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PSYCHOLOGICAL PROFILING FOR SECURITY-SENSITIVE ENGINEERING ROLES USING A HUMAN-CENTRIC SCREENING FRAMEWORK

MUKESH SHARMA
ASSISTANT PROFESSOR, KALINGA UNIVERSITY, RAIPUR, INDIA.
EMAIL: ku.mukeshsharma@kalingauniversity.ac.in, ORCID ID: 0009-0006-4052-2358

TRIPTI DEWANGAN
ASSISTANT PROFESSOR, KALINGA UNIVERSITY, RAIPUR, INDIA.
EMAIL: ku.triptidewangan@kalingauniversity.ac.in, ORCID ID: 0009-0009-0193-5661

DR. RASHMI CHAUHAN
ASSISTANT PROFESSOR, NEW DELHI INSTITUTE OF MANAGEMENT, NEW DELHI, INDIA.,
EMAIL: rashmi.chauhan@ndimdelhi.org, ORCID ID: HTTPS://ORCID.ORG/0009-0005-4371-0373

Abstract
Careers in security-sensitive industries such as aerospace, defence, and critical infrastructure will require more than simply technical skills, but also psychometric resilience and stress-honed reliability, along with demonstrated ethical reasoning. Human capacity, accessibility, and judgment are often overlooked in traditional hiring approaches. This article proposes a human-centric evaluation framework to support hiring decisions for security-focused activity roles within engineering. The framework proposes to introduce psychological profiling into the selection process. The human-centered framework would assess individual risk factors and resilience, and provide SJTs (situational judgement tasks) and behavioral simulations to measure a candidate's response and reaction to high-stakes situations. By presenting a potential candidate's psychometric sophistication along with emergent simulations, the appraisal framework provides a more comprehensive and contextual view of a person's suitability for risk-sensitive engineering. Together with a focus on psychometric statistical rigor and empirical acceptability, the human-centered framework proposed ensures fairness and transparency, in addition to maximizing ethical integrity in alignment with factors needed by organizations and best psychology practices surrounding human cognition and action. This paper suggests a systemic way of formalizing ethical hiring approaches to improve talent decisions in high-consequence engineering space and make systems safer by having the right people choose to be in the right places at the right times, and maximizing the chances in reliability, performance, and teamwork while providing a framework for longitudinal study in wound prediction and trust cue calibration; the presented framework is designed to support continuous improvement.

Keywords:psychological profiling, security-sensitive roles, human-centric screening, engineering psychology, situational judgment, behavioral assessment, risk suitability

INTRODUCTION

Security-sensitive engineering positions,such as in nuclear energy, critical infrastructure, aerospace, and defence,carry substantial responsibility and typically include the potential for organizational and public harm from one person's choices. The severity of responsibility in security-sensitive roles requires advanced technical acumen and psychological fortitude and integrity, as well as the ability to take effective action while under pressure [3]. However, the current selection and evaluation processes used in security-sensitive contexts are primarily based on technical qualifications and skill-based assessments, often neglecting psychological factors that underlie reliable and ethical performance [4]. Reliance on technical screening creates blind spots in the nomination pool where individuals may meet acceptable intellectual criteria yet still pose undiscovered risks because of personal attributes like low stress tolerance, poor impulse control, or poor judgment [7]. Recognizing these gaps, this paper provides a human-centered psychological profiling framework for nominations and selections in security-sensitive engineering roles. Designed specifically for the particularities of security-sensitive engineering positions, the proposed framework uses trait-based, situational judgment, and behavioral simulation-based assessments to support a more psychologically grounded, ethical, and role-related screening process that improves organizational safety and individual-role fit [1][11].

Understanding the Mind: Psychological Traits Related to Role Aptitude

Performance in security-sensitive engineering positions is influenced not only by cognitive ability but also by a set of stable psychological traits that impact behaviour in uncertain, pressured, or ethical situations [2]. This section indicates the baseline traits identified in the proposed human-oriented profiling approach and rationalizes them based on their usefulness in terms of predictability in situations with inherent risk [5].

