SUMMARY

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EDITORIAL

Psychological safety at workplace during changing times. Trends and research implications

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The Importance of Psychological Safety at the Workplace

The unprecedented uncertainty and complexity of today's workplace environment mark a period of deep change that imposes a need for innovation and experimentation within organizations. Consequently, recent research focuses on highlighting the correlation between leadership, psychological safety, and learning behaviors. A recent meta-analysis (Edmondson & Bransby, 2023) showed that psychological safety has increasingly captured the interest of academic researchers. Notably, most of the studies on this topic were published in the recent three-year span of 2019 to 2021, the predominant approach being quantitative, with significant theoretical contributions. The concept of psychological safety is pivotal in fostering an environment where open communication, innovation, and constructive risk-taking are encouraged, leading to improved learning and performance outcomes.

Psychological safety emerged in early research on organizational transformation its focus being on ensuring that individuals experience a high sense of security and being able to adapt to change (Schein & Bennis, 1965). Later on, Kahn (1990) linked psychological safety to employee engagement, suggesting that it enables individuals to fully engage physically, cognitively, and emotionally in their roles. While Schein & Bennis (1965) focused on individual perceptions of psychological safety, (Edmondson, 1999) defined psychological safety as a belief shared by team members about taking interpersonal risks. The central theme emerging from these perspectives is the significance of fostering a work environment where interpersonal risk perceptions are minimized, and where employees are encouraged to freely contribute ideas and actions to collective goals (Frazier et al., 2017).

Psychological Safety and Performance

Previous studies have extensively explored how psychological safety impacts a range of organizational outcomes. This includes areas like innovation, employee attitudes, creativity, knowledge sharing, voice behaviors, and communication (Newman et al., 2017). Research studies confirmed that psychological safety directly influences task performance, playing a crucial role in mitigating the adverse effects associated with making mistakes or initiating new actions, as identified by Edmondson (1999). This reduction in perceived risk enables employees and teams to

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concentrate more effectively on their tasks, subsequently enhancing performance (Faraj & Yan, 2009; Frazier et al., 2017; Mayer & Gavin, 2005). In their meta-analysis study, Newman and his colleagues (2017) revealed the impact of psychological safety on performance at multiple levels within organizations. Both at the individual and team level, there is a direct and strong influence of psychological safety on performance. Additionally, psychological safety's role extends to indirectly facilitating learning behavior, which in turn affects performance (Li & Tan, 2013; Ortega et al., 2014). Further, alternative mechanisms, such as team turnover, have been identified as factors through which psychological safety can impact performance (Chandrasekaran & Mishra, 2012). At an organizational level, the overall sense of psychological safety felt by employees within a company is closely and positively linked to the company's performance, as indicated by its return on assets and the achievement of its objectives (Baer & Frese, 2003).

Besides the effects of psychological safety on work performance, more specific results synthesised by Newman and his colleagues (2017) showed positive correlations between employees' perceptions of psychological safety and their creativity and risk-taking abilities (Carmeli et al., 2010; Palanski & Vogelgesang, 2011). Other studies revealed that psychological safety positively affects team performance, mediated by the sharing of information and "know-how" (Kessel et al., 2012). Some researchers suggest that psychological safety could improve performance by fostering better social exchanges between employees and the organization and sustaining employee identification with the organization (Singh et al., 2013). Correlated with other personality traits, psychological safety could also have an impact on performance, a recent study showed that self-efficacy and psychological safety explained the role of error tolerance on learning behavior which in turn, improved the overall work performance (Wang et al., 2020). These findings highlight the multifaceted role of psychological safety in enhancing performance across individual, team, and organizational levels.

Psychological safety during changing times; relationship with organisational change

Psychological safety plays a crucial role during periods of change, as it helps individuals and organizations manage the stress and uncertainty inherent in such transitions. By fostering an environment where people feel safe to express concerns and take risks, psychological safety enhances creativity, innovation, and decision-making, crucial for rapid adaptation. Given the high uncertainty and the rapid changes both at organisational and societal levels, current studies could focus on the impact psychological safety could have on organizational change and its effects on employees' well-being. Researchers considered psychological safety as a component of efficient organizational change, however, there are not many studies on this topic. Employees who experience a high level of fear are often less receptive to organizational change, which can lead to a decline in their job performance (Weeks et al., 2004). Recent research has indicated that when employees with a greater sense of psychological safety are more open to engage in future transformations within the organization. Furthermore, implementing practices that enhance psychological safety can foster a stronger bond between the leadership and employees (Page et al., 2019).

Research studies also focused on the mediating role of psychological safety on the association between authentic leadership and employees' behavior, as psychological safety leads to important behavioral outcomes, such as organizational learning, information sharing, citizenship behaviors, and creativity (Steger et al., 2006), which are important antecedents of change and learning in organisations (Edmondson & Lei, 2014). More recent studies showed that employee psychological safety is positively associated with performance and innovation (Frazier et al., 2017). Concerning change engagement, it seems that psychological safety and self-

efficacy have positive effects on change engagement (Albrecht et al., 2023). Therefore, research supports the idea that psychological safety could be an important antecedent for change engagement and proactive work behavior. If employees perceive organizational change as purposeful and feel competent and safe, organizations can significantly boost employee motivation to embrace change and drive innovation.

Conclusions

Factors such as organizational support and a positive safety climate are intrinsically linked to work performance. This perspective suggests that the benefits of psychological safety could extend beyond its immediate impact on work engagement; when organizations cultivate a supportive environment and a climate that prioritizes safety, the sense of security among employees is enhanced and their engagement and productivity are also stimulated (Kim et al., 2020). The perspectives outlined above underscore the crucial role of psychological safety in the workplace, particularly in the context of the evolving work environments we see today, such as distributed and hybrid models. Thus, in the modern workplace, where traditional office dynamics are rapidly evolving, prioritizing psychological safety is not just a matter of employee well-being, but a strategic imperative for organizational success. Understanding what factors contribute to the development of psychological safety, and how and when it influences work outcomes, is crucial for the success and well-being of individuals, teams, and organizations.

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RESEARCH ARTICLE

Psychological Safety and Job Performance: The Mediating Role of Work Engagement and Job Crafting

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Abstract

Modern organizations ask employees not only to accomplish their tasks, but also to cooperate effectively and be innovative. Psychological safety, the conviction of the employees that the workplace is a safe place, is an important factor in predicting these behaviours, but the explanations for these effects are not fully known. The aim of this study is to investigate the mediating role of work engagement and job crafting in the relationship between psychological safety and three types of work performance: task performance, contextual performance, and creative performance. A cross-sectional study was conducted on a sample of 316 employees (46.52% female). Data were collected with self-report questionnaires. Work engagement and job crafting completely mediated the effect of psychological safety on task performance and contextual performance, but the effect on creative performance was fully mediated only by work engagement. The study contributes to the development of theory by providing an explanatory mechanism in the relationship between psychological safety and three types of performance. From a practical perspective, fostering psychological safety can help organizations to increase employees' work engagement, job crafting, ultimately leading to enhanced performance.

Keywords

psychological safety; job crafting; task performance; contextual performance; creative performance

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Informed Consent: Informed consent was obtained from all individual participants involved in the study.
Data Availability: The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Introduction

In the rapidly evolving landscape of modern organizations, where innovation, adaptability, and creativity are key drivers of success, companies expect from employees not only to perform in their tasks, but also to come up with new ideas or to cooperate effectively (Frazier et. al., 2017). An important factor in stimulating such behaviors among employees is psychological safety, representing the conviction of the organization's members that the workplace is a safe place for risk-taking (Edmondson, 1999). Although studies show that psychological safety is positively associated with several types of workplace performance (Frazier et al., 2017), the mechanisms by which psychological safety leads to performance are not fully understood by researchers. Considering this gap in the scientific literature, previous systematic analyzes (Newman, Donohue, & Eva, 2017) suggested the study of mediators in the relationship between psychological safety and performance in the framework of organizational theories that are based on job resources.

