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# Conceptualization of Reliability Among Field Practitioners in Multiple Disciplines

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# Introduction

- Interdisciplinary collaborations are becoming increasingly prevalent.
- Reliability is critical when assessing autonomous systems[1-3].
  - Implications for trust, and hence, use [4-5].
- Widespread differences in how reliability is conceptualized across disciplines/populations [6-9].
  - These differences can lead to confusion within diverse teams.

# Two Broad Categories of Reliability

- Definitions of reliability fall into two general categories [9]:
  - Performance-based: Reliability linked to ability to meet the criterion objective.
  - Consistency-based: Reliability is linked to repeatability.

# Our Study

- Previous work has examined how the definitions provided by organizations and academics across disciplines have defined reliability [7-9].
- We are conducting a study in which we attempt to gather insights about how professionals conceptualize reliability.
  - Is reliability measured in a manner consistent with how it is defined?

# Methods

- We have recruited professionals ( $N = 35$ ) from LinkedIn so far.
  - 13 exclusions.
- Participants provided their personal definition of reliability.
  - Good/Poor reliability
  - Measures/Assessments
- Rank importance of 11 factors related to reliability
- Picked one of four reliability definitions: US Government, NATO, SEBok or a recent review [7, 10, 11, 12].
- Participants given a chance to explain why and revise their original definition.

