Rigor in Information Analysis

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Macrocognitive Approach

- Joint Cognitive System:
  - Mutuality between agent-environment-tools
  - Experienced practitioner
  - >1 person
  - Includes sophisticated tools
- Includes broader social and organizational context
Macrocognition: Levels and Functions

Levels

*Top*  Adaptability and Resilience

*Middle*  Coordination for Collaboration

*Bottom*  Growth of Effective Expertise

Functions

- analysis
  - problem recognition
  - sensemaking
- (re)planning
Definition: Rigor in Analysis

Logical
Correct
Deep
Broad
Disciplined
Systematic
Orderly
Strict
Precise
Critical
Extensive
Informed

Comparison
Assessment
Appraisal
Exploration
Construction
Evaluation
Consideration

of
Alternative
Competing
Hypotheses
Explanations
Stories
Mini-stories

for
Data
Information
Findings
Inferences
8 Interacting Dimensions of Rigorous Analysis
### Hypothesis Exploration

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<thead>
<tr>
<th>HIGH</th>
<th>MEDIUM</th>
<th>LOW</th>
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<tbody>
<tr>
<td>“I am confident of the best explanation and have seriously considered other possibilities”</td>
<td>“I feel comfortable that one explanation explains data well”</td>
<td>“I have one hypothesis I like”</td>
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<tr>
<td>Hypothesis set clearly evolved and broadened beyond initial framing</td>
<td>Unbalanced focus on most likely hypothesis</td>
<td>No serious consideration of alternatives to favorite hypothesis</td>
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<tr>
<td>Interactive debate from multiple perspectives on alternatives</td>
<td>Acknowledges other hypotheses are possible. Initial consideration of how data could support other hypotheses</td>
<td>Argues how data that does not fit or is new can be made compatible with a favorite hypothesis</td>
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<td>Actively considers and tracks data that does not fit most likely or most dangerous hypothesis</td>
<td>Considers risks of alternative hypotheses</td>
<td>Fixation and shielding behaviors</td>
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## Information Validation

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<td>&quot;I feel confident that I validated, by reasonable means, the facts used to support key arguments&quot;</td>
<td>&quot;I verified my key arguments and predictions are based on the most trustworthy source I have&quot;</td>
<td>&quot;I found one that sounds good&quot;</td>
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<td>Most &quot;authentic&quot; sources used that are beyond personal networks in verification of data</td>
<td>Uses strategy to verify arguments from multiple independent sources</td>
<td>Copies text with little re-interpretation (e.g., &quot;cut and paste&quot;)</td>
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<td>Systematic, semi-formal processes employed to verify information</td>
<td>Aware of vulnerabilities on how analysis could be wrong based on past experience or feedback</td>
<td>Does not display a &quot;suspicious&quot; orientation towards what was read</td>
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<td>An attempt was made to distinguish facts and assumptions</td>
<td>Aware of corrupted sources or other primary reasons to discount accounts</td>
<td>No tracking of process, in particular sources for information</td>
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**Explanation Critiquing**

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| “A series of reputable peers and specialists carefully examined the chain of reasoning/story and explicitly identified which inferences might be wrong and why” | “A reputable peer examined my chain of reasoning/story”  
Peers reminded of current beliefs on certain issues  
Peers critiqued product  
Peers suggested ways to augment the process (e.g., you should talk to “Joe” about this part) | “I trust my supervisor to critique my report”            |
Calibrating Low/Medium/High to a Setting

- Consequences for failure
- Role (function, expertise, scope of responsibility)
- Team architecture and dynamics
- Access to resources
- Types and quality of data
- Communication media
- Time constraints, workload expectations