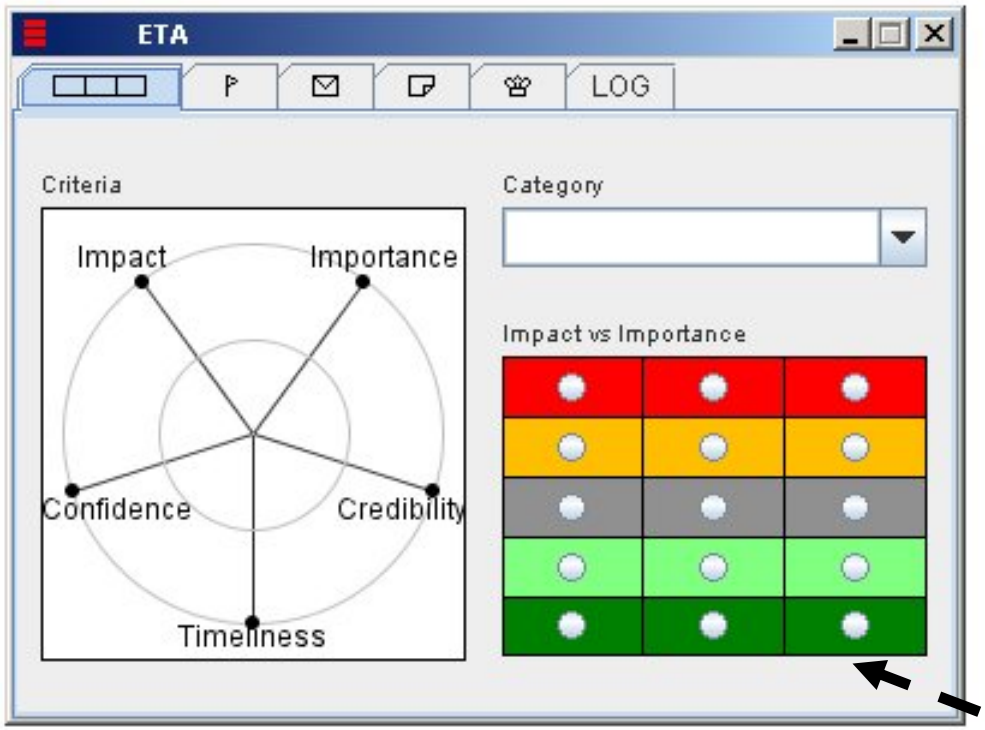

Every time Carlos has left Columbia, there have been large deposits and withdrawals in his account

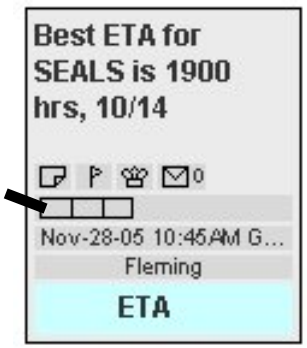



This DCODE coding tells me that this information …

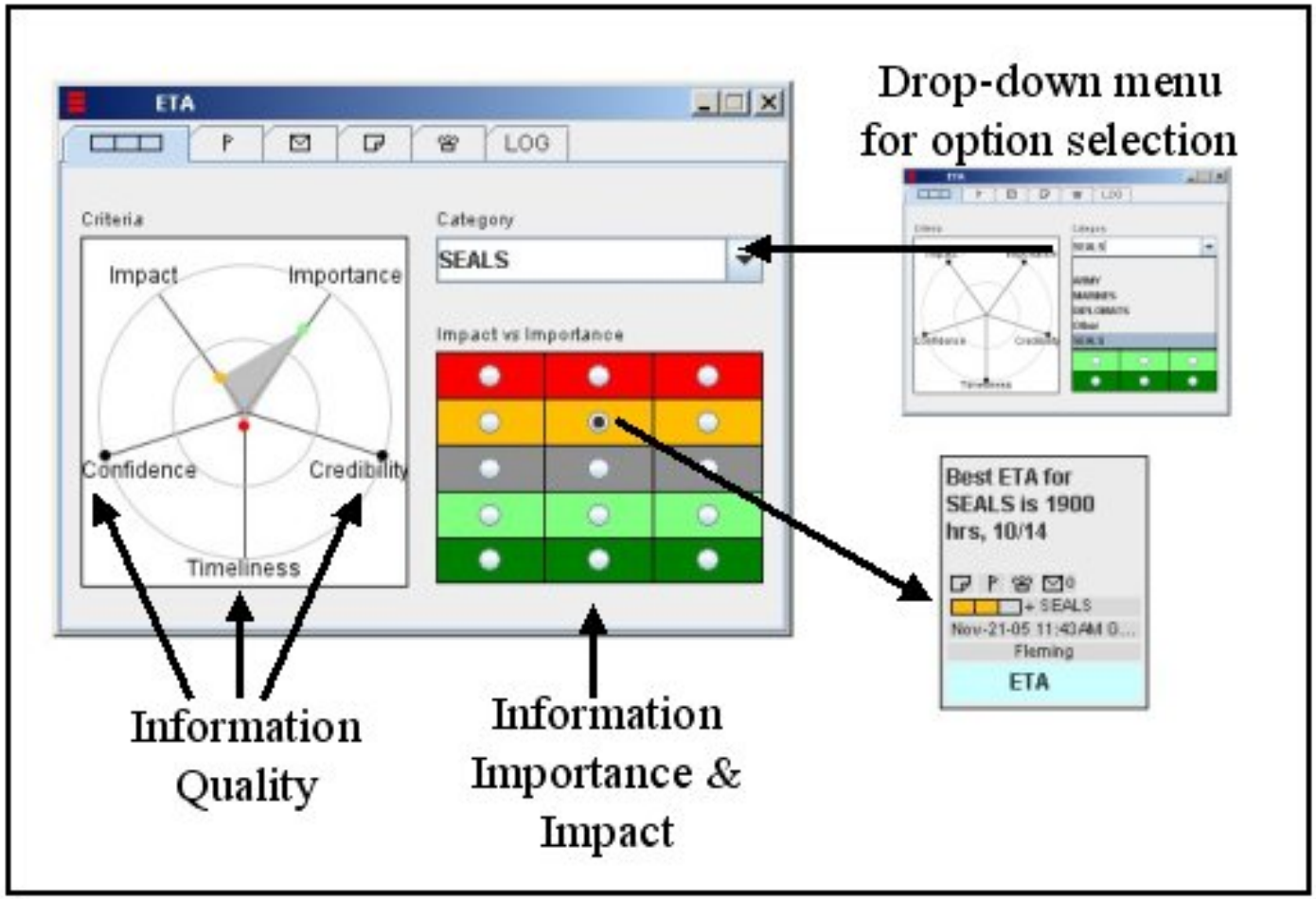
- **Very Negatively impacts the likelihood Carlos is in Columbia.**
- **Is considered of high importance.**
- **There is no question about the quality of the information.**

