All Signals Go: Investigating How Individual Differences Affect Performance on a Medical Diagnosis Task Designed to Parallel a Signals Intelligence Analyst Task
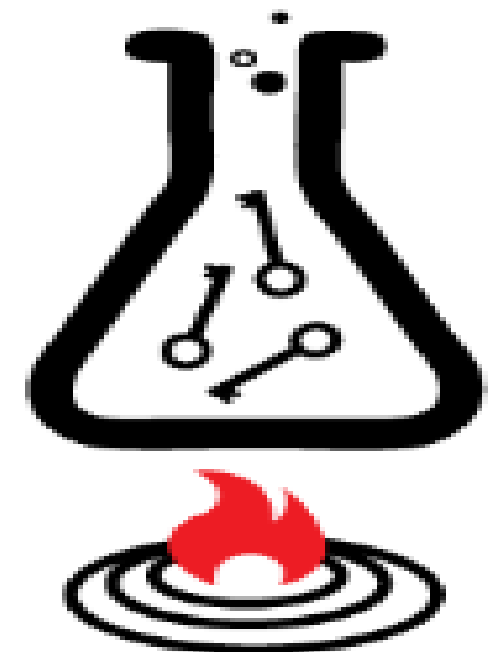
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First Thing's First

We're here to discuss the **science of security.**

So, how does signals intelligence relate to security?

Signals Intelligence Analysts: What Do They Do?

Signals intelligence analysts collect and evaluate foreign communications and activity.

They identify and extract "signals" or items of information that may be of interest to our government's national security

Inform the United States government of our adversaries' capabilities, actions, and intentions.

Signals Intelligence Analysts: How Do We Help?

Signals intelligence analysts are influential to our nation's security..

How do we insure that they perform their jobs well?
1. Analysts should be selected that are likely to perform the job well
2. Analysts should receive training that maximizes performance

Research Goal:

Determine factors that influence performance on signals intelligence tasks

Signals Intelligence Tasks: More Information

- Collect
- Organize
- Analyze
- Evaluate
- Decide

Complex Decision Making:
A process that involves several alternative options and requires integrating a large set of information (Dijksterhuis, 2004)

Previous Research on Complex Decision Making

- **Fluid Intelligence:** capacity to think logically and solve problems in novel situations, independent of previous knowledge – linked to CDM (Gonzalez, 2004)

- **Working Memory:** capacity to temporarily store and manipulate information **–** linked to information evaluation (Bruine de Bruin, Parker, & Fischhoff, 2007)

- **Experience with elements of task** (Jacoby, Kuss, Mazursky, & Troutman, 1985; Jacoby, Troutman, Kuss, & Mazursky ,1986; Kalyuga, 2009; Moon, Betts, & Anderson, 2013; Nicholson & O'Hare, 2014)

Current Research

Generalize and expand upon previous research by investigating:

1. How cognitive (i.e. working memory) and individual differences in experience (i.e. task familiarity) influence performance on a complex decision-making task.

1. Which factor **best** predicts performance?

Method

Confidentiality and practicality concerns – we designed a task that aimed to *simulate* a signals intelligence task

Medical Diagnosis Task:

Receive a list of symptoms, search the Internet, organize information, diagnose a hypothetical patient.

Example:
- Stuffy nose
- Bumps on the skin that may be faded/discolored
- Muscle Weakness
- Loss of feeling in the arms and/or legs (tingling/numbness)
- Thick, stiff or dry skin
- Lumps or swelling on the earlobes/face
- Eye problems that may lead to blindness
- Enlarged nerves (especially those around the elbow and knee)

Method (Continued)