In line with the Conservation of Resources (COR) theory (Hobfoll, 1989) and the Job Demands-Resources (JD-R) model (Bakker, 2015), the aim of this study is to investigate the mediating role of work engagement and job crafting in the relationship between psychological safety and three types of work performance: task performance (fulfilling the formal job requirements, responsibilities, and tasks that are explicitly outlined in the job description), contextual performance (voluntary actions and behaviors that go beyond an employee's formal job requirements), and creative performance (generating innovative ideas, solutions, and approaches to tasks and problems) (Koopmans et. al., 2011). From a theoretical point of view, the present study contributes to the existing literature by considering several types of performance as outcomes of psychological safety. In addition, the research contributes to the understanding of the mechanisms by which psychological safety leads to performance. From a practical point of view, the study emphasizes the role that psychological safety can have in the management of several types of performance in organizations. The study can inform human resources policies and training programs for managers with the aim of increasing psychological safety and indirectly the performance of employees.

Psychological Safety and Performance

Psychological safety refers to a shared belief within a group or organization that one can express ideas, opinions, concerns, and take interpersonal risks without fear of negative consequences, such as embarrassment, marginalization or punishment (Newman et al., 2017). The link between psychological safety and job performance can be explained through the lens of the Conservation of Resources (COR) theory (Hobfoll, 1989), highlighting the significant role that psychological safety plays in facilitating resource accumulation and preservation, ultimately leading to enhanced performance (Newman et al., 2017). COR Theory is a psychological framework that explains how individuals strive to acquire, preserve, and protect their resources in order to cope with stress and maintain well-being (Hobfoll, 2001). The theory is based on several key postulates that explain the underlying principles and mechanisms of resource dynamics.

One postulate posits that individuals are inherently motivated to acquire and invest in resources that they value. People seek to obtain and maintain resources that contribute to their well-being and functioning, which can include tangible and intangible assets, personal characteristics, and social connections (Hobfoll, 1989). Another postulate suggests that individuals are sensitive to the potential loss of resources, therefore individuals may engage in resource-protective behaviors to avoid resource depletion (Hobfoll, 2001). Finally, one postulate posits that resource gain leads to a positive cycle of resource accumulation and increased well-being, meaning that when individuals experience resource gains, they are better equipped to acquire and preserve additional resources, leading to enhanced resilience and well-being (Hobfoll, 1989).

In the COR framework (Hobfoll, 1989), psychological safety, as an intangible resource, becomes a crucial factor in the process of protecting and acquiring resources. The theory suggests that when employees feel psychologically safe, they can better allocate and mobilize their resources towards achieving higher levels of job performance. Psychological safety can represent a job resource, which can be used to acquire other relevant resources for increasing performance. Also, psychological safety protects employees from potential resource loss that may occur in environments characterized by blame or fear of punishment. Not being focused on protecting existing resources due to an unsafe environment, employees will be motivated to invest existing resources to obtain even more resources. In a psychologically safe workplace, employees are more likely to feel secure, enabling them to focus more on their tasks, leading to improved job performance. In such an environment, employees are more likely to engage in risk-taking behaviors, leading to the acquisition of valuable information, knowledge, and skills. In the end, they will reinvest these resources in work activities, utilizing them optimally for job-related performance.

An updated version of COR theory (Hobfoll, 2001) suggests that resources can be managed in a proactive manner (i.e., proactive coping), in the sense that individuals seek to accumulate reserves of resources and to put themselves in circumstances that favor the acquisition of subsequent resources in order to cope with possible upcoming stressful events. In our specific case, when employees are in a psychologically safe environment, they do not have to focus on avoiding certain resource losses (e.g., loss of reputation as a result of stigmatization, criticism or punishment of personal initiatives). Therefore, as a proactive coping strategy, employees will naturally be motivated to prepare for future negative situations and will try to accumulate additional resources. Thus, they will invest existing resources to perform at work and obtain additional resources as a result of their high performance.

In line with the predictions of COR theory (Hobfoll, 1989; 2001), meta-analytical findings showed that psychological safety and in-role performance are positively associated (Frazier et al., 2017). The most studied explanatory mechanism in this relationship is learning behaviors (e.g., offering and seeking feedback, discussing errors, experimenting with new ideas). The role of this mediator is supported by both qualitative and quantitative studies (Edmondson, 1999). Team learning behavior mediates the positive link between psychological safety and team performance (Kim et al., 2020). Kostopoulos and Bozionelos (2011) differentiated between two types of learning that can explain this relationship: exploratory learning (a flexible and varied approach to tasks, discovering and experimenting with new ideas) and exploitative learning (selecting and refining ideas and implementing them). Also, Google's People Analytics Unit identified psychological safety as the best predictor of success in teams (Bergmann & Schaeppi, 2016).

Regarding contextual performance, engaging in behaviors that go beyond formal job requirements (e.g., initiating changes, suggestions for improvement) involves an investment of resources (e.g., time, energy) and possible risks (e.g., disapproval from colleagues or managers). Based on the COR theory (Hobfoll, 1989; 2001), when the risks of losing resources are limited, employees will be naturally motivated to engage in behaviors that develop individual, team, and organizational resources. Psychological safety creates a supportive environment which motivates them to go beyond their formal duties and engage in voluntary citizenship behaviors. This explanation is supported by meta-analytic results (Frazier et al., 2017), the correlation between psychological safety and contextual performance being .32.

The same reasoning can be applied to creative performance. In a safe environment, where there is no risk of losing certain resources, employees can invest existing resources to generate and test innovative ideas (Frazier et al., 2017). For example, in healthcare teams, psychological safety increases creative performance through information sharing and know-how sharing (Kessel et al., 2012). Indeed, a recent meta-analysis highlighted the positive relationship

between psychological safety and creativity (Frazier et al., 2017).

Hypothesis 1. Psychological safety is positively related with task performance, contextual performance, and creative performance.

The Mediating Roles of Work Engagement and Job Crafting

Although previous studies have indicated positive relationships between psychological safety and different types of performance, the explanatory mechanisms for these relationships are not fully understood. Based on COR theory (Hobfoll, 1989) and the Job Demands-Resources (JD-R) model (Bakker, 2015), we expect work engagement and job crafting to serially mediate the link between psychological safety and performance. Work engagement, from the perspective of the JD-R model, refers to a positive and fulfilling state of mind that employees experience when they are fully absorbed, enthusiastic, and dedicated to their work (Bakker, 2011). Job crafting, when viewed from the JD-R perspective (Bakker, 2015), refers to the process through which employees actively and intentionally modify their job demands and resources to optimize their work experience and well-being. It involves four types of behaviors: (1) increasing structural job resources (e.g., seeking additional training opportunities, requesting more flexible working hours, or initiating job rotations to gain new skills), (2) increasing social job resources (e.g., building stronger networks with colleagues or seeking out mentoring relationships), (3) increasing challenging job demands (e.g., volunteering for additional responsibilities, seeking out opportunities to take on new projects, or actively seeking challenges to enhance skill development), and (4) decreasing hindering job demands (e.g., reducing certain responsibilities or avoiding demanding social relationships at work) (Tims et al., 2012).

The JD-R model (Bakker, 2015) is based on the premise that jobs can be described by two main categories of factors: job demands (aspects of a job that require sustained physical, cognitive, or emotional effort from the employee, such as workload, time pressure, and role ambiguity) and job resources (factors that facilitate an individual's ability to cope with job demands and achieve work-related goals, such as social support, feedback, and opportunities for development). These factors influence employees' attitudes, behaviors, and overall work outcomes. The model proposes a motivation process that employees go through in the workplace: when job resources are high, they can lead to increased work engagement, job satisfaction, and positive performance outcomes. Employees are more likely to be motivated, proactive, and resilient when they perceive their job as providing them with the necessary resources to perform well. According to the JD-R model, when employees have resources, they are more engaged in their work, which makes them craft their job more. Finally, as a result of job crafting behaviors, employees will have more resources available and will be more efficient in their work.