# Activating the DCODE Assessment Template

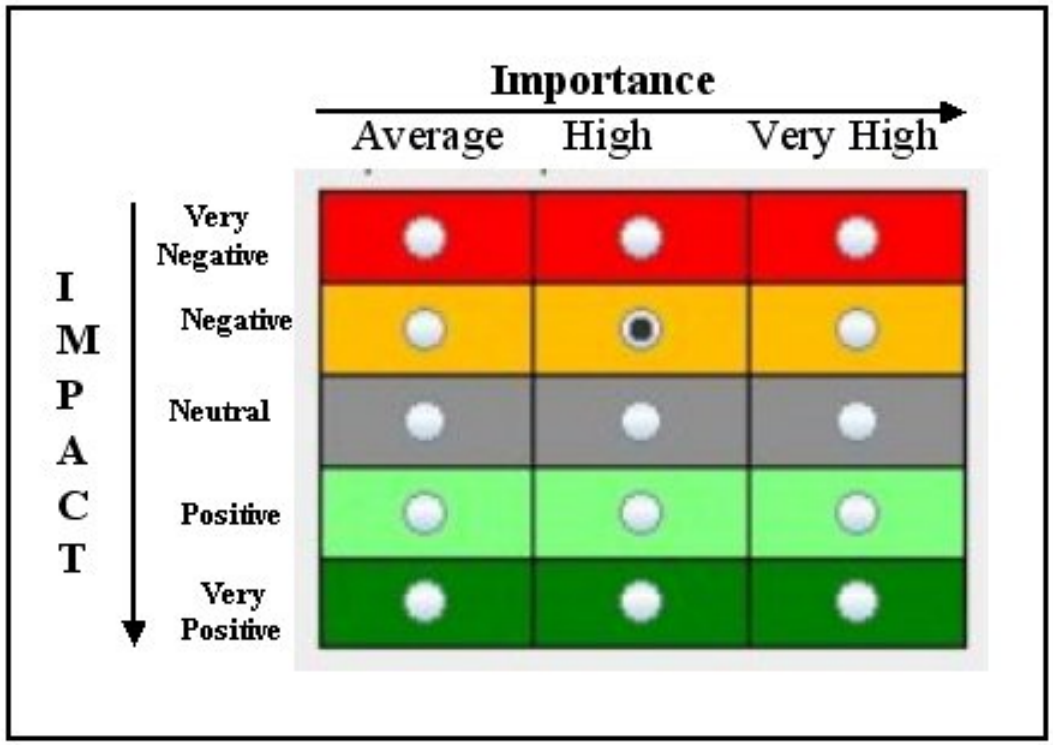


# The Assessment Template



# Scoring Impact and Importance




Item is of “High” importance (2 boxes) and
has a “Negative” impact (yellow) on this option.

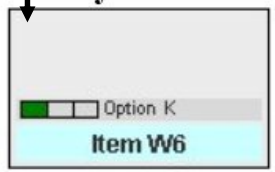
## IMPORTANCE (# boxes filled):

AVERAGE (1) | HIGH (2) | VERY HIGH (3)

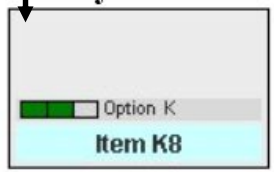
## IMPACT: (color)

