Analytic Best Practices

Presented By

Mercyhurst College

MERCYHURST COLLEGE
INSTITUTE FOR INTELLIGENCE STUDIES

Astrophysical Best Practices & Intelligence Analysis

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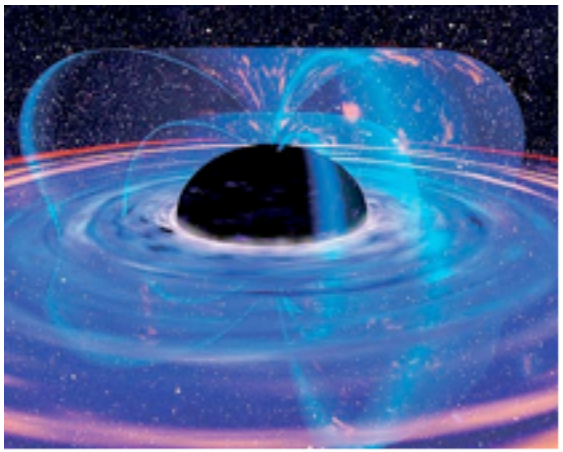
My Background

- Ph.D. Astrophysicist
  - Cambridge University & the International School for Advanced Studies, Trieste, Italy
  - Space Telescope Science Institute
  - The Pennsylvania State University, State College
  - Adjunct Professor, George Mason University [current]

- Government Analyst
  - World-wide space programs
- Founder & CEO, Omnis, Inc.
  - Critical Thinking and Analytic Methodology training; mentoring
  - Science & Technology Consulting

Astrophysics

- Similarity to Intelligence Analysis
  1. Indirect study
  2. “Noisy” datasets
  3. Limited (holey) data
  4. Information: Over-abundance of general, paucity of specific
  5. Observational science
  6. Repeatability of experiment ⟷ repeatability of observation



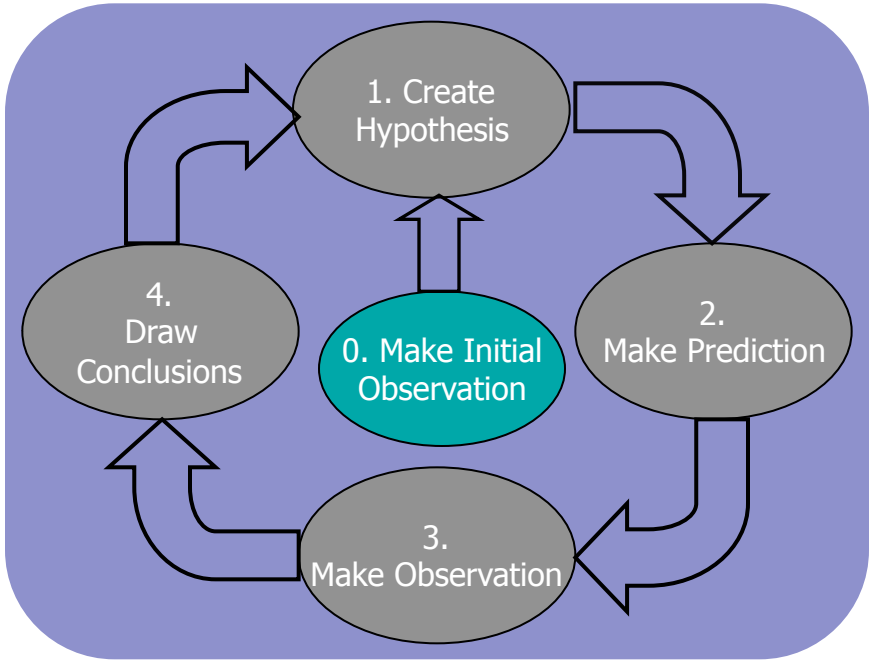
Astrophysics - Best Practices

- Why does it work and how can it inform intelligence analysis?
  1. Critical thinking
  2. Interdisciplinary approach
  3. Open to new ideas
  4. Open to multiple perspectives
  5. Acceptance of (embraces) failure (risk taking)
  6. Collaboration & peer review
  7. Objectivity
  8. Scepticism (and willingness to abandon ideas that don't work)
  9. Scientific method

A Methodological Approach

- Why is Methodology Important?
  1. Establishes a framework that makes the process explicit
     - A common language shared by all practitioners
  2. Creates a path for analysis
     - Allows repeatability
     - Facilitates feedback mechanism
     - Forces adherence to path
  3. Aides in making thinking explicit
  4. Counters bad elements of human cognition
     - Mitigates our faulty short-term memory
     - Helps ID and mitigate biases

The Scientific Method



0. Make Initial Observation
1. Create Hypothesis
2. Make Prediction
3. Make Observation - Info gathering
4. Draw conclusions

Why the Scientific Method?

1. Already employed in general problem solving
2. Long history of success
3. Feedback mechanisms
4. Self correcting
5. Makes thinking explicit
6. Forces:
   - Elimination of hypotheses
   - Making assumptions explicit (and constant re-examination)
   - Assessment of logic, argumentation, explanation & conclusions
7. Requires critique, collaboration, and peer review
8. Requires repeatability of results
9. Minimizes and helps mitigate errors in human cognition

Summary of Best Practices - I

- Employ critical thinking
  - Constantly look for better approaches
  - Be objective
  - Employ an interdisciplinary approach (multiple perspectives)
  - Be open to new perspectives & ideas
  - Make assumptions explicit
  - Practice Intellectual humility, courage, and integrity
- Use a methodology & related techniques
  - Analogies
  - Models
  - Statistics

Summary of Best Practices - II

- Collaborate
  - Perform peer review
  - Communicate (with individuals, attend conferences, etc.)
- Question
  - Be skeptical
  - Always look for alternatives
  - Always question assumptions
- Be ever-vigilant of confirmation bias:
  - Don’t prove hypotheses
  - Jettison ideas that don’t work, etc.

Summary of Best Practices - III

- Risk Taking
  - Be open to taking risks
  - Don’t punish failure

Specific Issues

Issue	Practice
❑ Indirect nature of target	Corroboration; statistics; multiple perspectives; analogies
❑ Noisy data	Multiple perspectives; statistics; objectivity; peer review
❑ Limited data	Collaboration; statistics; peer review
❑ Lots of general, limited specific data	data filtering mechanism (structuring); statistics
❑ Understanding	Generate multiple hypotheses
❑ Alternatives	Multiple scenario generation; collaboration; multiple perspectives; peer review

Issues in Science & Intelligence Analysis

- Knowing when enough information to start analysis
- Knowing when enough analysis to start writing

Questions?

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