Conscientiousness, a core trait from the Big Five model, represents reliability, discipline, and goal-focused behaviour [6]. Studies have reported a consistent link between high conscientiousness and job performance, which is also particularly important in encouraging adherence to processes due to its relevance in regulated engineering environments [8]. Emotional stability (the opposite of neuroticism) acts as a buffer for how effectively individuals can handle stress, anxiety, and unexpected disruptions to their routine, and is importantly situated in a crisis-related task such as nuclear or defence work.

Table 1: Core Psychological Traits for Profiling in Security-Sensitive Engineering Roles

Trait	Psychological Basis	Role-Relevant Behavior
Conscientiousness	Big Five / HEXACO	Task diligence, protocol adherence, risk avoidance
Emotional Stability	Big Five	Stress regulation, calm under crisis
Cognitive Control	Executive Function Theory	Focus, decision accuracy, impulse inhibition
Trust Propensity	Interpersonal Psychology	Secure collaboration, team dynamics
Ethical Judgment	Moral Development Theory	Resolving ethical dilemmas, accountability

Table 1 provides the details regarding which fundamental psychological traits were proposed for inclusion in a human-centered screening framework. Each trait is linked to a theoretical framework in established psychology, e.g., the Big Five, HEXACO, and cognitive control/decision-making models, and includes a short description of its application to security-sensitive engineering occupations. These traits were selected because they indicate a person's capacity to perform reliably, rationalize ethical decision making, withstand stress, and behave appropriately and consistently under life-or-death scenarios [9]. The table serves as a conceptual transition from psychology to engineering practice, supporting the framework's trait-based assessment modules as well as providing a basis for the development of simulations and scoring approaches across the screening process.

Cognitive control, as a psychological construct, is built on the theory of executive functioning and has some level of influence on an individual's attentional focus, working memory, and inhibitory performance. It impacts the speed and accuracy of decision-making in complex tasks under high pressure. Trust propensity relates directly to team-based security engineering scenarios where teams of multiple disciplines collaborate and reason through communication efforts in a security context that is often done in a highly sensitive, compartmentalised environment. Ethical judgement, informed by material on moral reasoning, relates to the predicted likelihood of reasoned decision-making in a vague context, or as a result of ethical conflict.

These construct definitions are solidly anchored in established psychological models, such as the Big Five, HEXACO (adding honesty-humility as an additional dimension), and Cognitive Load Theory, which describes how cognitive resources are limited under duress. By profiling these traits together, the framework captures the psychological disposition of candidates to work safely, ethically, and effectively in environments where human error or poor judgment can lead to systemic consequences [12].

Framework Design: A Human-Centric Screening Ecosystem

The conceptualization of a human-centric psychological screening framework is envisioned as a multi-layered screening structure that captures rigor scientifically, is ethically sensitive, and practical. The framework is built up of several assessment modules that target ranges of psychological dimensions when assessing an individual relevant to inhospitable working environments associated with high-risk engineering, from which modules combine to offer a psychological profile of a candidate.

1.1. Self-report inventories

The first layer consists of standardized psychometric instruments assessing stable traits such as conscientiousness, emotional stability, integrity, and stress tolerance. Approaches are employed to provide validated measures of these personality structures, such as the NEO-PI-R (Big Five) or HEXACO-PI-R. Measures of stress reactivity and resilience are obtained using standard measures such as the Perceived Stress Scale (PSS) and the Connor-Davidson Resilience Scale (CD-RISC). This layer will obtain dispositional tendencies that may affect performance under duress.