- Very Positive
- Positive
- Negative
- Very Negative

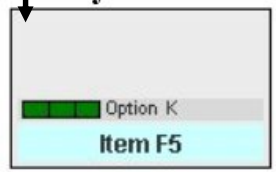
Average Importance
Very Positive



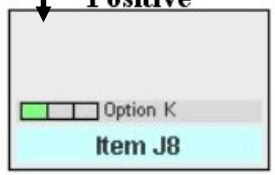

High Importance
Very Positive



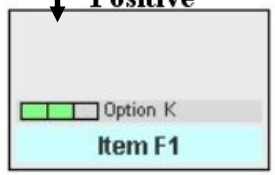

Very High Importance
Very Positive



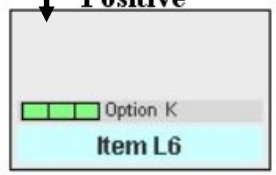

Average Importance
Positive



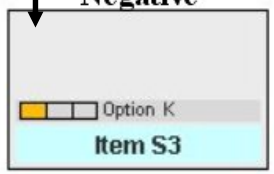

High Importance
Positive



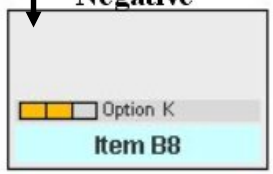

Very High Importance
Positive



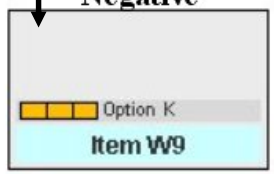

Average Importance
Negative



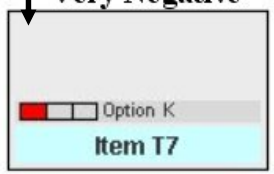

High Importance
Negative



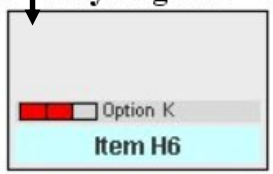

Very High Importance
Negative



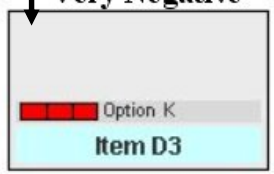

Average Importance
Very Negative




High Importance
Very Negative



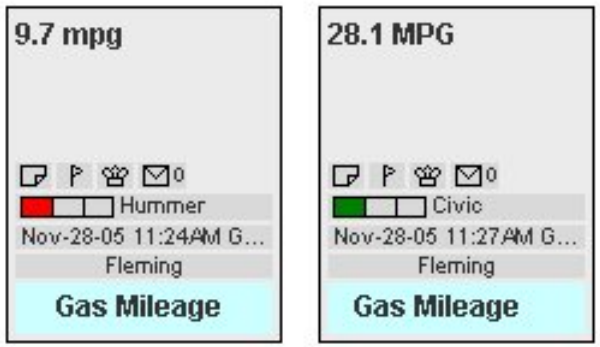

Very High Importance
Very Negative



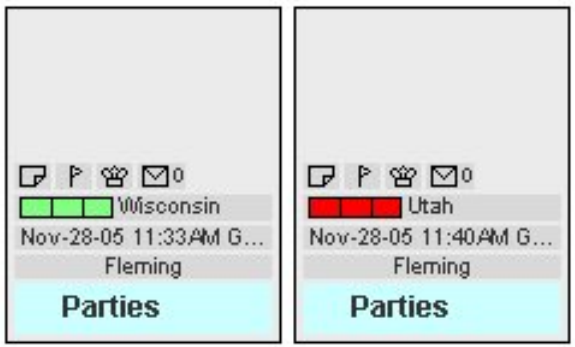
