



Assessment of Reliability in Autonomous Systems from Multiple Disciplines

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Why does Consistency Matter?

- The consistency in definitions are essential to limit confusion when individuals from different disciplines collaborate
- Inconsistency can introduce miscommunication, inefficiencies, different mental models, etc.

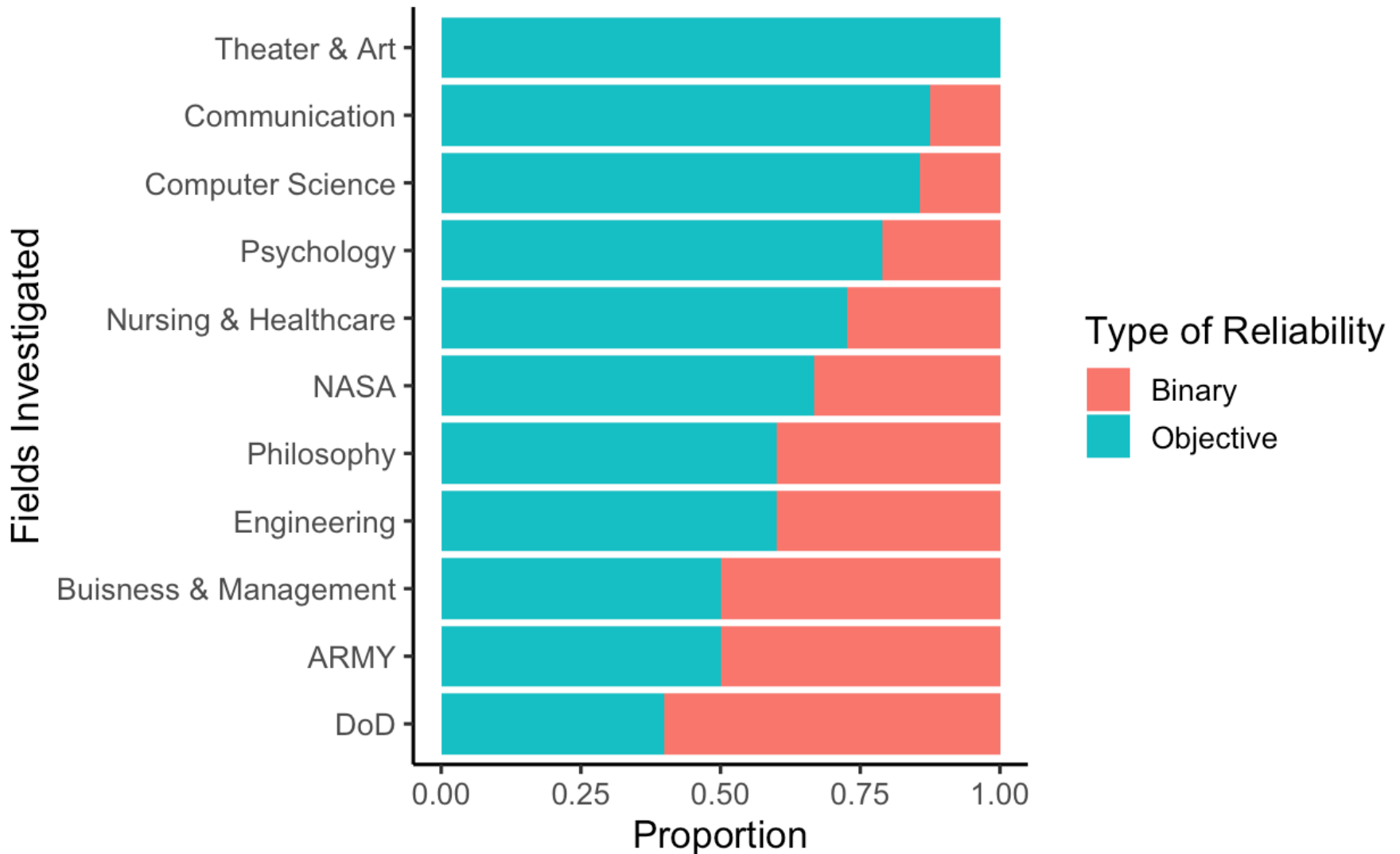


Reliability

Reliability is defined from both perspectives:

- Binary
- Objective

Definition of Reliability Investigated within Fields



Binary Definitions

- **Governmental Agencies:** System will perform without failure under specified conditions
- **Engineering:** The ability of an item to operate without failure
- **Human Factors Psychology:** The proportion of correctly indicated events, diagnoses, decisions, or actions
- **Computer Science:** The systems capability to perform its task without failure
- **Nursing:** The devices' ability to perform the task accurately



Objective Definitions

- **Governmental Agencies:** The degree or percentage measuring the system performance
- **Engineering:** The degree to which a system ensures mission success
- **Psychology:** The trustworthiness or consistency of a measure
- **Computer Science:** Probability of a system functioning for a period
- **Nursing:** Probability that the robot will be able to perform intended functions at a particular point in time



What is a Failure?

Governmental Agencies:

- Inability of a system to perform its required function
- Single Point Failure

Human Factors Psychology:

- Lumberjack analogy
- Black swans

**NHTSA Investigating Indiana Crash Where
Tesla Model 3 Hit Fire Truck**



Measurements of Reliability

- The way reliability is measured changes from governmental agencies, industry, and users (i.e., soldiers)



Measurement of Reliability by Governmental Agencies

- Reliability, Availability, & Maintainability (RAM)
- Reliability & Maintainability (R&M)
- Statistical Metrics (i.e., MTBF)
- Probability Analysis
- Fault Hazard Analysis (FHA)



Measurement of Reliability by Engineers and Designers

- Highly Accelerated Life Testing (HALT): Prototypes tested to identify flaws
- Highly Accelerated Stress Screening (HASS): Screening process to verify operation
- Failure Modes, Effects & Criticality Analysis (FMECA)
- Historical Data (i.e., degradations in parts)
- Simulation



F-16 Fighting Falcon

- F-16 accident
- Ejection seat malfunction
- What metric potentially would have prevented malfunction?



Measurement of Reliability from the User

- Measuring reliability through experiences
- Bomb locator (i.e., signal detection theory)

Proposed Definition

- Probability that a system achieves ideal or preferred performance while operating under specified conditions and intervals

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Questions?

