A Review of Personnel Selection Approaches for the Skill of Decision Making

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Abstract. Personnel Selection has been a long standing focus in the fields of Organizational Psychology, Human Factors Psychology, Business Management, Human Resources, and Industrial Engineering. Assessment methods in personnel selection can be categorized into subjective and objective methods. Selection assessments are often broad in attempting to capture the essence of person for success in a role or organization. However, this type of approach often yields inconclusive and biased subjective results. Therefore, focusing on key skills seems to be more beneficial. The skill of focus for this effort is decision making. Since those who make more good decisions are often influential and rise to leadership positions, it is imperative that better ways to uncover, assess, predict, or enhance DM skills, be developed. To do so, a review and firm understanding of personnel selection and decision making is necessary.

Keywords: Personnel selection · Decision making · Assessment · Physiological response · Subjective measures

1 Introduction

Selection has been a long standing focus in the fields of Organizational Psychology, Human Factors Psychology, Business Management, Human Resources, and Industrial Engineering. Each of these fields approach the challenge of selecting the right person for the job from a slightly different angle. For example, Human Factors Psychologists focus on task performance, whereas Industrial Engineers think in terms of manpower necessary to accomplish tasks. However, assessments for personnel selection have centered around a few traditional approaches. Those will be discussed first before examining a new method for assessing skills and utilizing ever-expanding technologies available for repeatable and objective assessment, which include simulations to present stimuli and physiological measures. That alternative approach is the basis for the present experiment. Specifically, the goal for this work is to is to determine if physiological responses assessed during a battery of tasks would improve prediction of decision making performance in a real-world task that incorporates the components of the battery, beyond the prediction associated with traditional assessment methods.

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2 Traditional Approaches to Personnel Selection

Assessment methods in personnel selection can be broadly categorized into subjective and objective methods. Subjective methods include personality measures, stress and coping style inventories [1], interviews, and supervisor ratings [2]. Objective measures include work samples [3], biographical data such as gender and age [4], situational judgment tests [5], and aptitude tests [6]. This section introduces several traditional approaches used in personnel selection in various organizations, clubs, teams, and businesses.

2.1 Personality Measures and Stress Coping Inventories

The American Psychological Association (APA) defines personality as the variations in characteristic patterns of thinking, feeling, and behavior [7], across individuals, and personality traits of an individual typically describe the individual's inclinations towards certain patterns of thinking, feeling, and behaving.

A widely used framework in personality research is the 5-factor (i.e., "Big Five") model. The Big Five personality inventory taps five traits: Neuroticism, Openness, Conscientiousness, Agreeableness, and Extraversion [8]. A study which relates personality to DM examined the career decisions made by various groups. While investigating career DM difficulties [9], researchers combined emotional levels and personality measures in three sample groups: (a) 691 deliberating individuals who entered a career self-help website, (b) 197 students in a university preparatory program, and (c) 286 young adults from the general population. As hypothesized, increased levels of personality-related and emotional DM difficulties were associated with greater levels of neuroticism, agreeableness, perfectionism and the need for cognitive closure, but were not strongly associated with high levels of extraversion, openness to experience, and career decision self-efficacy.

However, such studies that link personality traits to DM are relatively rare. Rather than relate any particular personality trait to DM, studies are more likely to show evidence that personality traits relate to job performance [10]. For instance, Conscientiousness has been shown to be predictive of performance [11]. Since superior job performance is unlikely without good DM, this may suggest a potential indirect link between personality and DM. While personality measures such as that which assesses the "Big Five" personality traits have demonstrated some utility in personnel assessment, evidence suggests that room exists for improving assessments of DM for selection, and that other measures be used.

Besides personality measures, stress coping inventories have also been utilized in personnel selection. For instance, selection of personnel for jobs such as law enforcement often includes an assessment of stress coping style and ability. This is because the job of law enforcement officers typically involves making high-stakes decisions under time pressure, Selection for such positions may include administering stress coping inventories to obtain information about stress tolerance and coping styles [3].