1.2. Scenario-Based Simulations (Situational Judgment Tests)

Candidates are provided with realistic and job-relevant dilemmas that replicate ethical, technical, and interpersonal scenarios commonly encountered in security-sensitive contexts. These SJTs assess decision-making style, ethical

reasoning, rule-following, and flexibility. SJTs are different than self-report inventories in that they provide information to assess applied behaviour in context-sensitive situations to determine how individuals create small-scale rationalizations when faced with ambiguous, high-stakes decisions.

1.3. Interactive Behavioral Tasks

This is a time-succession series of gamified scenarios that require candidates to navigate scenarios to (ideally) illustrate, in real-time, behavioral signals such as reaction time, attention-shifting, response inhibition, and error recovery. They simulate ethical challenges that are dynamic and time-bound scenarios representing ethical decisions under pressure, like interrupting your resolution of competing goals to respond to a surprise system failure. They also offer implicit- and bias-resistant approaches to measurement.

1.4. Design Principles

The design framework emphasizes the usability of the assessments. We seek to make our assessments as naturalistic and as little burden on candidates as possible. We also seek to uphold fairness in design by using culturally neutral scenario materials for individual differences, maintaining responsiveness to neurodiversity, and using a variety of scoring techniques to mitigate bias among candidates. It maintains transparency in the recruitment assessment approach by providing candidates with timely feedback to allow candidates to see the evaluation across scenarios, while preserving reasons for the failing/final decisions [13]. The system is constructed to a standard assuring the dignity of candidates and also the privacy of personal information, by psychological ethics and applicable data protection laws.

Behavioral Signals Under Pressure: Profiling when using Situational Modules

In situations where high-stakes engineering is involved and there is a reasonable chance that mistakes will lead to severe consequences, understanding how individual differences play out when under pressure is crucial. I explain in this section a process for harnessing situational modules, which are realistic, dynamic assessments able to elicit genuine behavioral signals through realistic first-person experiences. While these modules can be used to assess knowledge or preferences, they are more interested in actual decision-making, emotional regulation, and resilience in the face of engineered constraints.

The heart of this process includes Situational Judgment Tests (SJTs), which task candidates with ethically and operationally complex dilemmas using scenarios modelled on issues faced within Security Sensitive Contexts, such as dealing with equipment failure, conflicting protocols, and prioritizing time-sensitive consideration where safety and efficiency may conflict [14]. Candidates were asked to select or rank actions depending on what they felt was the appropriate response. Here, we are interested in their judgment, prioritization, and willingness to follow the guiding rules.

Predictive Model (Logistic Regression for Risk Classification):

$$\mathrm{P(HighSuit)} = \frac{1}{1 + e^{-(\beta_0 + \beta_1 T + \beta_2 B + \beta_3 S)}}$$

Where:

- P(HighSuit) = probability that the candidate is a good fit (low-risk)
- T = Trait-based assessment score (e.g., Big Five or HEXACO index)
- B = Behavioral task performance score (reaction time, accuracy, error control)
- S = Situational Judgment Test score
- $\beta_0, \beta_1, \beta_2, \beta_4$ = model coefficients (trained on pilot/test data)

This model outputs a probability (0 to 1), which can be thresholded (e.g., >0.75 = Ideal, 0.5–0.75 = Acceptable, <0.5 = High-Risk) [10].

To collect richer behavioral data, micro-decision capture (MDC) processes are utilized. MDC processes include tracking a candidate's behaviour patterning (hesitation, action sequence, decision pause, consistency) accordingly within interactive simulations. This data provides indirect yet strong markers of cognitive control, risk tolerance, and behaviour predictability. Stress tolerance assessments are also included, for example, using time-restricted frames or situations that induce pressure through noise, so the candidate feels the pressure to act. In this way, candidates are subject to a stressor that may elicit physiological or behavioral changes (for instance, a change in response time or an increase in error), allowing the assessors to look for signs of resilience and self-regulation ability.