# Sample DCODE Assessments

## Selecting a House

## Selecting a Car

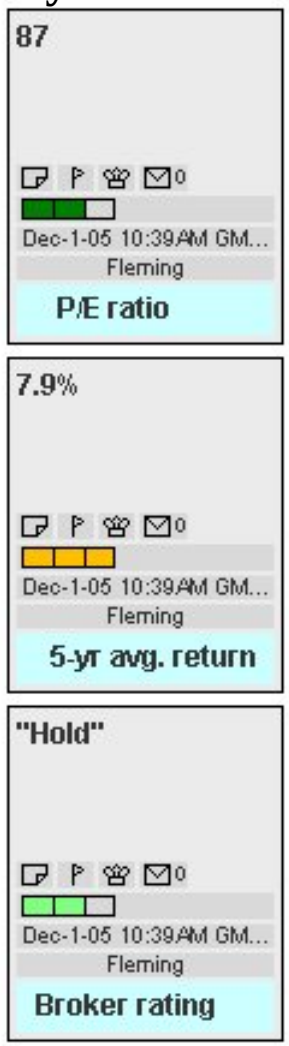



## Selecting a College



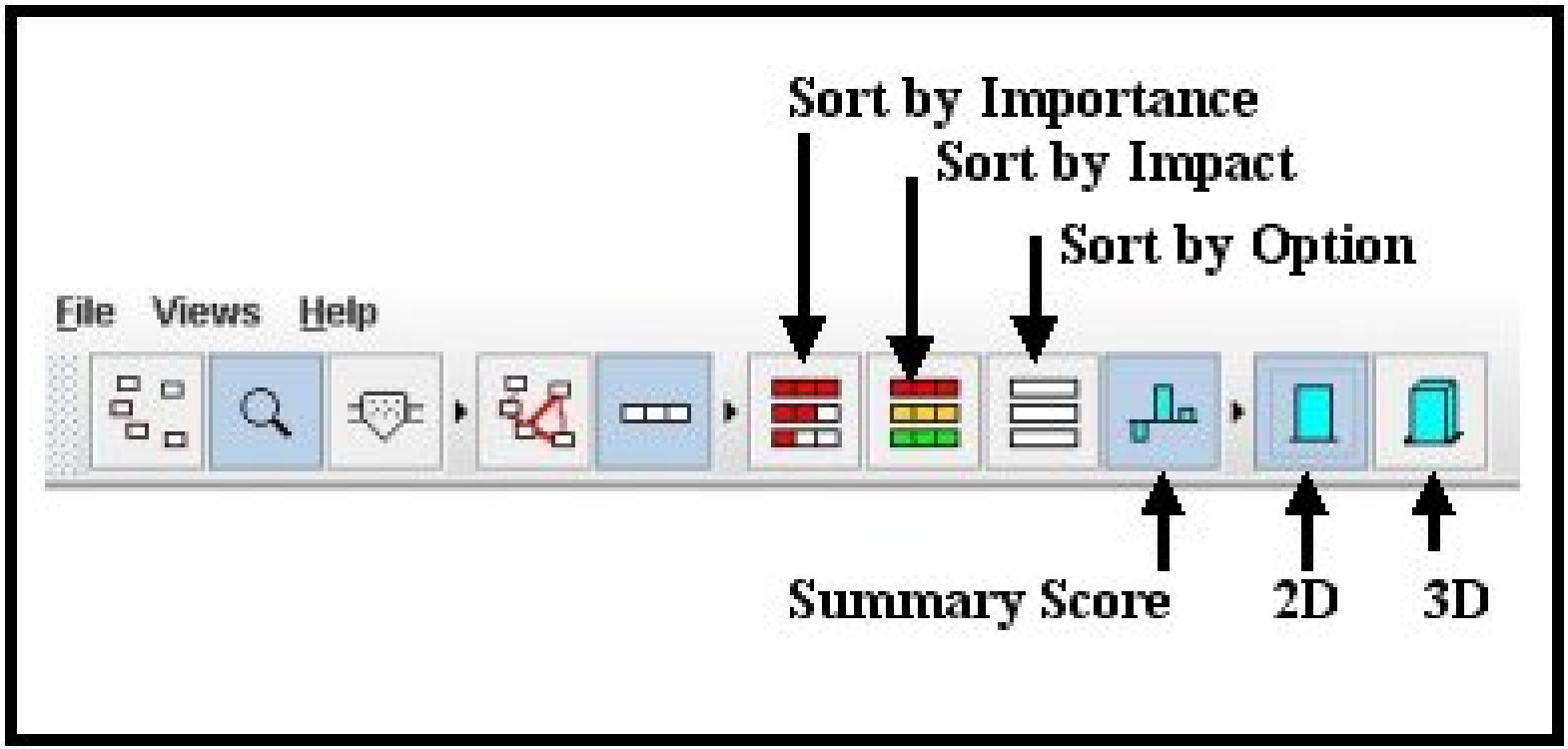

## Single Option:

**Buy stock "A"?**

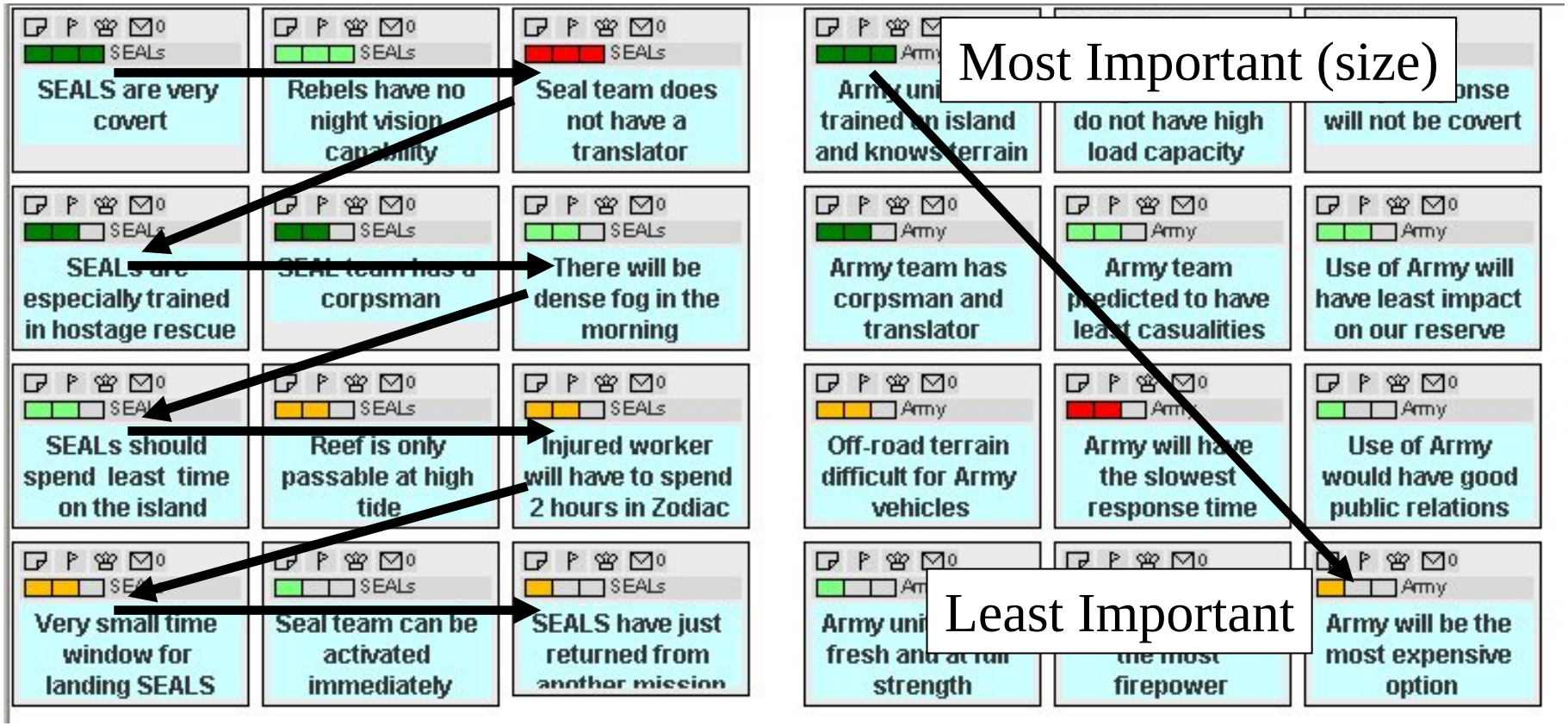


# Which is the BEST option?

# Integration of IOBs

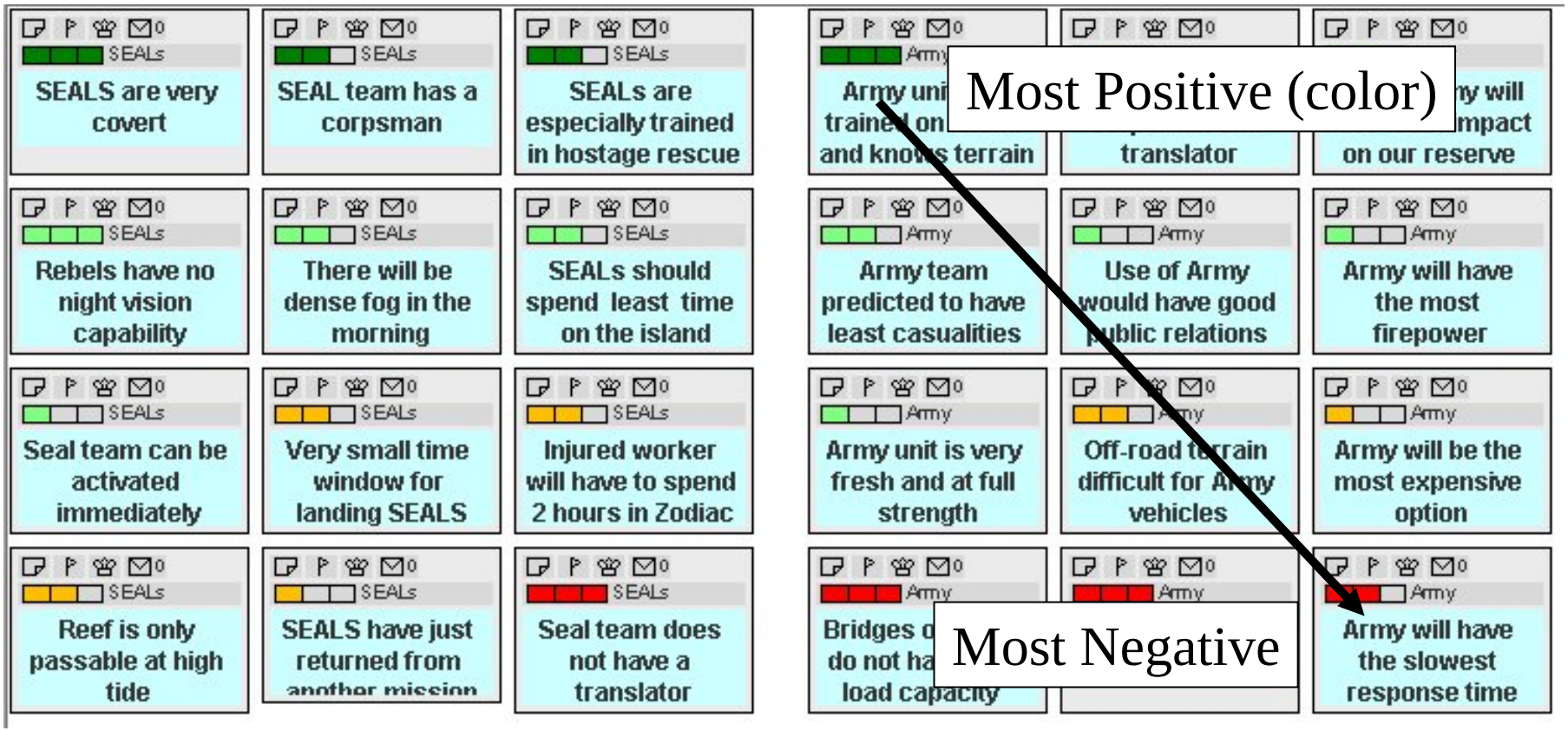


# Sorted by Importance: Very High – High -- Average



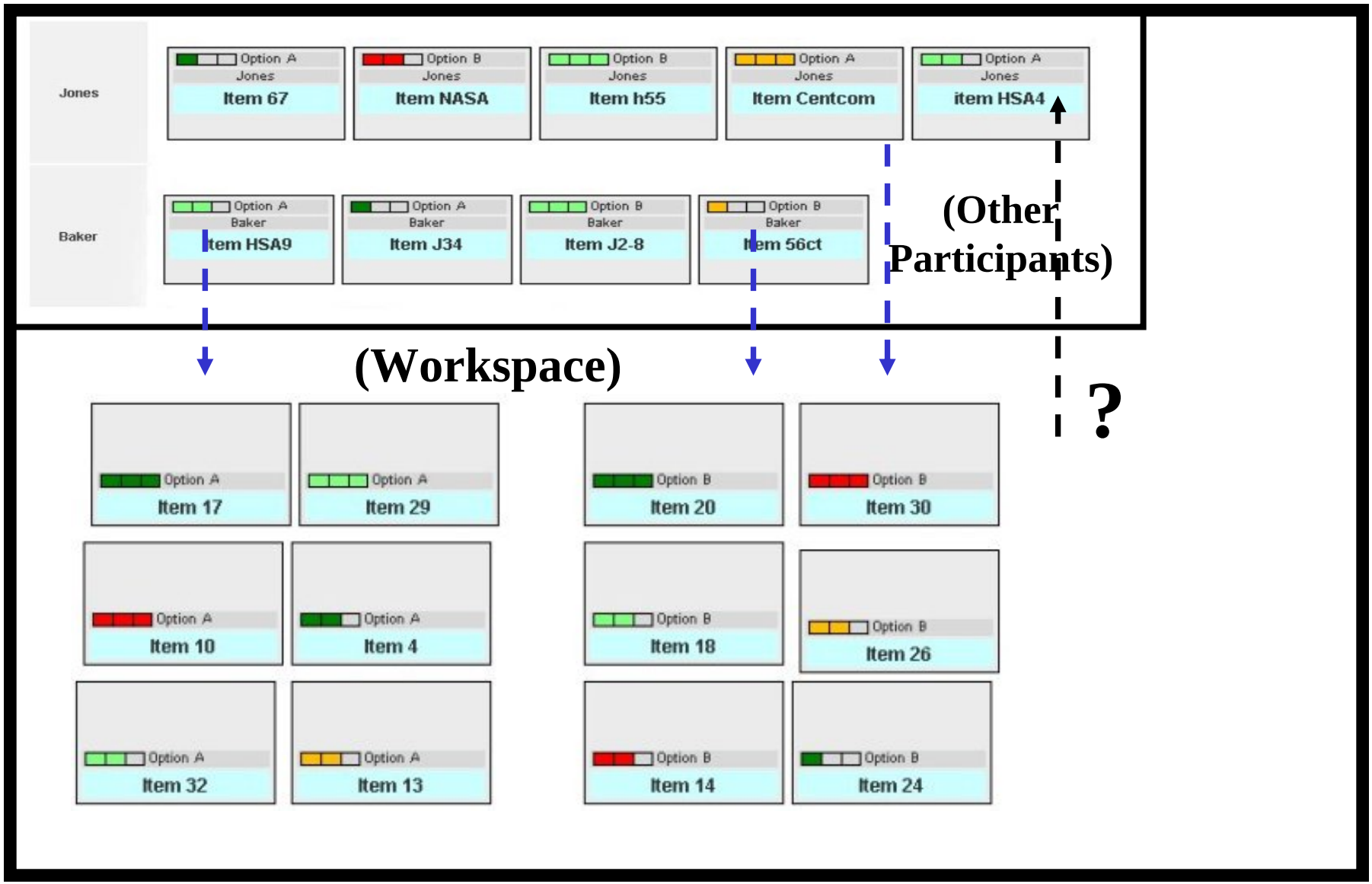
# Sorted by Impact:

## Very Positive, Positive, Negative, Very Negative



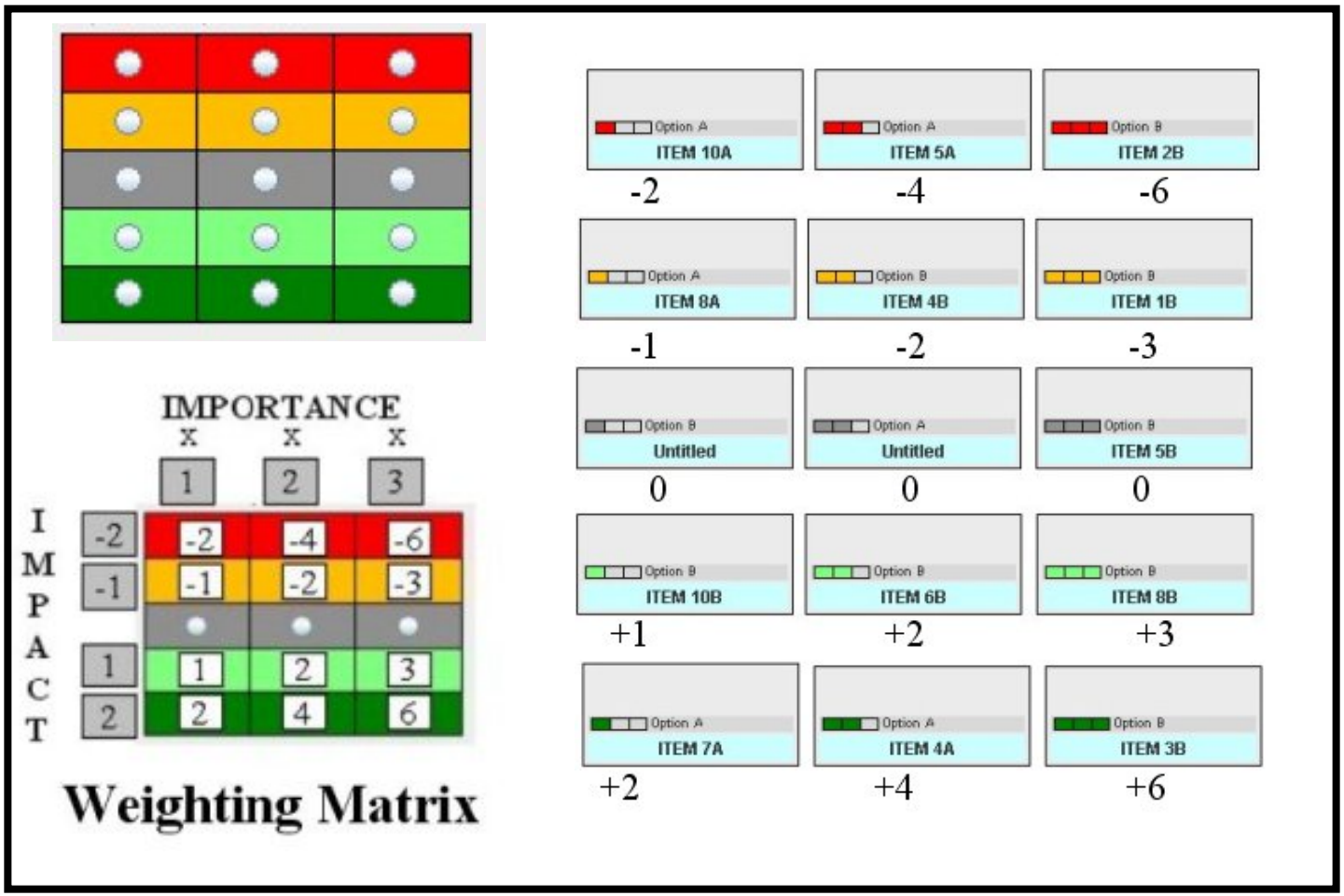
# DCODE Sharing

Research & Engineering Development, Inc. (RED-Inc)

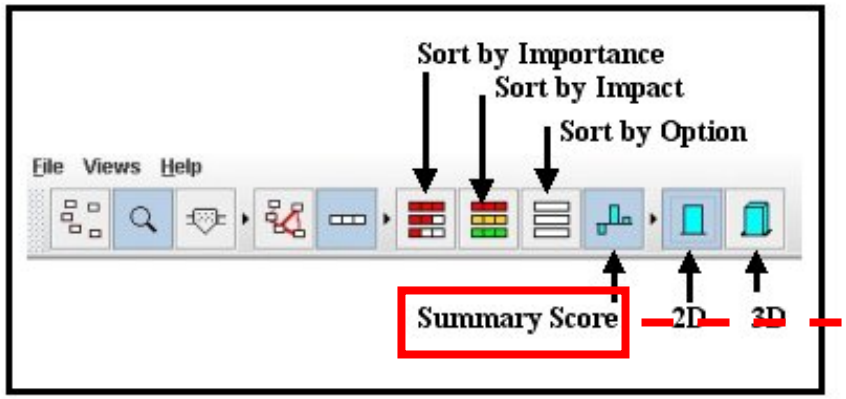


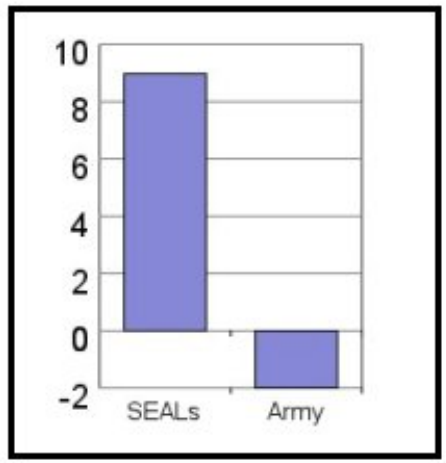

Smith's Display (EWall workspace + Exchange view)