We expect psychological safety to be a resource that starts this motivational process. Based on the JD-R approach, psychological safety can represent a resource that makes employees more engaged in their work. When the level of engagement is higher, employees will seek to invest their existing resources to obtain even more job resources. Employees can achieve this through job crafting behaviors, which will ultimately lead to higher performance. Indeed, previous results support the positive link between psychological safety and both work engagement (Frazier et al., 2017) and job crafting (Plomp et al., 2019) and the mediating role of job crafting in the association between psychological safety and performance (Lee, 2022). In line with COR theory (Hobfoll, 1989) and the JD-R model (Bakker, 2015), we expect work engagement and job crafting to serially mediate the links between psychological safety and task performance, contextual performance, and creative performance. Our expected model in presented in Figure 1.

Hypothesis 2. Work engagement and job crafting serially mediate the links between psychological safety and task performance, contextual performance, and creative performance.

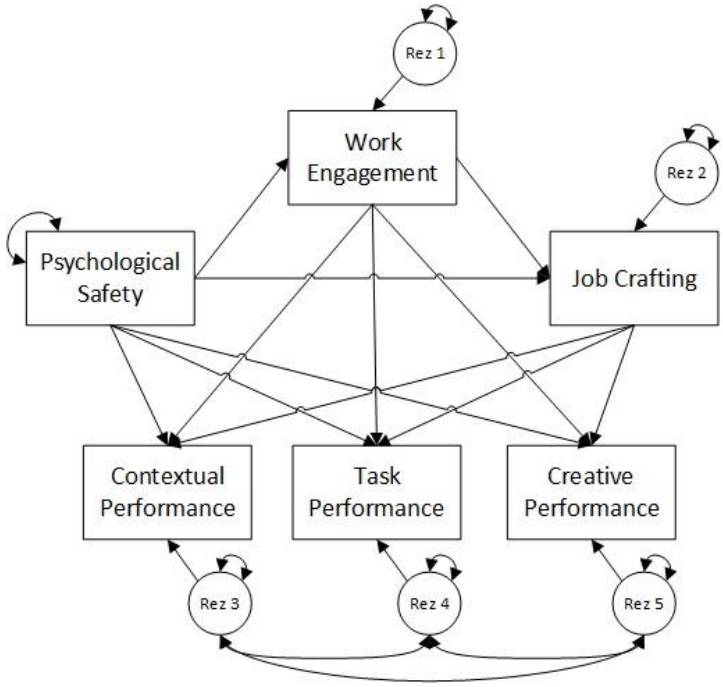

Figure 1. The proposed research model

Methods

Participants and Procedure

A total of 316 employees (46.52% female) from Romania were included in the study, with the age between 20 and 67 years (M = 44.31 years, SD = 10.77 years). 47.47% of the participants had over 10 years of experience in the company, 13.29% between 3 and 5 years, followed by 17.72% between 5 and 10 years, and 13.61% between 1 and 3 years. A non-experimental, cross-sectional study was conducted on a Romanian company, the employees completed the questionnaires during a periodic assessment. Before the questionnaires were administered, the participants were briefed and informed that data were confidential and the participation in the study was voluntary.

Measurements

Psychological safety was assessed with the Psychological Safety Scale (Edmondson, 1999), a questionnaire with 6 items (e.g., *"Members of this organization are able to bring up problems and tough issues."*) scored on a 5-point scale, α = .55, which had adequate psychometric properties in previous studies (e.g., Kark & Carmeli, 2009).

Work engagement was measured with Utrecht Work Engagement Scale (Schaufeli et al., 2006), a 7-points Likert-type questionnaire, with 3 items for vigor (e.g., *"When I wake up in the morning, I feel like going to work."*; α = .86), 3 items for dedication (e.g., *"I am enthusiastic about my work.",* α = .84), and 3 items for absorption (e.g., *"I am immersed in my job."*, α = .65). The internal consistency for the global score was α = .87. The Romanian version of the scale had adequate psychometric properties for both the global score and for the three factors in previous research (e.g., Vîrgă et al., 2009).

Job crafting was measured with the Job Crafting Scale (Tims et al., 2012; Oprea & Ștefan, 2015), a questionnaire with 21 items on a 5-points scale and 4 sub-scales: increasing structural job resources (e.g., *"I try to develop my capabilities."*, α = .74), decreasing hindering job demands (e.g., *"I make sure that my work is mentally less intense.", α* = .82), increasing social job resources (e.g., *"I ask my supervisor to coach*

me.", α = .80), and increasing challenging job demands (e.g., *"When an interesting project comes along, I offer myself proactively as project co-worker."*, *α* = .83).

Task performance was measured with nine items (*"You achieve the objectives of your job."*) from Goodman & Svyantek's Performance Scale (Goodman & Svyantek, 1999), α= .87. *Contextual performance* was measured with seven items (*"You assist your colleagues with their duties."*) from Goodman & Svyantek's Performance Scale (Goodman & Svyantek, 1999), α= .78. *Creative performance* was measured with three items on a 7-points scale (e.g., *"How creative is your work? Creativity refers to the extent to which the employee develops ideas, methods, or products that are both original and useful to the organization."*) (Oldham & Cummings, 1996), α = .90.

Statistical Analysis

We used R (Version 4.2.3; R Core Team, 2022) and the R-packages dplyr (Version 1.1.2; Wickham et al., 2023), flextable (Version 0.9.1; Gohel & Skintzos, 2023), Hmisc (Version 5.0.1; Harrell Jr, 2023), kableExtra (Version 1.3.4; Zhu, 2021), lavaan (Version 0.6.15; Rosseel, 2012), mvtnorm (Version 1.1.3; Genz & Bretz, 2009), naniar (Version 1.0.0; Tierney & Cook, 2023), papaja (Version 0.1.1; Aust & Barth, 2022), PerformanceAnalytics (Version 2.0.4; Peterson & Carl, 2020), psych (Version 2.3.3; Revelle, 2023), readxl (Version 1.4.2; Wickham & Bryan, 2023), sasLM (Version 0.9.8; Bae, 2023), tinylabels (Version 0.2.3; Barth, 2022), xts (Version 0.13.1; Ryan & Ulrich, 2023), and zoo (Version 1.8.12; Zeileis & Grothendieck, 2005) for all our analyses.

In order to verify the univariate normality, the initial assumptions assessment was performed by descriptive univariate analysis, data screening for outliers, and missing cases analysis; the Mardia indicator (Mardia, 1970) was computed to assess multivariate normality. Internal consistency was assessed using the α Cronbach indicator. A confirmatory factor analysis based on diagonally weighted least squares was used to test the factorial validity and the dimensional structure of the instruments. Finally, the main SEM model was assessed based on robust SEM techniques and the parameters were estimated.

Results

An initial descriptive analysis was performed to assess the univariate normality assumptions for the scalar variables. Some extreme outliers were identified for Vigor (lower than 3), but only 22 (1.18%) cases were extreme, so we decided to remove entire cases. Results suggested that Increasing structural job resources, Task performance, Creative performance, Vigor, Dedication, and Absorption were negatively skewed. Decreasing hindering job demands and Increasing social job resources were positively skewed. Also, Decreasing hindering job demands and Increasing challenging job demands were platikurtic and Task performance, Vigor, Dedication, and Absorption were leptokurtic. The multivariate normality assumption based on Mardia coefficient (Mardia, 1970) was not met, as the Mahalanobis distances from centroid coordinates were between 1.45 and 7.23. A statistically significant multivariate positively skewed (Mardia = 15.99, Skewness = 842.30, $p < .001$) and a statistically significant multivariate leptokurtic distribution (Mardia = 160.08, Kurtosis = 8.98, $p < .001$) were observed.

Most of the Spearman's ρ correlations were statistically significant (see Table 1), with values between .08 and .58 and the correlation matrix was positively defined. Only contextual performance was associated with psychological safety, partially supporting Hypothesis 1.