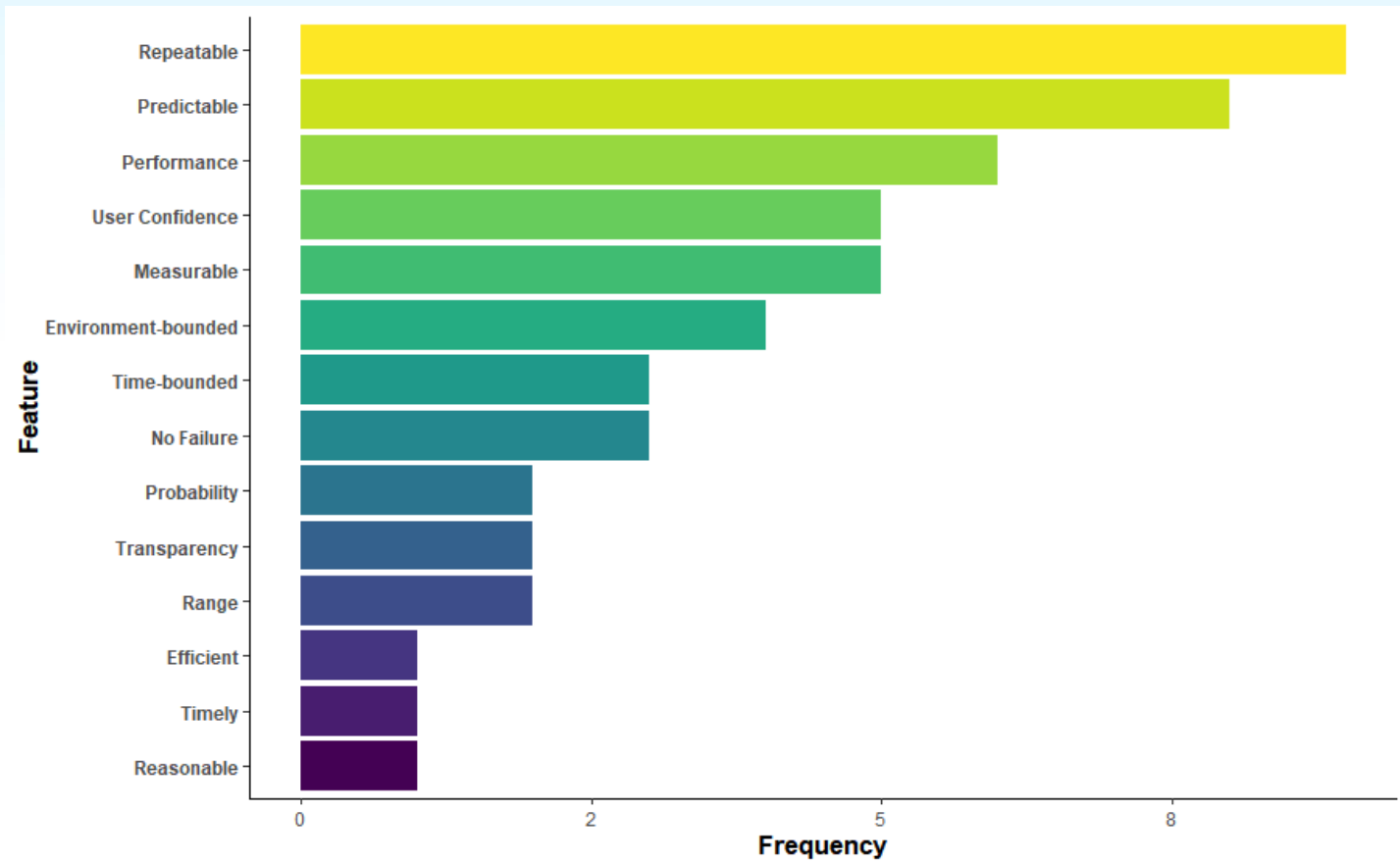
# Reliability Definitions

- **NATO:** “the ability of a functional unit to perform a required function under given conditions for a given time interval.”
- **SEBok:** “the probability of a system or system element performing its intended function under stated conditions without failure for a given period of time.”
- **US Government:** “ability of a system to provide desired capability without failure, degradation, or demand on the support system includes the ability to perform required functions in routine and non-routine and/or unexpected circumstances.”
- **Recent Review:** “Probability that a system achieves ideal or preferred performance while operating under specified conditions and intervals”

# Coding Scheme

- One coder (three will examine final data).
- Identify themes in participant definitions of reliability
  - e.g., consistency, time-bounded.
- Themes present in each definition? (i.e., frequency count)
- Do definitions focus on performance or consistency?

# Coding

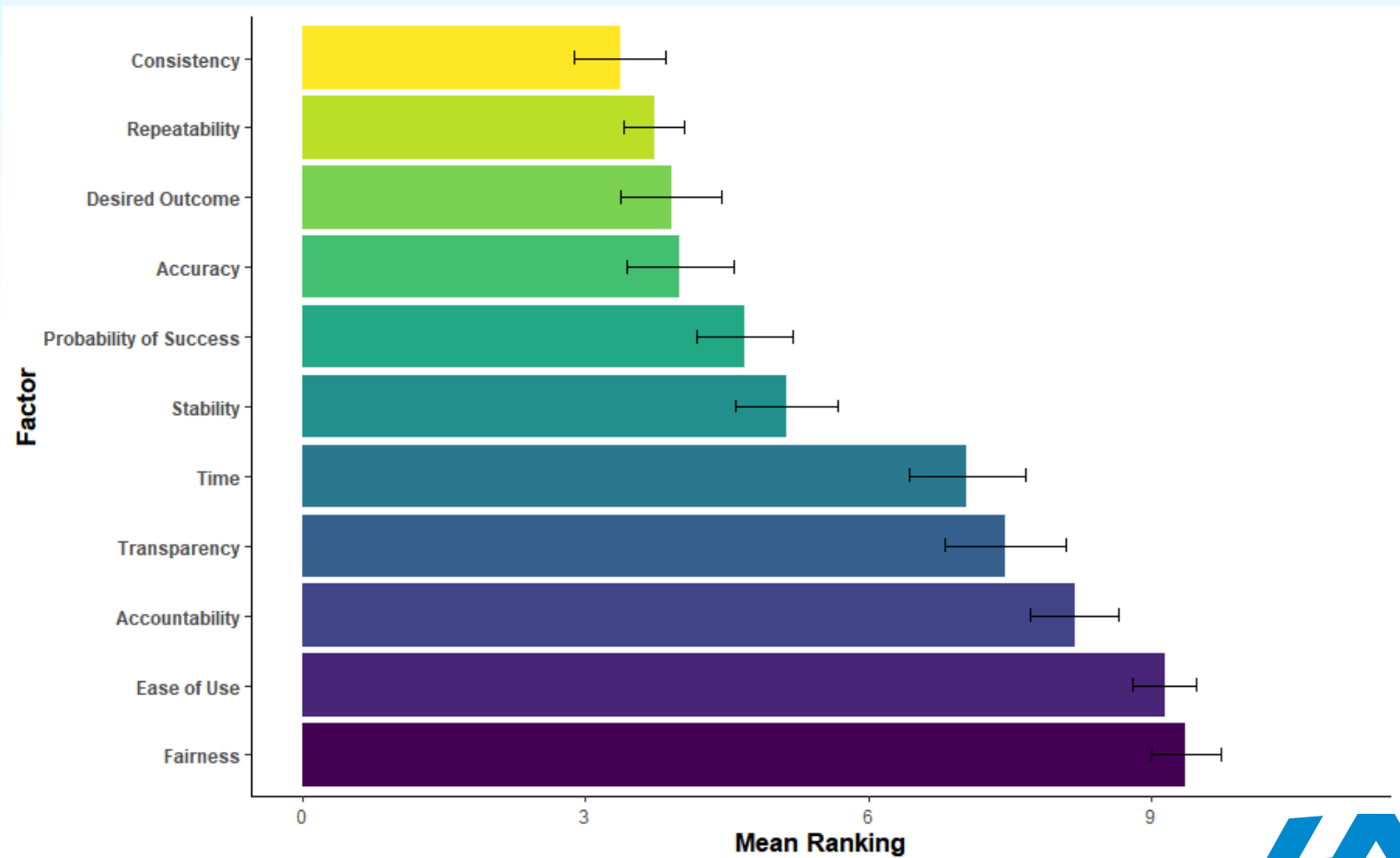




# Ranking of Factors

- We computed a Kruskal-Wallis Test to determine whether there were differences in participant rankings of the 11 factors.
  - We observed differences between rankings across the factors,  $H(10) = 114.13$ ,  $p > .001$ .