Predictor Variables:
- Working memory capacity (Reading Span)
- Rapid Estimate of Adult Literacy in Medicine (REALM)
- Prior experience using the Internet
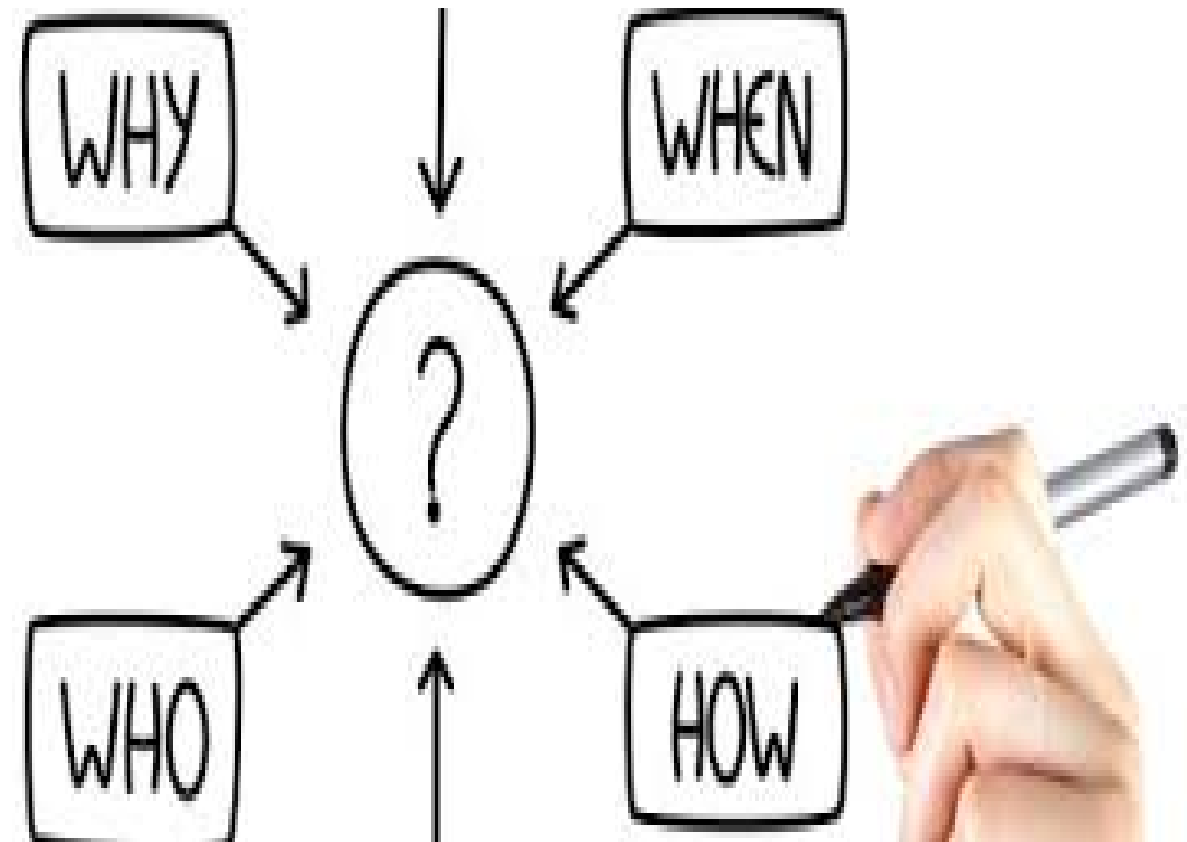- Prior experience conducting Internet searches

Outcome Variable:
- Decision Making Performance: Correct/Incorrect diagnosis

Participants:
- 40 Undergraduate students that varied by age and gender

Age: (*M*=18.93, *SD*=1.2*0)*
Gender: 61% male, 39% female

Results

Descriptive Statistics
- 41% of individuals correctly diagnosed the patient
- No ceiling or floor effects

Correlation Analyses
- **Positive** relationship between **performance** and **REALM** scores
- **Positive** relationship between **performance** and **working memory** scores
- Other relationships between independent and dependent variables were non-significant
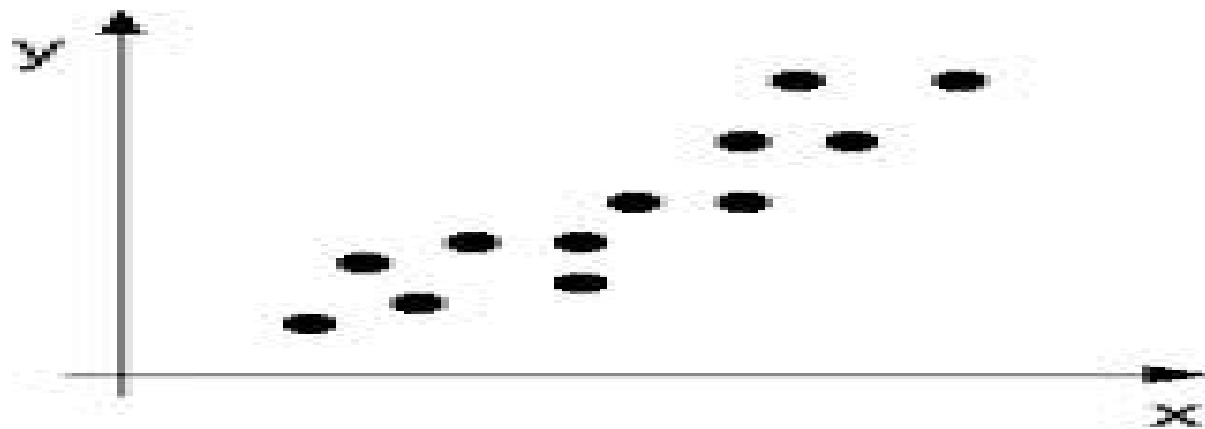
Results

Logistic Regression Analysis
Individual predictors:

- Working memory was the **only** significant predictor: $p = .037$

- Positive predictor: higher working memory = higher likelihood of generating the correct response

- Odds ratio information: Exp(B) = 1.05; meaning, for every unit increase in working memory score, the relative probability of participants generating the correct diagnosis was increased by 5%
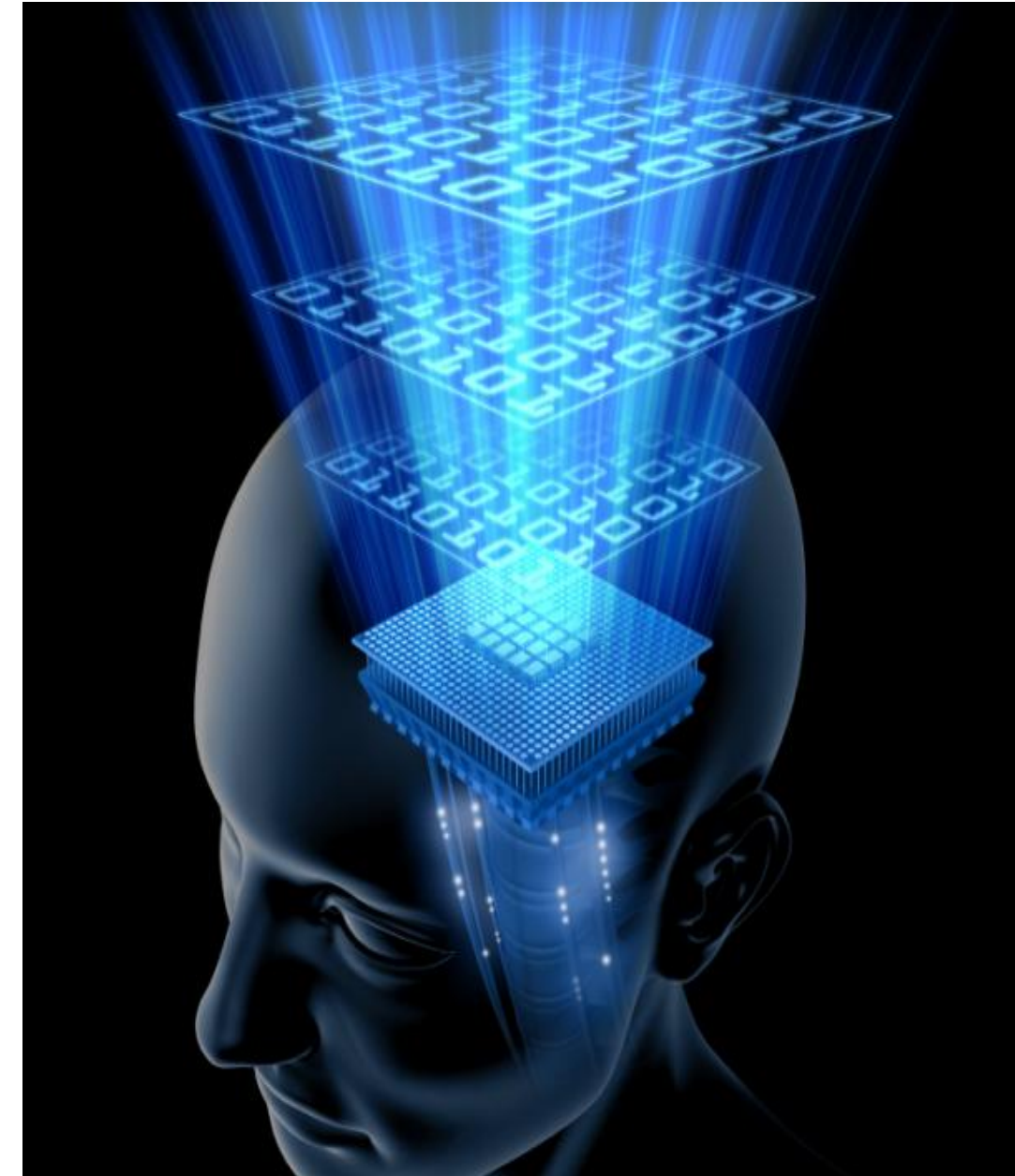
Discussion

Findings

- Consistent with previous research: Cognitive ability relates to complex decision-making performance
- Prior experience with a task's elements may not play a critical role in decision making
- Working memory **best predicted** performance on the implemented decision making task

Limitations

- Limited sample: not representative of signals intelligence analysts (age & education level)
- Decision making task: not truly representative

Discussion

Implications
- Intelligence employee screening/selection
  - Stray away from experiential assessment methods
  - Include working memory assessments

Future Directions
- Generalize these findings to signals intelligence analysts (representative population)
- Generalize these findings with a true signals intelligence task (representative task)

Questions?

For additional information, please feel free to contact me:

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