Table 1. *Means, Standard Deviations, and Correlations Among Study Variables*

Variables	*M*	SD	1	2	3	4	5
1. Psychological safety	24.38	6.07					
2. Work engagement	14.18	3.03	.26				
3. Job crafting	15.99	4.35	.32***	.20***			
4. Task performance	30.31	3.87	.08	.46***	.19***		
5. Contextual performance	22.56	3.16	.21***	.45***	.34***	.58***	
6. Creative performance	15.50	3.74	.25	.50***	.21***	.54***	.51***

Note. *** p < .001.

We further analyzed a model in which work engagement and job crafting serially mediated the links between psychological safety and the three types of work performance. Convergence was acquired after 66 iterations, estimating 21 parameters, based on 316 data, and a saturated model was obtained (χ^2 = 0, *df* = 0, *p* = NA, *CFI* = 1, *SRMR* = 0, *RMSEA* = 0, *p* = NA, 90% *CI* [0, 0]). By analyzing the path coefficients, we found that the direct relationships between psychological safety and the three types of performance were not statistically significant and the relationship between job crafting and creative performance was not statistically significant, therefore these paths were eliminated, gaining 4 degrees of freedom and resulting in an over-identified model that could be tested.

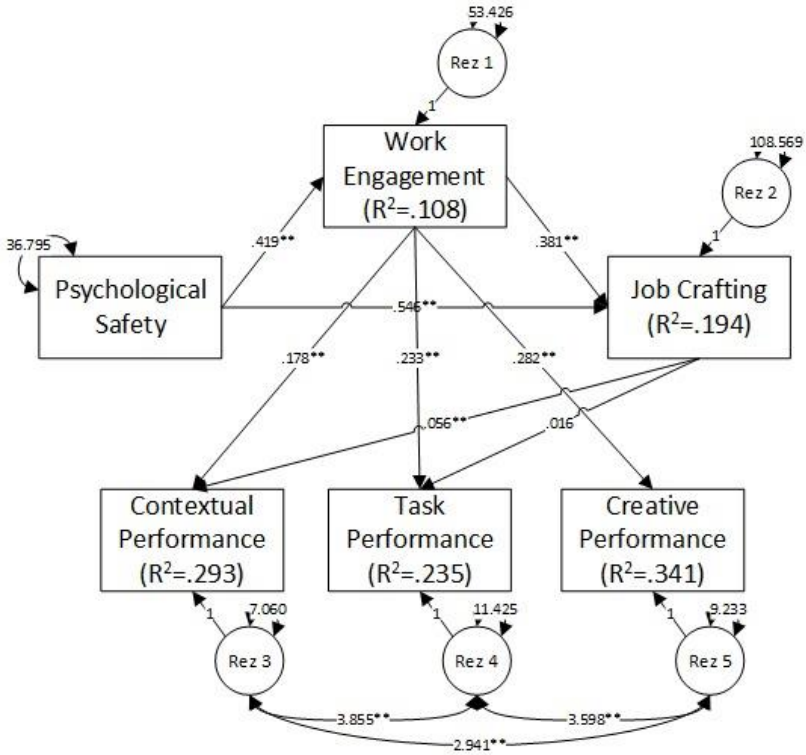

Figure 2. Estimates for the relationships between psychological safety, work engagement, job crafting, and performance

A plausible, well sustained model was observed after 62 iterations, estimating 17 parameters, based on 316 participants, and the fit indices were acceptable (χ^2 = 18.99, *df* = 4, *p* = .001, *CFI* = .97, *SRMR* = .04, *RMSEA* = .04, 90% *CI* [0, 0.10], *p* = .48) (see Figure 2). Psychological safety had a direct, positive, and statistically significant effect on job crafting (*B* = .55, *z* = 4.82, *p* < .001, β = .28), as well as a positive and statistically significant indirect effect, mediated by work engagement (*B* = .80, *z* = 7.26, *p* < .001, β = .58), therefore we concluded that work engagement partially mediates the effect of psychological safety on job crafting. Work engagement was the strongest predictor for all three types of performance: creative performance (*B* = .28, *z* = 11.38, *p* < .001, β = .58), task performance (*B* = .23, *z* = 7.13, *p* < .001, β = .47), and contextual performance (*B* = .18, *z* = 7.44, *p* < .001, β = .44). Work engagement and job crafting completely mediated the effect of psychological safety on contextual performance (*B* = 1.03, *z* = 9.24, *p* < .001, β = 1.22) and on task performance (*B* = 1.05, *z* = 8.47, *p* < .001, β = 1.10), but the effect on creative performance was fully mediated only by work engagement (*B* = 1.08, *z* = 9.04, *p* < .001, β = 1.17).

Discussion

The present research had two objectives. First of all, we investigated the relationship between psychological safety and three types of performance: task performance, contextual performance, and creative performance. Secondly, we tested the serial mediation effect of work engagement and job crafting in the relationship between psychological safety and the three types of performance. Psychological safety was positively associated with contextual performance and job crafting. This finding is in line with the theoretical assumptions and the previous studies indicating positive links between psychological safety and performance (Frazier et al., 2017) and job crafting (Lee, 2022; Plomp et al., 2019). Similar results were also obtained by the practitioners from Google's People Analytics Unit; in their analysis, psychological safety was the most important factor in predicting the performance of the teams (Bergmann & Schaeppi, 2016). Contrary to our expectations and previous findings, psychological safety was not related with task and creative performance. Previous reviews on psychological safety indicated that its effects are conditioned by certain factors. The links between psychological safety and its outcomes are weaker in an uncertainty-avoidance culture, but this moderating effect was not found for citizenship behaviors (Frazier et al., 2017). Therefore, the lack of relationships with task and creative performance in this study may be due to the sample consisting of employees from a single company that could have a culture based on uncertainty avoidance.

In line with previous meta-analytical findings (Christian, Garza, & Slaughter, 2011; Rudolph et al., 2017), work engagement was positively related with job crafting and all three forms of performance and job crafting was associated with task, contextual, and creative performance. Work engagement and job crafting mediated the links between psychological safety and performance. This result is in accordance with a previous study, in which job crafting was a mediator in the relationship between psychological safety and performance (Lee, 2022). The mediating effects identified in the present study contribute to a deeper understanding of how psychological safety leads to positive consequences for organizations. Most previous studies highlighted as explanatory mechanisms only variables related to learning: individual learning behaviors (e.g., offering and seeking feedback, discussing errors, suggesting new ideas) (Edmondson, 1999), exploratory learning, exploitative learning (Kostopoulos & Bozionelos, 2011), and team learning behaviors (Kim et al., 2020). Therefore, the current research highlights additional explanations for the positive effects of psychological safety.

Theoretical and Practical Implications

In their literature review, Newman and colleagues (2017) argued that future studies should use the COR theory (2001) to provide a more in-depth understanding of the mechanisms through which psychological

safety influences workplace outcomes. They suggested that this theoretical framework can explain how workplace resources lead to the emergence of a climate of safety and how psychological safety positively influences performance and well-being at work. The current study contributes to the development of theory in the field by following these suggestions and offering an explanatory mechanism in the relationship between psychological safety and three types of performance (task, contextual, and creative). Based on COR theory (Hobfoll, 1989) and the JD-R model (Bakker, 2015), we argued that psychological safety is an important resource in the workplace. When employees feel that they are working in a safe environment, they will be more engaged in work and will seek to create more resources through job crafting. Finally, the resources accumulated through job crafting behaviors will be used by employees to have a higher performance. Previous studies also support the mediating role of engagement and job crafting in the psychological safety-performance relationship (Idris et al., 2015; Lee, 2022). Identifying this motivational process is a step forward in understanding the mediating mechanisms that explain the relationship between psychological safety and performance.