2.2 Interviews

Another common assessment method used in personnel selection is the interview. Interviews are favored by both supervisors [12] and human resources (HR) practitioners [13]. Although structured, competency-based interviews have been used to assess specific competencies such as decision-making, there are few studies that validate the use of the selection interview for assessing decision-making skill. Besides, more often than not, interviews are unstructured and results subject to a variety of interviewer bias including the "halo" effects, stereotyping, contrast effects among others [14].

2.3 Supervisor Ratings

Another common personnel selection method is the use of supervisory ratings of various competencies that can include decision-making ability [2]. However, measures of job performance with such ratings have been heavily criticized by researchers for having poor reliability and insufficient validity [15, 16]. Furthermore, supervisory ratings can be misinterpreted, misread, affected by extraneous influences, or lose accuracy due to its susceptibility to effects such as the "halo" or recency effects [17]. These issues have led researchers to conclude that subjective measures in personnel selection may not be sufficient.

2.4 Aptitude Measures

In the effort to address the aforementioned issues of subjective measures, as well as other problems such as social desirability [18] and "faking good" [19] in the personnel selection context, researchers have turned to assessment methods that are more objective. For example, United States Military Entrance Processing Command administers the Armed Service Vocational Aptitude Battery (ASVAB) to determine qualification for enlistment in to the US Armed Forces [20]. The ASVAB assesses knowledge and ability on various subjects (i.e., math, science, and electronics) to inform selection and deployment decisions. The premise is that decisions made in different military vocations would require specific abilities. This is also the notion underpinning assessment instruments such as the Adult Decision Making Competence [21], which assesses vulnerability to certain cognitive biases associated with DM (e.g., resistance to framing and the ability to apply decision rules). Other ability tests utilized in assessing DM potential include critical thinking and logical reasoning tests. For example, the Watson-Glaser Critical Thinking Appraisal [22] has been widely used in managerial selection to assess the ability to reflect and evaluate arguments and uncover assumptions and inferences in the process of logical thinking [23]. The challenge with aptitude tests is that they offer broad assessments and do not match-up directly with the skill of making decisions.

2.5 Situational Judgment Tests

On the other hand, situational judgment tests (SJT) can be developed to assess DM in a specific context (e.g., cross-cultural work scenarios, customer service). An item in an

SJT typically consists of a real-world situation accompanied by possible courses of action or responses to that situation. Respondents rate the effectiveness of each behavior or select what they think is the most effective course of action from the response options [5]. Since actual situations and response options are used in their development, SJTs incorporate features that correspond to events encountered during operations and, in so doing, are able to better portray the multidimensional nature of real-world decision making. However, like many personnel assessment methods, they can often be context- or task-specific, and may not be useful in assessing potential for skill development.

2.6 Biographical Data and Bio Data Measures

Another assessment method in selection utilizes biographical data and bio data of candidates that tend to relate to the desired qualities or job competencies. Studies supporting the use of bio data in assessment of DM include that by Manley et al. [24], which report that assessments of conscientiousness and locus of control using biographical data fared better in predicting ethical decision making compared to the self-report assessments of the same constructs. Despite the ability of bio data to tap specific constructs, the most common biographical data used in personnel selection are still the applicants' gender, age, and experience.

2.6.1 Gender

Appropriately, researchers have investigated the possibility of gender as a huge contributor in good or bad DM [4]. There is a specific area of research that examines if the gender effect in strategy and risk propensity in financial DM is more robust than certain contextual factors [25]. For example, the research investigates if level of task familiarity and framing of the task would account for more differences in DM strategies and risk preferences than would gender. The results provided by Powell & Ansic claimed that females are less risk seeking than males, irrespective of familiarity and framing, costs, or ambiguity. The results also revealed that each gender adopts different strategies in financial DM environments. 0.