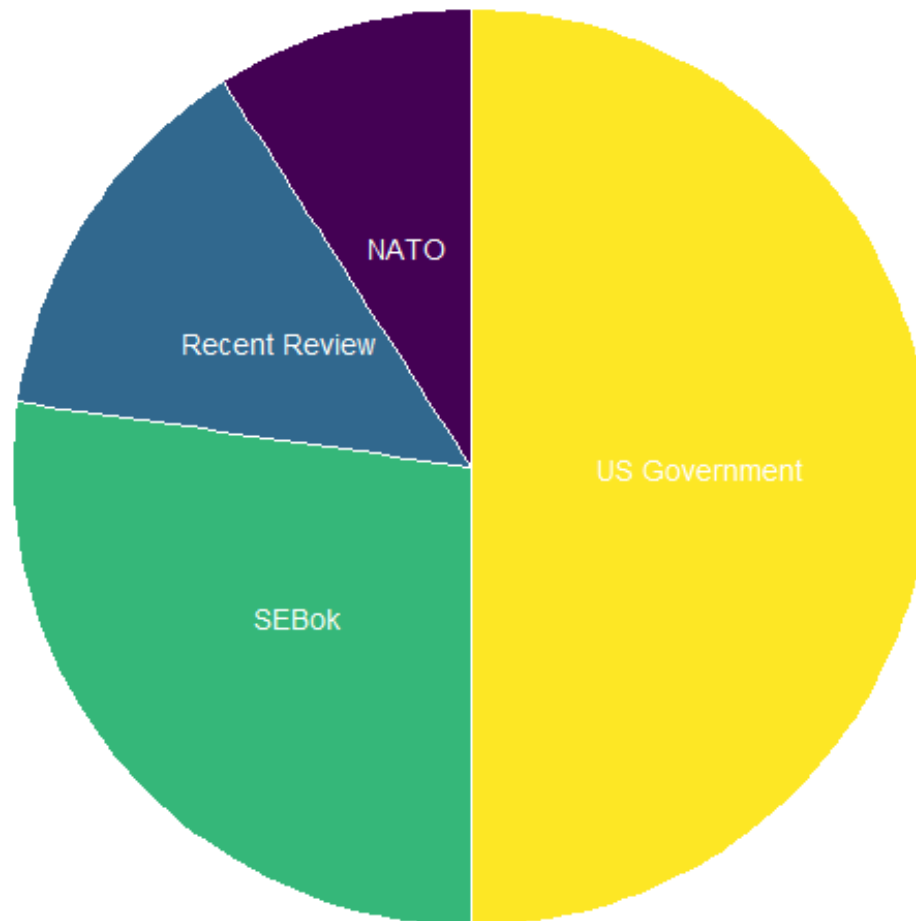
# Important Ranking of Factors



# Preferred Definition

- We instructed participants to choose their preferred definition of reliability among a definition provided by SEBok, NATO, the US Government, and a recent review.
- We observed significant differences in participant choice,  $X^2(3, 22) = 8.154, p = .04$ .

# Preferred Definition



# Discussion

- Our limited results indicate that Consistency and Repeatability are preferred to Accuracy when defining reliability.
  - A few respondents even indicated that a failing, but consistent system is considered more reliable than an inconsistent system.
- A US Government definition of reliability was most frequently preferred [10].
  - “ability of a system to provide desired capability without failure, degradation, or demand on the support system includes the ability to perform required functions in routine and non-routine and/or unexpected circumstances.”
  - Performance-based definition.

# Limitations

- Our study is currently incomplete
  - More participants
  - Comparison of stated reliability to conception of good/bad reliability.
  - Multiple coders.

# Limitations & Future Research

- Lack of truly random sampling.
  - Participants recruited through LinkedIn.
- Reliant on participant self-reports.
  - Empirical study: tradeoffs between performance and consistency.
  - Consistency/Repeatability are stressed, but a performance-focused definition is preferred.
    - Good performance taken for granted?

# Conclusions

- Future work will need to reconsider how reliability is defined.
  - Existing definitions of reliability focus on performance and consistency, but a widely accepted, unified conception of reliability is needed [7-9].
  - A nonsignificant group of field professionals prioritize consistency in a performance-agnostic sense.
    - It's unclear how impactful this is in practice



Thank you for attending our  
presentation!

For any questions about our work, please contact the authors at  
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