From a practical perspective, by implementing strategies to foster psychological safety, organizations can reap numerous benefits, including increased employees' work engagement and a higher frequency of job crafting behaviors, ultimately leading to enhanced performance. Kolbe and colleagues (2020) recommended a series of explicit strategies (e.g., transparency, clarifying expectations, inviting feedback, offering support, paraphrasing) and implicit strategies (e.g., confidentiality, positive regard, empathy, listening, circular seating) for improving psychological safety at work. Managers can learn to use these strategies in training programs delivered by practitioners from the field of industrial-organizational psychology. By providing a supportive and secure environment, organizations can promote psychological safety, enabling their employees to effectively allocate and protect their resources, leading to improved job performance and overall organizational success. At the organizational level, an organizational culture based on psychological safety can be promoted, in order to increase work engagement and stimulate job crafting behaviors. At the managerial level, leadership development programs can include specific recommendations for increasing psychological safety among teams. At the individual level, psychoeducational interventions can be carried out to raise awareness of the importance of psychological safety and to encourage the improvement of the workplace climate.

Limitations and Future Directions

This study has a series of limitations. First, being cross-sectional, this research capture data at a single point in time, therefore it is not possible to establish causal relationships between variables. Future longitudinal studies can provide a more comprehensive understanding of how variables change over time and of causal relationships. Secondly, the data were collected through self-report questionnaires, so the study has a number of vulnerabilities (e.g., common method bias, desirability bias). By using multiple sources of data collection in future studies, researchers can avoid these vulnerabilities. Thirdly, the current study was based on the assumption of linearity in the relationship between the studied variables. However, in a recent research, the relationship between psychological safety and performance was curvilinear; a moderate level of psychological safety was associated with the highest performance (Eldor et al., 2023). Future studies could explore the curvilinear relationship between psychological safety and the three types of performance in order to highlight the possible negative consequences of 'too much' psychological safety. Also, the low internal consistency for the measurements of the two variables (i.e., psychological safety and absorption) could represent a vulnerability of the study by raising concerns regarding the reliability of these measurements. Finally, the effect of psychological safety on performance can be moderated by different variables. Therefore, future studies could test the moderating role of different variables in the

relationship between psychological safety and the three types of performance.

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RESEARCH ARTICLE

The Relationship between General Mental Ability and Workplace Deviance

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Abstract

General Mental Ability (GMA) refers to an individual's capability to reason, plan, solve problems, and comprehend complex ideas. In the context of work and organizational psychology, GMA is one of the best predictors of overall job performance, and especially task and contextual performance. However, the relationship between GMA and a third dimension of overall job performance, workplace deviance, remains inconclusive and under-researched. We investigated this hypothesis using a sample of 391 individuals from various occupational fields. Using novel Bayesian cumulative link mixed effects models, our results show that even after controlling for all Five-Factor Model factors, GMA has a significant, yet weak effect on workplace deviant behavior. Our findings emphasize the need for a more comprehensive exploration of the influence of GMA across diverse occupational sectors to fully understand its impact on workplace behavior.

Keywords

GMA, Intelligence, Workplace Deviance, Personality, Performance

General Mental Ability (GMA), or general intelligence, is a "...capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience" (Gottfredson, 1997, p. 13). GMA has been linked to a series of favorable outcomes from various life domains, such as higher literacy levels, better general physical health, and lower odds of unemployment. Within the realm of work and organizational psychology, GMA has been recognized alongside work samples as the most stable predictor of overall job performance (e.g., Schmidt & Hunter, 2004) and of some of its dimensions, namely, task performance ($\hat{\rho}$ = .69, Schmidt et al., 2008) and Organizational Citizenship Behaviors (OCB, $\hat{\rho}$ = .23, Gonzalez-Mulé et al., 2014).

The influence of GMA on the remaining domain of job performance - Workplace Deviant Behaviors (WD) - remains a subject of ongoing research. For example, previous research has assumed a negative correlation due to the potential inhibitory effects of GMA on WD According to this argument, high-GMA individuals can reason better, learn faster, and also possess enough foresight to evaluate the consequences of their actions, which makes them less likely to engage in counterproductive or deviant behaviors. Empirical evidence to date has been less than

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conclusive. In particular, early meta-analytic efforts showed a near-zero effect size for the relationship between GMA and WD ($\hat{\rho}$ = -.02, Gonzalez-Mulé et al., 2014).

However, these meta-analytic efforts were weakened by the state of the literature. For example, military and police samples accounted for over half of the available correlations. As these occupations are characterized by unique, stringent rule enforcement and high-integrity selection criteria, the relatively low remaining number of observations from other occupational sectors leaves a *de-facto* population gap in research (Robinson et al., 2011). In such high-integrity settings, the strict enforcement of rules may naturally lead to lower incidences of WDB, potentially causing a range restriction in the WDB variable itself. This situation suggests that the findings of the meta-analysis, heavily based on these sectors, might not fully represent the variations in WDB that occur in less regulated environments. Consequently, the generalizability of the relationship between GMA and WDB as observed in these contexts might be limited. To underscore the importance of this issue, we point to the fact that more recent research links overqualified workers (GMA proxy) to WD risk (Fine & Edward, 2017), while other studies (Cuadrado et al., 2021) show that GMA is indeed related to Counterproductive Academic Behavior (CAB), such as cheating or plagiarism (ρ = .19).

It is clear that our understanding of the role of GMA in work performance, particularly in relation to counterproductive or deviant behaviors, is far from complete. More primary studies, encompassing a wider range of occupational sectors, are needed to further elucidate these relationships. The current scarcity is evidenced by the latest two meta-analyses on workplace deviant behavior, where neither Liao et al. (2021), nor Mackey et al. (2021) have included GMA in the analysis.

In this paper we contribute to solving this gap in two ways: first, by providing further data on the subject and second, by analyzing the data using a modern approach, namely, Bayesian cumulative link mixed effects models (CLMMs), an approach that avoids distorted estimates, a risk inherent in the way ordinal data has been treated until now (Liddell & Kruschke, 2018; Taylor et al., 2022).

General Mental Ability and Workplace Deviant Behavior

Defined as "...voluntary behavior that violates significant organizational norms and, in so doing, threatens the well-being of the organization or its members, or both" (Bennett & Robinson, 2000), workplace deviance (WD) has a longstanding tradition in organizational research, perhaps due to the high economic and moral costs that are associated with it (Bennett et al., 2018). From a theoretical perspective, WD is a part of the larger umbrella term of Counterproductive Work Behaviors (CWB) that includes behavioral sets such as bullying or retaliatory actions (Mackey et al., 2021). In this respect, workplace deviance is unique because it involves actions that violate organizational norms, meaning they are behaviors that are uncommon and frowned upon (Thrasher et al., 2020). For example, WD includes acts such as stealing from colleagues, falsifying receipts for personal gain, or using illegal drugs or consuming alcohol on the job. Predicting workplace deviance has obvious upside potential in applied psychology, with general mental ability being a strong candidate, due to its powerful predictive capacity on overall job performance.

Historically, initial queries into the relationship between GMA and WD originate from an attempt to generalize findings from criminological literature to job-related deviance (e.g., Marcus et al., 2009). The main reasoning lines used to link general mental ability to lower levels of norm violating behavior generally revolve around the inhibitory effects of GMA on deviant behavior. For example, it is argued that high-GMA individuals can better reason, learn, and evaluate the consequences of their actions, which makes them less likely to engage in deviant behaviors. Furthermore, people low in reasoning abilities may take more risks and engage in behaviors that more intelligent

individuals would avoid due to their ability to anticipate negative long-term consequences (Dilchert et al., 2007). However, empirical evidence shows a non-significant link ($\hat{\rho}$ = -.02, Gonzalez-Mulé et al., 2014). There are several interpretations that might explain the observed null effect.

First, range restriction can significantly impact primary studies that are developed in this domain. Participants in these studies are employees, i.e., one has to be an employee before being eligible to participate in a study on workplace deviance. Having a job is therefore a gateway to the study, but having a job is also associated with higher GMA than not having one. This means that these workplace studies systematically exclude people with lower GMA - and in turn the same reasoning explains why criminology studies do find one: this particular audience is not excluded from studies with inmates as participants.