However, these strategies have no significant impact on performance of the individual [25]. Since it is easier to observe strategies than either risk propensity or the results of daily DM, differences in DM strategies serve to reinforce the stereotype that proposes that females perform less favorably in the financial arena than that of their male counterparts. This view, suggesting that women are more risk-averse than men, has been around for a long time and is becoming increasingly widespread [26]. Consequently, this type of stereotypical thinking perpetuates throughout the financial community and is the basis for the so-called *glass ceiling* for women in corporate promotion ladders [4]. To this end, men are more likely to be trusted than women to make the risky decisions that may be vital for an organization's success. Similar stereotyping in the investment broker arena suggests that these perceptions disadvantage female clients, as well [27]. Wang suggested that women are typically, more conservative in their investing, and therefore, are usually offered investments with lower risks, which generates lower expected returns.

Research investigating male and female DM performance in correlation to leadership aimed to understand whether the proposed performance differences in gender existed [28]. Results of a meta-analytic review of 17 studies examining gender differences and leadership showed that male and female leaders exhibited equal amounts of initiating structure and consideration. Both male and female leaders attained an equal amount of satisfied subordinates. However, according to Dobbins and Platz [28], male leaders rated higher on the effective chart than female leaders in a laboratory setting. The findings in their meta-analytic review recommended imposing a moratorium on research correlating leadership performance between genders. The foundation for this selection approach is subjective in nature, due to the use of heuristics and biases. Therefore, a more objective approach to assessing and determining DM potential should provide results that are more descriptive.

2.6.2 Age and Experience

Another traditional approach to assessing and characterizing the skill of DM is via age and experience. In addition, like other traditional methods, researchers have explored the prospect of using age and experience to identify potential DM skills. An investigation where age and DM experience influences managerial DM performance, discovered that age was the more prevalent factor supporting this assertion [29]. There was little evidence supporting the notion that older managers were less adept at processing information and making decisions.

However, according to modern neuropsychological models, there are some age-related cognitive changes associated with deterioration in the frontal lobe, which has been associated with DM processes [30]. However, on the contrary, these models did not consider the potential parceling of the frontal lobes into dorsolateral and ventromedial regions. Three tasks of executive function and working memory (i.e., tasks dependent on dorsolateral prefrontal dysfunction), along with three tasks of emotion and social DM (i.e., tasks dependent on ventromedial prefrontal dysfunction) were assessed for age effects [30]. Although age-related variations in performance were discovered on dorsolateral prefrontal dysfunction tasks, there were no age-related variations observed during the majority of the ventromedial prefrontal dysfunction tasks and therefore, the results support the theory that instead of an overall degradation in executive function with age, there is a specific dorsolateral prefrontal cognitive relates to aging [30].

A main drawback in using biographical and biodata is that it rests heavily on the notion that past behavior predicts future behavior and assumes that individuals would not exceed their existing level of skill. This assumption is also true for other traditional assessment methods as well. Hence, their use can be limited in assessing DM skill or potential. Given all this, it may be necessary to explore measures beyond self-report, behavioral, or even tests of judgment and ability. A possible alternative approach may be to use physiological measures.

3 An Alternative Approach to Selection

Neuroscience research has implicated certain physiological structures and responses, such as the ventromedial prefrontal cortex, parietal lobe, amygdala, that are indicative of various DM processes [31] and skill development [32]. Findings of physiological

changes related to DM have inspired the use of physiological measures for personnel assessment. The rationale for the use of physiological measures is that cognitive processes can be reflected in physiological responses. For instance, lie detector tests based on galvanic skin response (GSR) are linked to cognitive processes underlying integrity [33]. The experience of high workload has been associated with heart rate variability (HRV) changes and fixation durations [34], and the cognitive processes related to cerebral blood flow velocity (CBFV) are involved in certain vigilance tasks [35].