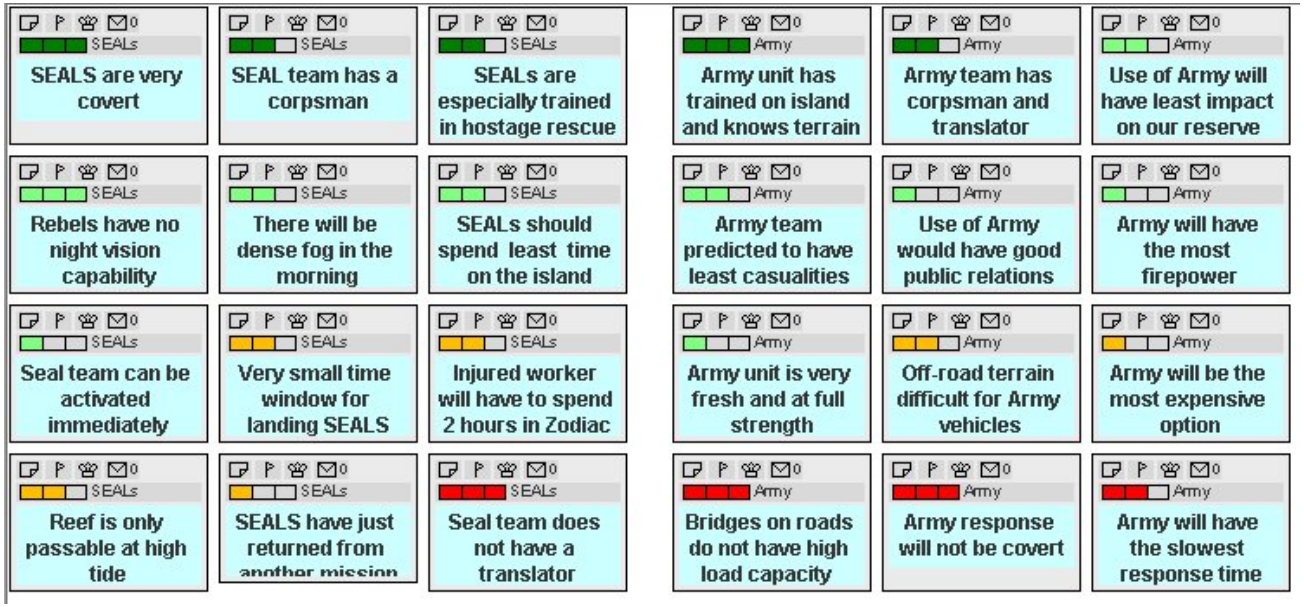
# Making Decisions with DCODE (the weighting matrix)



# Summary Score Bar Chart

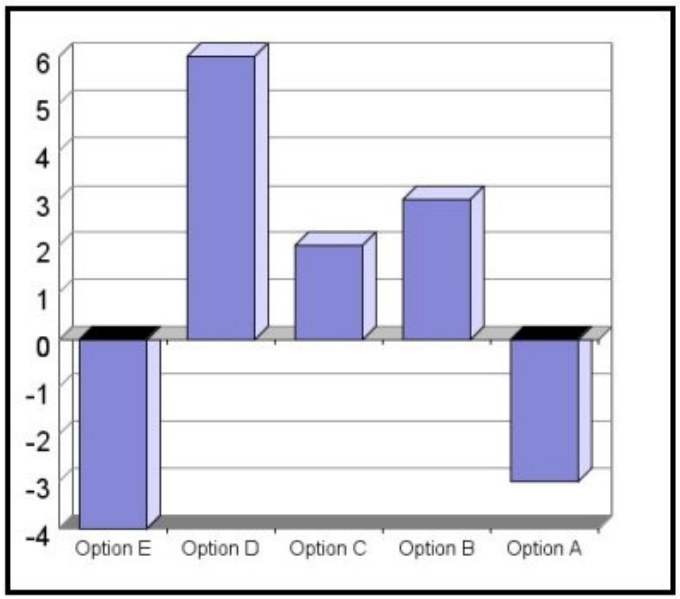


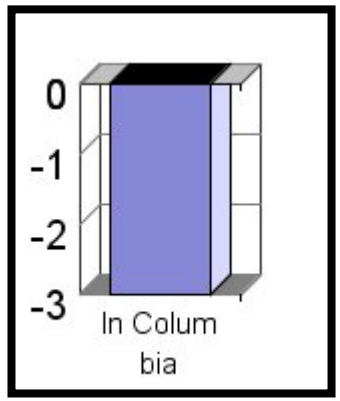




Algebraic sum of all IOBs for each option.

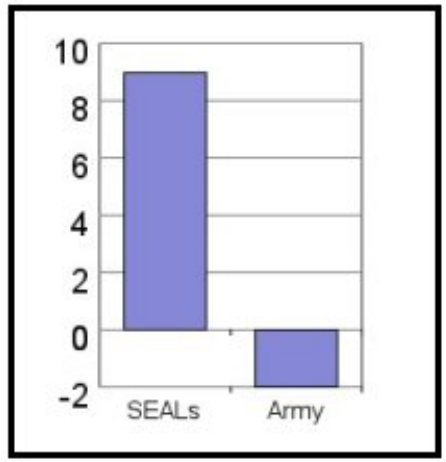
# Sample DCODE Summary Results




Multiple Options




Single Option
(Yes-NO,Act-Don't Act)

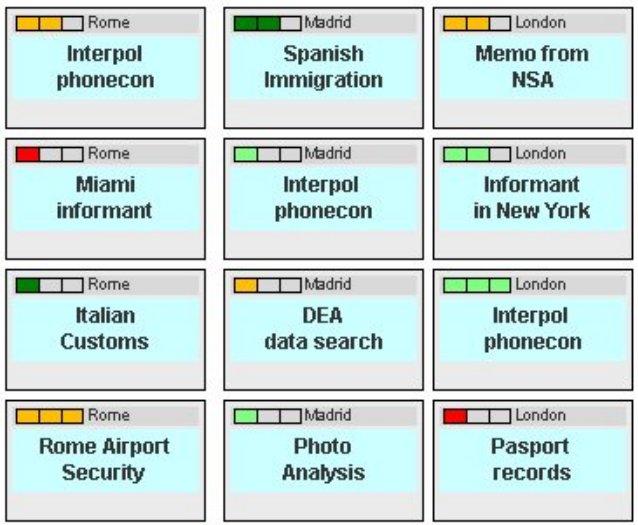


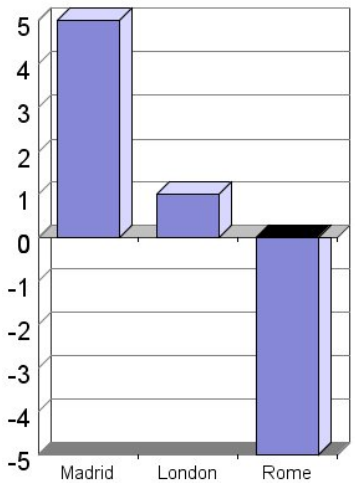

Two Options

# Use of DCODE in the Intelligence Community

"Is Carlos still in Columbia?"

"Where is Carlos?"