Second, as already noted, the quality and characteristics of the primary studies will always shape the conclusions of a meta-analysis. Gonzales-Mulé et. al (2014) meta-analysis contains about 30 correlations, and more than half of them are based on military and police samples, i.e., samples coming from environments where deviant behavior is severely punished and integrity tests and other connected overt and covert indicators are used both as part of the selection process and for workplace monitoring.

Furthermore, the Gonzales-Mulé et. al (2014) paper appears to have significantly influenced the research trajectory on the topic. Following its publication, we observed a notable decline in subsequent studies in this area, with only two exceptions identified. Fine and Edward (2017) investigated the counterproductive work behaviors of overqualified employees; this study has limitations for the present topic because over-qualification was measured strictly in terms of GMA (which is actually a proxy for over-qualification and not a direct indicator), and because the related job requirements were identical (i.e., all participants were employed in the same job). The results of this study showed small or no effects of the investigated relationship (see p. 403). Fine et. al. (2015) also investigated our focal relationship on a military sample, again (as probably expected) with no significant effects. At the same time, indirect evidence points to a stronger relationship than the zero or almost-zero effect reported in these studies: For example, Cuadrado and his colleagues (2021), in his meta-analysis on academic deviance pointed out that lower GMA is significantly associated with academic deviance.

Personality and Workplace Deviant Behavior

The link between personality traits and workplace deviance is stronger and much better documented than the GMA-deviance relationship. In fact, a number of both broad and narrow personality traits are among the best predictors in the domain of individual differences that were ever found for deviant behaviors (cf. Dilchert et al., 2007). When focusing on broad personality traits, components of the Big Five model, like conscientiousness and agreeableness were found to be (negatively) related to CWB, and albeit with a lower strength emotional stability has also been highlighted (Barrick et al., 2003; Berry et al., 2007; Penney et al., 2011). In the same area of broad personality traits, core-self evaluations (CSE), a broad but fundamental personality domain that is a compound of the narrow traits of self-esteem, generalized self-efficacy, neuroticism, and locus of control, have also been linked (negatively) to CWB (Chang et al., 2012). Turning to narrow personality traits, several variables were associated with CWB: all three components of the dark triad of personality (i.e., machiavellism, narcissism, and psychopathy; O'Boyle et al., 2011), self-control (Tangney et al., 2004), locus of control (O'Brian & Allen, 2008; Spector, 1988) and others.

Methods

General Procedure and Sample Recruitment

Participants

The data was collected online with the help of a survey company, that operates a large panel of participants in Romania. The sample drawn

comprises 391 individuals, with an average age of M = 33.70 and with a standard deviation (SD) of 5.68. The sample is balanced in terms of gender distribution, including a number of 216 (55%) male participants, with the remaining 175 (45%), female.

Scales and Instruments

General Mental Ability

General mental ability was measured with the General Ability measure for Adults (GAMA, Naglieri & Bardos, 1997). The GAMA is a 66-items, self-administered, timed (25 minutes) test that uses nonverbal items grouped into four templates (matching, analogies, sequences, construction), and is scored based on the tenets of Classical Test Theory: each item provides an unweighted contribution (0 or 1) to the raw total score. The raw total score is then transformed into a standardized score based on age-specific norms. Psychometric data such as reliability and validity evidence for GAMA is presented by Iliescu & Livinti (2008), Ispas et al. (2010), and Naglieri & Bardos (1997). For the present study, the split-half reliability of the GAMA is .89.

Workplace Deviant Behavior

WDB was measured using the questionnaire developed by Bennett and Robinson (2000). The instrument measures a wide range of workplace deviant behaviors from taking property from work without permission to discussing confidential company information with unauthorized individuals, using 19 items. Examples are: "Told someone about the lousy place where you work" or "Made an ethnic, religious, or racial remark or joke at work. Responses were collected on a 7-point frequency scale, ranging from 1 = "daily" to 7 = "never". The full scale had $M = 2.38$, $SD = 0.94$, and $\alpha = .92$.

Personality Measures

The five domains of the Five-Factor Model, i.e., Neuroticism, Extraversion, Openness, Agreeableness and Conscientiousness were measured with the NEO-FFI (Costa & McCrae, 1992). The NEO-FFI is a 60-item questionnaire measuring each of the five domains with 12 items on a 5-point Likert response scale from 1 = "strongly disagree" to 5 = "strongly agree". The internal consistency of the five personality scores (N, E, O, A, and C) was .86, .76, .76, .75 and .74 respectively.

Data Analysis

While ordinal data, such as Likert scales, are modeled in routine fashion using metric models, this choice is ultimately inappropriate since it is prone to consistently produce Type I and II errors, even to the point of systematic effect inversions (Liddell & Kruschke, 2018). To address these issues, we analyzed the data using Bayesian cumulative link mixed effects models (CLMMs). These account for the unequal psychological distances between response categories, respect the discreteness of ratings or accommodates easily for non-normal information (Bürkner & Vuorre, 2019), while increasing accuracy of the estimated parameters by accounting for subject and item variability. Furthermore, Bayesian inference was preferred over the frequentist implementation since it offers a complete posterior distribution of the parameters of interest and therefore quantifies uncertainty more naturally (McElreath, 2020), is more flexible and will perform very well even in small or moderate sample sizes (Liddell & Kruschke, 2018) that are pervasive in psychological science.

Results

The analysis was run under R, version 4.3.1 (R Core Team, 2023) and RStudio (version 2023.06.0). The models were fit and analyzed using *rstan* for Markov Chain Monte Carlo probability sampling (Stan Development Team, 2018) interfaced with *brms* (version 2.17.0, Bürkner, 2018). Tidyverse implementations drew inspiration from the work of Kurz (Kurz, 2022) and the reporting follows the Bayesian Analysis Reporting Guidelines (BARG, Kruschke, 2021) as well as the recommendations by Veríssimo (2021).

For the CLMM, we standardized the predictors, and we initialized four chains for each parameter, with a total of 8000 steps with a burn-in of 2000, the rest being saved. Chain convergence was observed (*potential scale*

reduction factor; $\hat{R}$ = 1), with good stationarity, overlapped and well mixed, representative of the posterior distributions. For all β parameters we used a weakly-regularizing – N(0, 1) – prior and for the second level σ an Exponential(1) was applied. The priors for the thresholds were set at equally distributed probability mass points on the latent continuous distribution. The full model containing the likelihood, priors, by item and by person varying intercept is:

$$p(\text{rating} = k | \{\tau_k\}, \mu_{ij}) = \Phi(\tau_k - \mu_{ij}) - \Phi(\tau_{k-1} - \mu_{ij})$$

$$\mu_{ij} = b_0 + b_{1\text{O}_{ij}} + b_{2\text{C}_{ij}} + b_{3\text{E}_{ij}} + b_{4\text{A}_{ij}} + b_{5\text{N}_{ij}} + b_{6\text{GMA}_{ij}} + u_i + v_j$$

$$\tau_1 \sim \mathcal{N}(-1.07, 1)$$

$$\tau_2 \sim \mathcal{N}(-0.57, 1)$$

$$\tau_3 \sim \mathcal{N}(-0.18, 1)$$

$$\tau_4 \sim \mathcal{N}(0.18, 1)$$

$$\tau_5 \sim \mathcal{N}(0.57, 1)$$

$$\tau_6 \sim \mathcal{N}(1.07, 1)$$

$$b_0, b_1, b_2, b_3, b_4, b_5, b_6 \sim \mathcal{N}(0, 1)$$

$$u_i, v_j \sim \mathcal{N}(0, \sigma_u)$$

$$\sigma_u, \sigma_v \sim \mathcal{E}xp(1)$$

While Table 1 reports means, dispersion data and frequentist Pearson correlations for each variable of interest, Table 2 presents the summary information on the posterior distributions of the mixed-effect threshold cumulative model predicting response categories as a function of the FFM and GMA data. Further information regarding model specification and diagnostics (chain information, auto-correlation plots) or posterior-predictive checks are also included in the ESM.