A new assessment using a multidimensional approach, whereby a Transcranial Doppler (TCD) measured cerebral blood flow velocity to the brain, and the Dundee Stress State Questionnaire (DSSQ) assessed stress, during a short battery of tasks predicted subsequent vigilance task performance [36, 37]. Specifically, the results of three short high information-processing tasks captured the core components and attributes that comprise vigilance tasks, which are primarily two categories: 1. Simultaneous or successive vigilance tasks and 2. Sensory or cognitive. The TCD recorded CBFV during the presentation of the three short tasks and a pre to post-DSSQ. Basic scientific principle of using different complex real world vigilance tasks validated the approach: 1. Simultaneous, sensory air traffic control, 2. Successive, cognitive verbal math problems, and 3. Long distance driving where vigilance was only one element. In other words, the integration of the short battery, CBFV, and stress response as an instrument for selecting personnel with optimal vigilance skill should predict task agnostic vigilance.

Different university student samples substantiated the effectiveness of the battery for predicting final period vigilance performance, which is the time where task performance suffers and errors are more likely to occur. In other words, the battery should be predictive even with a different sample. Results showed that utilizing this multidimensional approach accounted for up to 24% of vigilance performance variance [36].

4 Advancing the Multidimensional Approach

The present effort sought to extend the seminal work by Reinerman-Jones and colleagues [34, 36, 38] in two key ways. The first way was to apply the method to a different skill – that of decision-making. This would entail identification of a different task battery. Second, the inclusion of additional physiological measures would be used to account for more variance than did just the TCD. However, an extensive literature review of decision making and decision making assessment was first needed.

4.1 The Reason for the Skill of Decision Making

Like the skill of vigilance, the skill of DM is quantifiable and some people are better at making decisions than others [39]. Since those who make more good decisions are often influential and rise to leadership positions [40], it is imperative that better ways to uncover, assess, predict, or enhance DM skills, be developed. This realization is evident in the amount of resources that organizations and companies invest to ensure that they select the right leader who will make reasoned, timely, and intelligent decisions that are crucial to the success of an organization [41]. Identifying an individual's DM skill level for proper job selection and placement will enable a greater return on

investment, lower attrition, and greater productivity [42]. Therefore, the purpose for this research is to establish an effective assessment tool that supports talent management – in particular, personnel selection, by focusing on the assessment of the skill of decision-making.

4.2 Current Theories and Models of Decision Making

There are several theories on how humans make decisions. In general, there are (i) theories that prescribe the best ways to make decisions (i.e. normative theories), and, (ii) theories that describe how decisions are actually made (i.e., descriptive theories).

4.2.1 Normative Theories

Normative theories outline the ideal standard or model of DM, and are based on what is considered to be the normal or correct way of making decisions. Normative theories are based on empirical assumptions for interpreting how or what the world should be. Along with empirical assumptions, normative theories also comprehensively include the social value systems or moral judgments of a mass on which to base their normative questions. The underlying theme of normative theories is that decision-makers are rational and will seek to select options that maximize utility by systematically consider all options thoroughly before making the decision [43]. However, the usefulness of normative theories has been challenged by observations by descriptive DM theorists who posit that human decision making often involve the use of heuristics and the presence of bias.

4.2.2 Descriptive Theories

Descriptive theories of decision making include the Prospect theory, and the Naturalistic decision making theory [44]. The pivotal contribution of the Prospect Theory is the notion that human decision making often involves the use of heuristics and bias. Heuristic methods are used to speed up the problem solving process for finding a satisfactory solution and ease the cognitive load of the decision making process [45]. On the other hand, a bias is defined as any particular tendency, trend, inclination, feeling or opinion that is preconceived or unreasoned [46]. Given Hick's Law [47] which states that the time taken for a decision is a function of the number of options, heuristics and bias serve as cognitive shortcuts that enable a decision to be reached in a timely manner. Nevertheless, although heuristics are helpful in making decisions, they can also lead decision makers down the wrong path, if not utilized properly.

Naturalistic decision-making theories emerged as a means of studying how people make decisions and perform cognitively complex functions in demanding real-world situations [44]. Essential characteristics of Naturalistic decision making theories include proficient decision makers, context-bound informal modeling, empirical based prescription, situation-action decision rules, and process orientation [48]. The study of Naturalistic DM highlights important decision theories neglected previously by the other models such as the use of expertise and the ability to generate options. Naturalistic DM also introduces important concepts including recognition primed decision-making (RPDM), coping with uncertainty, team DM, and decision errors [44].