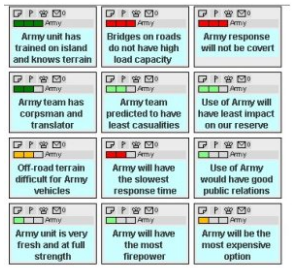



# DCODE Process

- Abstract
- Encapsulate
- Assess

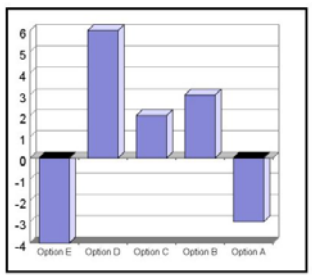
- **Option**
- **Importance**
- **Impact**
- **Quality**

- **Option**
- **Importance**
- **Impact**




- Integrate/Sort
- Share

- Decide



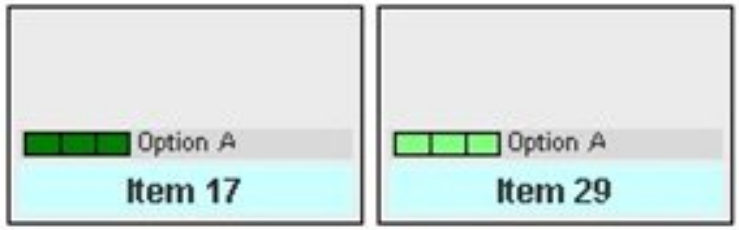
# Recent DCODE Developments

# Does DCODE Work?
# DCODE Experiment

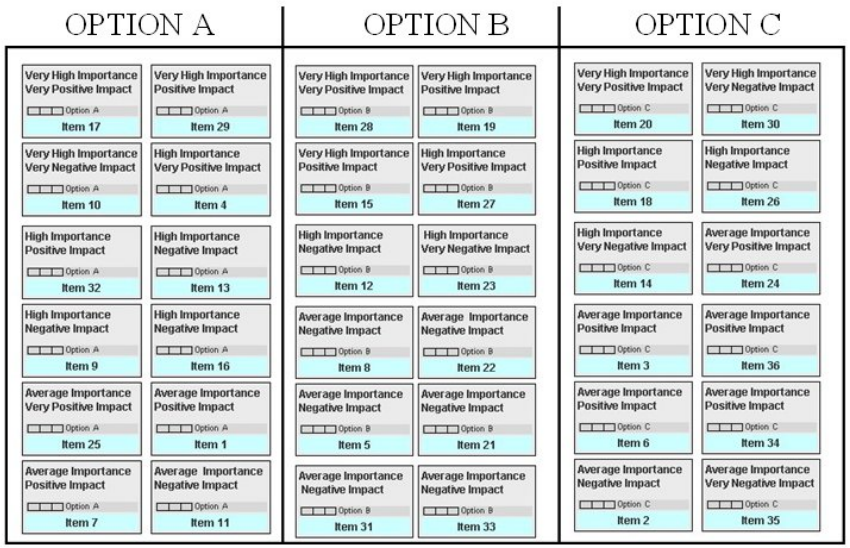
- 123 College Students
- Task: Rank order three cities (A, B and C) in terms of expansion sites for a new plant
- 12 items of information about each city
- Items had been rated on importance (three levels) and impact (4 levels)
- Given 30 min. for task (most took 10-15 min.)
- Text vs DCODE COLOR coding
- Male vs Female

# Text versus Color Condition

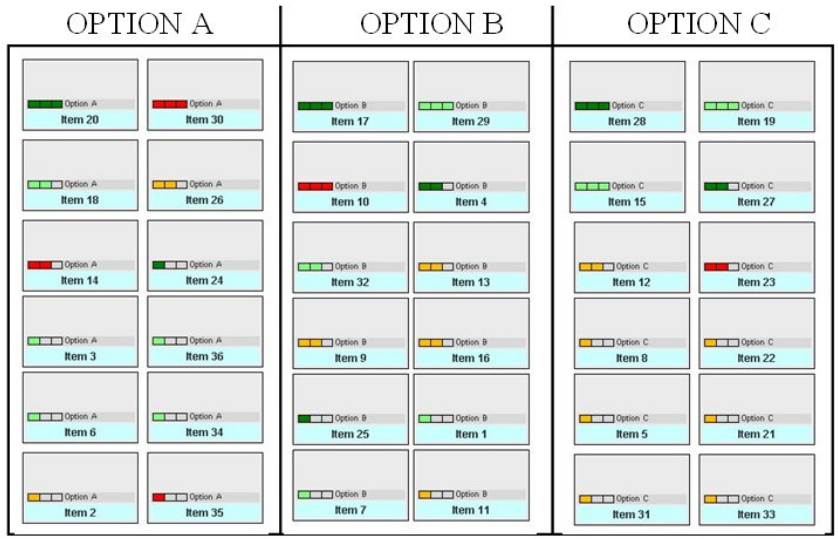
Two Text Item Examples




Color Equivalent




36 Item Display
Text Condition




36 Item Display
Color Condition

# Response Sheet

-Write your choice as Best option on the "100" line.

-Write your choice as Worst option on the "0" line.

-Circle the number that best represents where you would assign the remaining option.

| | |
|---|---|
| 100 | Option C |
| 90 | |
| 80 | |
| 70 | Option A |
| 60 | |
| 50 | |
| 40 | |
| 30 | |
| 20 | |
| 10 | |
| 0 | Option B |

# Results

- Color condition had significantly fewer errors
- Color condition had significantly more people get all 3 rankings correct
- Color condition was significantly better at assigning position to the Middle rank
- Text condition had more people select the Best option—but then performed significantly worst than chance on the last two rankings
- Males had significantly more confidence in their rankings

# DCODE Small business Technology Transfer Program (STTR) Awarded

- N06-T025 Decision Making Constructs for a Distributed Environment (DCODE)

- OBJECTIVE: Enable quick-response knowledge interoperability in coalition operations decision making.

- PHASE I: Develop a cognitive processing-based concept, tool or methodology to
  - improve the ability of both individual and distributed group decision makers to evaluate, share, and integrate decision-relevant information items and
  - to improve decision time by reducing the time and effort devoted to conflict resolution and consensus building in reaching an overall group decision.

**Three Phase I proposals accepted by ONR 6/06**

# More Information

- DCODE contacts:
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  - Mike.cowen@navy.mil
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