Unlike the previous use of personality tests, these modules are far less susceptible to faking or impression management issues and allow actions rather than self-description to be used as well. Similarly, emotional states in the moment and behavioral patterns offer real-world evidence of behavioral response. Implicit measurement approaches also generally improve reliability and validity by reducing social desirability and, more broadly, by grounding behaviour in overt action rather than self-perception. In aggregating the cognitive demand, emotional tension, and moral ambiguity in simulations, the situational modules offer a succinct yet ecologically valid way to assess an individual's psychological fitness for sensitive security engineering.

Profiling Logic and Ethical Guardrails

To distil raw psychological and behavioral information into actionable decision-support tools, this framework blurs the lines between 'integrating' module outputs, incorporating structured profiling logic. This logical framework fuses scores from self-report inventories, SJTs, and behavioral simulations to create composite risk/suitability profiles. Each module provides insights into key factors like integrity, stress tolerance, ethical reasoning, and

cognitive control, displayed generally in that order, although their importance is derived from the importance associated with the engineering role in question, as indicated. For example, stress regulation and compliance with rules might carry more significance than interpersonal qualities required for construction, if applied to a defence or nuclear role.

The candidate profiles are reported based on ratings in a number of profile categories, i.e., Ideal Fit, Low-Risk, Borderline, or High-Risk, based on total scores, score requirements, and variations across a profile vis-à-vis thresholds established across modules. The report on the profiles will use interpretability protocols, which inform how properly to present the outcomes to decision-makers and candidates. The scoring can be provided in z-scores, percentile rank, or behaviour patterns to better reduce subjectivity and add visibility.

Ethical integrity is an important part of this framework. Our use of anonymized data for processing, storage, and retention allows us to guarantee data privacy and candidate rights. Candidates are fully informed with respect to what data is collected, how it is used, and any ability to access the collected data or withdraw their participation - this is done in a way consistent with the global standards of data protection, such as GDPR.

To counter any potential bias or discrimination, all tools are tested against inappropriate bias and discrimination through fairness auditing against gender, cultural, and neurodiverse groups. Algorithmic decision making is periodically reviewed to discover any disparate impact as the assessment methodologies are developed or refined, and/or there is a requirement for an alternative language to reduce cultural bias in assessments. Furthermore, regulatory compliance is guaranteed through ethical review boards and guidelines from regulatory bodies that choose not to restrict any aspect of psychological testing, including the acceptance of the APA and any local labour/regulatory authorities.

Through the implementation of ethical guardrails at both the assessment design development as well as the interpretation logic, the framework helped ensure that role-matching is accurate while also helping protect human dignity and ensure that profiling remains equitable, transparent, and scientifically defensible.

CONCLUSION

Psychological profiling within the context of security-sensitive engineering positions advances the protection of technical competence by also ensuring human reliability, decision-making with ethics, and the ability to tolerate stress. In settings with safety, national security, or critical infrastructure implications, traditional practices for screening candidates fail to account for the requisite behavioral and psychological performance elements. This research emphasizes the benefits of human-centered profiling by way of integrating different assessment tools into an overall behavioral approach that enables an understanding of human behavior that leads to the development of risk/suitability profiles.The practical implications can be extensive. Organizations could use the above approach to improve recruitment decisions, to get role-to-person fit, predict burnout, and vet values in integrity tests for business-critical roles. By incorporating behavioral knowledge within a talent pipeline, organizational leaders would be able to proactively consider the risks associated with human error or psychological unfitness. Future studies will include longitudinal validity studies to follow real-world performance against profiles. In addition, the use of AI-supported profiling tools that offer explainability to the algorithms they use to develop profiles would be worth examining for enhanced efficiency and fairness. There should also be an effort to adapt profiling frameworks to conceptualizations of what it means to be culturally competent or relevant to planning for risk in a globalized enterprise without sacrificing accuracy. Lastly, organizational contexts can be profoundly normalized by embedding psychological profiling into risk profiles, leading to a form of institutionalized building of trust at the operational level and enhancing human reliability.

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