4.3 Physiological Measures Associated with DM

Apart from selecting a new skill, the other aspect of the alternative approach is the use of various physiological measures. Some of the physiological sensors available for this application are shown in Table 1.

Table 1. Physiological sensors

Sensor	Definition
Electroencephalogram (EEG)	Sensor that detects electrical activity in your brain using small, flat metal discs (electrodes) attached to your scalp [49]. Your brain cells communicate via electrical impulses and are active all the time, even when you're asleep. This activity shows up as wavy lines on an EEG recording. The types of waveforms have been indicative of various types of cognitive processing
Electrocardiogram (ECG or EKG)	Sensor that checks measures the electrical activity of your heart. Fluctuations in heart rate and other associated metrics (HRV and IBI) have been tied to responses to stress, workload, and other cognitive demands [50]
Function near-infrared (fNIR)	Sensor of functional neuroimaging that measures brain activity through hemodynamic responses associated with oxygen used to process information [51]
Transcranial doppler (TCD)	Sensor that measures the velocity of blood flow through the brain's blood vessels by means of ultrasound [52]. Changes in task load have been shown to have a paralleled effect in CBFV [37]
Eye tracker	Sensor that tracks where your eyes are focused. It determines your presence, attention, focus, drowsiness, consciousness, or other mental states [53]. This information can be used to gain deep insights into consumer behavior or to design revolutionary new user interfaces across various devices

Studies have found that brain regions that are activated in moral DM relate to areas involved in cognitive processing in the right dorsolateral prefrontal cortex and bilateral inferior parietal lobe, emotional processing in the medial prefrontal cortex, parietal lobe, and amygdala, and finally, conflict processing in the anterior cingulate cortex [31]. Further results from patients with brain lesions implicate the ventromedial prefrontal cortext in moral DM [54]. General activation of these frontal lobe regions may be accessed by physiological measures from the electroencephalogram (EEG) and prefrontal cortex fNIR. Moreover, as proposed in the "somatic marker hypothesis" [55], the emotions that may be evoked during moral DM may be reflected in the autonomic nervous system. Autonomic nervous system activity can be accessed via the measures of cardiac activity (i.e., via electrocardiogram (ECG)).

Another experiment revealed a reduction in the high frequency component of heart rate variability (HRV) and an increase in the low-to-high frequency ratio during time pressure stress situations compared to the control settings, while no changes were shown in the low frequency component of HRV [56]. The results of their experiment imply that HRV is a more impressible and discriminatory measure of mental stress,

which suggests that variables derived from heart rate physiology reflect a central command for managing stress and making decision under pressure.

In regards to critical thinking and brain activity, researchers claim that the consciousness and precision of certain tests to measure frontal lobe functions proves to have substantial influence on research findings [57] and they concluded that frontal lobe lesions prevail to be the attributing cause of the "bewildering array" of deficits. Metabolic responses such as those indexed by rSO_2 and CBFV have also been linked to DM. For instance, a metabolic experiment by Masicampo and Baumeister [58] related the availability of metabolic substrates (e.g., glucose) to resources that are required for certain DM processes. The hypothesis was based on the assertion that serious complex processing and self-restraint in DM requires large amounts of glucose, which in turn means, that heuristic strategies are more prevalent when this fuel is depleted [58]. This suggests a link between metabolic responses that tap blood flow activity to the brain to processes required for complex judgment. Other research utilizes an EEG measure called N_2 to reflect executive inhibition ability, which suggests better performance on "No-Go" DM tasks [59].

5 Future Direction

Based upon the above review, it is clear that personnel selection and decision making are complex constructs and assessments for each are varied. However, it is also necessary to develop an effective assessment for the skill of decision making given that it takes many good decisions to be successful and only one bad decision to set back a career, an entire organization, or an entire country. A battery of tasks can be developed and physiological measures selected for instantiation like the Reinerman et al. work [36].

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