First, the results show that the effect of FFM on Workplace Deviance varies in significance depending on the dimension, but remains overall weak, with the slope for Conscientiousness, β = -.16, 89% CrI[-.25, -.07], and for Agreeableness, β = -0.12, 89% CrI[-.21, -.03]. These coefficients are a bit smaller, but in line with previous meta-analytic reports on FFM and deviant behavior in the workplace (e.g., Thrasher et al., 2020). Two other FFM factors, Extraversion, β = -.04, 89% CrI[-.12, .04] and Neuroticism, β = .03, 89% CrI[-.08, .13], have posterior θ distributions that fall almost completely within the Region Of Practical Equivalence with 91% and 87% respectively (ROPE set at -.1 to .1 *SD*, Kruschke & Liddell, 2018). As such, they are not significant, however we cannot safely accept the null due to the remaining uncertainty. Interestingly, FFM-Openness shows a small, positive effect with a β of .15, 89% CrI[.07, .24]. As for the central variable of interest of this study, the effect of GMA has a probability of 100 [*pd*] of being negative (Median= -.22, 89% CrI[-.29, -.14]), and can be considered to be small and significant (with 0% in ROPE). Figure1 shows the effect of GMA on self-rated response categories of WD. At lower levels of GMA, all response categories from the WD scale seem to be almost equally probable. However, as GMA increases there is also a steady increase in the probability of observing a "Never" response, while there is a slow decline in the other categories. As GMA passes the +1*SD* mark, "Never" becomes more likely to be observed.

Table 1. *Means, Standard Deviations, and Frequentist Pearson Correlations for the Variables of Interest*

	M	SD	1	2	3	4	5	6
1. Openness	35.70	7.73						
2. Conscientiousness	48.27	5.93	.07					
2. Extraversion	44.66	6.70	.28**	.26**				
4. Agreeableness	40.60	7.25	.05	.25**	.17**			
5. Neuroticism	33.03	9.80	.24**	-.52**	-.17**	-.51**		
6. GMA	104.06	10.41	.02	.05	.04	.09+	-.06	
7. WD	2.38	0.94	.17**	-.24**	-.07	-.19**	.25**	-.24**

Note. N = 391. M and SD are used to represent mean and standard deviation, respectively. WD = Workplace Deviance Behaviors. GMA = General Mental Ability. + indicates $p < .10$. * indicates $p < .05$. ** indicates $p < .01$.

Table 2. *Posterior Summary, Parameter Decision and Convergence Statistics for the Described Model, Fixed Effects Only*

		HDI					
Parameter	Median	lower	upper	*pd*	% in ROPE	$\hat{R}$	*ESS*
Threshold[1]	-.41	-.64	-.21	1.00	0%	1.00	1,997
Threshold[2]	.36	.13	.56	.99	1.4%	1.00	2,004
Threshold[3]	.85	.61	1.05	1.00	0%	1.00	2,006
Threshold[4]	1.65	1.42	1.85	1.00	0%	1.00	2,033
Threshold[5]	2.26	2.03	2.47	1.00	0%	1.00	2,059
Threshold[6]	2.97	2.73	3.19	1.00	0%	1.00	2,239
Openness	.15	.07	.24	1.00	14.6%	1.00	2,356
Conscientiousness	-.16	-.25	-.07	1.00	10.6%	1.00	2,409
Extraversion	-.04	-.12	.04	.78	90.6%	1.00	2,333
Agreeableness	-.12	-.21	-.03	.98	33.0%	1.00	2,551
Neuroticism	.03	-.08	.13	.66	87.2%	1.00	2,193
GMA	-.22	-.29	-.14	1.00	0%	1.00	2,755

Note. Median = Posterior median; HDI = 89% highest density interval with lower and upper bounds; pd = Probability of Direction; Region of practical equivalence (ROPE) range = -.01 to 0.1 SD; % in ROPE = Percent of the highest density interval within ROPE; ESS = Effective sample size; $\hat{R}$ = Gelman-Rubin Statistic.

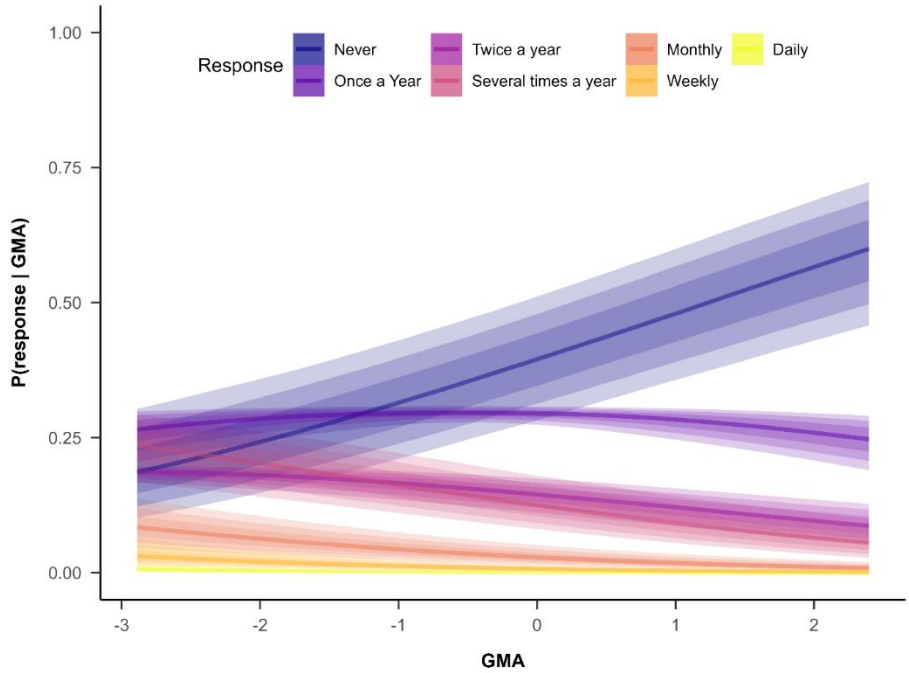

Figure 1. Effect of GMA on self-rated Workplace Deviant Behavior. The plot indicates separate predictions for each response category. Transparent bands indicate 50, 75 and 89% credible intervals.

Discussion

The main objective of the current paper was to bring further empirical evidence for the nuanced relationship between General Mental Ability (GMA) and tendencies for deviant behavior in the workplace. This relationship has seen dormant interest in the existing literature of organizational psychology. The last comprehensive meta-analysis on this topic was conducted almost a decade ago (Gonzalez-Mulé et al., 2014) and while its findings showed a non-significant relationship, a substantial gap still persists in the literature offering avenues for further research.

For example, previous studies relied heavily on samples from military and police sectors, where deviant behavior is strictly penalized, monitored and controlled for, possibly suppressing the true relationship between GMA and WD. While the sample homogeneity hypothesis (Marcus et al., 2009), suggests GMA will be a better predictor of WD in occupationally homogenous groups, this is due to better control of the confounding variables. However, the specific nature of military and law enforcement jobs might suppress this effect.

Our findings contribute to this complexity by revealing a nuanced relationship between GMA and workplace deviance, suggesting a departure from the conclusions drawn in the Gonzales meta-analysis. For example, the meta-analysis conducted by Cuadrado (2021) reveals a significant negative correlation between lower GMA and Counterproductive Academic Behaviors such as cheating, plagiarism, or deception, with the reported effects sizes being in the same range as our results ($\hat{\rho}$ = -.19).

Our study started on the assumption that the GMA effect will be more likely to be observable in samples outside the military/police domain and the results of this research provide further supporting evidence for this assertion. Indeed, our data shows that, when accounting for personality factors (notably Conscientiousness and Agreeableness – the two best personality

based predictors of deviant behavior; Thrasher et al., 2020) GMA has a small, yet non-zero and significant effect on workplace deviance. Together with the results obtained by Cuadrado (2021), our findings suggest that this this research avenue should not yet be discarded.

In addition to the sample homogeneity hypothesis, the source of the ratings for workplace deviance might also play a moderating role. For example, in the aforementioned law-enforcement and military samples, deviance was measured predominantly using supervisory ratings. Despite the apparent benefits, measuring deviant behavior through supervisory ratings is not without drawbacks. For example the notion that supervisors have the observational opportunity for certain workplace deviant behaviors was challenged (Chan, 2009), because instances of workplace deviance are likely to happen when supervisors are absent (e.g., stealing or acts of aggression). Therefore, data obtained from supervisors may be a deficient representation of deviant behaviors in the workplace (Harris & Schaubroeck, 1988).

Just as is the case of Organizational Citizenship Behavior (Gunnesch-Luca & Moser, 2020), it is generally perceived that individuals are the most reliable sources for reporting the frequency of their own deviant behaviors, since they have firsthand knowledge of their actions, especially those that go unnoticed by others. This perspective is also backed by the Gonzales meta-analysis that revealed that people often admit to participating in more counterproductive behaviors than what is reported by observers.

Another possible factor that might come into play when using self-reports is that individuals high in GMA may be inclined to under-report their own deviant behavior. This may be because they are more capable of anticipating the adverse repercussions of confessing to such actions. In turn, this might accentuate the negative correlation between GMA and WD in self-reported instances compared to data obtained from other sources.

Yet another strength of this paper is the use of Bayesian cumulative link mixed effects models. The consequences of using metric methods for fitting ordinal data can be a serious issue, even to the point of threatening inferential validity (Liddell & Kruschke, 2018). Using ordinal models, we mitigate these problems by accounting for unequal psychological distances between responses and the discreteness of the answers, thereby providing unbiased estimates for the parameter of interest.

While our study has limitations, one of which is the heterogeneity of participants' jobs, this aspect also emerges as a significant strength. Initially, the varied job types among participants might seem to introduce variability that could challenge the uniformity of the findings. However, this diversity actually enhances the generalizability aof our results. Unlike studies that focus narrowly on specific sectors like law enforcement and military organizations, our diverse sample allows for a broader exploration and understanding of the relationship between General Mental Ability (GMA) and Workplace Deviance (WD) across different occupational settings. This approach provides valuable insights into how this relationship manifests in a wider range of work environments, offering a more comprehensive perspective for future research.

Second, it would have been ideal for workplace deviance indicators to be collected both in self-report and supervisor-reported manner; a triangulation of such a kind would have possibly given a glimpse into how our predictors converge or diverge with the "deviance" variable depending on its measurement.

Third, as previously commented in several instances, investigations into deviance and other similar constructs that have very low endorsement rates may be better suited to intensive studies of criterion-positive samples, i.e., samples containing individuals who, based on objective indicators, are known to have exhibited deviance in the workplace. This solves one of the major issues in our study, i.e., the very low endorsement rate of deviance items - the from a theoretical range of 1-7, the mean endorsement has been $M = 2.38$ ($SD = .94$), which makes the criterion barely notable and also contributes heavily to range restriction, which in turn may

artificially hide a potentially stronger relationship.

Despite these limitations, we consider the results of this study interesting and timely, coming after a decade-long gap in research dedicated to the relationship between two important variables: GMA, the most important predictor of workplace performance and WD, a fascinating and critical workplace performance criterion.

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RESEARCH ARTICLE

Crafting Flow: The Role of Acting Extraverted, Conscientious, and Emotionally Stable

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Abstract

The present study aimed to investigate experimentally how flow, as a state, is influenced by inducing behaviors specific to conscientiousness, extraversion, and emotional stability in daily activities for ten days. Informed by prior research, an intervention was developed, requiring participants to adopt behaviors associated with these three dimensions. The methodology used was to randomize participants into two groups, one group benefiting from intervention and the other being a control group. Initial measurements were taken using a dispositional flow scale and a personality inventory. Subsequently, a flow state scale was applied on the 4th, 7th, and 10th days. The main findings indicated a significant increase in the flow of experience and subjective happiness for the experimental group compared to the control group. The study's conclusions suggest that it is possible to act more extraverted, conscientious, and emotionally stable in daily life, and doing so can potentially lead to an enhancement in the flow state. We discussed the practical implications in organizations.

Keywords

flow state, subjective happiness, personality, extraversion, conscientiousness, emotional stability

1. Introduction

Over time, we have noticed an increase in studies in the literature that analyze concepts such as happiness, well-being, or life satisfaction. In line with this trend, our study aims to enhance individuals' happiness by providing them with a way to introduce 'flow' into their daily experiences. How can we find fulfillment that is not contingent upon and should not be strengthened by additional extrinsic motivation? Studies in the field have highlighted several key elements characterizing the flow state. These include self-forgetfulness or forgetting personal worries, intense concentration, clear goals, immediate feedback, and a distorted sense of time, control, and pleasure (Csikszentmihalyi, 2008). Flow state also requires a balance between challenges and skills. The person can become anxious if the challenge goes far beyond the ability. Boredom can be installed if the ability surpasses the challenge (Nakamura & Csikszentmihalyi, 2014). In other words, as illustrated by Csikszentmihalyi (2008), flow can be

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described as what a painter feels when he paints, what an athlete feels in a competition, and what a musician feels when he composes. A specialized interpretation focusing on flow within the workplace has been formulated. Because flow is experienced more during working time than in leisure time, it is essential to invest time and energy to experience flow at work (Bakker, 2008).

Expanding upon the multi-faceted understanding of flow, a more nuanced exploration of its relationship with happiness is paramount. The literature in positive psychology acknowledges a connection between flow states and happiness, but empirical findings confirm that they are not mutually inclusive experiences (Engeser et al., 2023; Tappolet, 2022). This aligns with Csikszentmihalyi's (2008) predictions, indicating that the attainment of a flow state precedes the experience of happiness. Thus, initial engagement in flow can serve as a launchpad for individuals to enhance their happiness levels.

Given that initiating engagement in flow can serve as a potent launching pad for heightening levels of happiness, a universal aspiration, it becomes crucial to explore in depth the underlying mechanisms and attributes of the flow experience. Indeed, the prospect of having such a valuable resource at one's disposal raises pivotal questions: Who can readily access this launching pad to happiness? What are the prerequisites enabling individuals to harness this state at will? The exploration of these queries necessitates a deeper look into the mechanisms and characteristics intrinsic to the flow experience, as outlined by the theory of optimal experience. This theory, grounded in Csikszentmihalyi's (1990) concept of flow, posits that an individual who feels in control during an activity attains a state of intense concentration and can set clear goals and forget about personal worries, is likely experiencing a state of flow at that moment. It also stipulates that while the experience of flow appears to be a universal phenomenon, its occurrence varies from one individual to another. The flow quality or intensity may vary as well (Asakawa, 2010; Csikszentmihalyi & Csikszentmihalyi, 1992, 2008; Moneta, 2004; Nakamura & Csikszentmihalyi, 2014). Given this variation, Csikszentmihalyi (1990) notes that there are individuals who can find enjoyment and satisfaction even in challenging situations, terming them as having an "autotelic personality". But beyond personality traits, considered stable, experiencing flow also takes into account the conscious effort made to experience more flow (Csikszentmihalyi, 1990). But how stable these personality traits really are? What about the moments when the same person behaves totally differently in two similar moments? Here arises the problem of the differentiation between personality traits and personality state. If the first is considered more stable over time, the second can be influenced more easily and depends on the effort and desire of the person. However, the principle of state–trait isomorphism argues that states share many properties and consequences with traits. Moreover, the same principle holds that a trait mainly comprises states and that state changes can lead to traits over time (Fleeson et al., 2002).

Early studies in the literature initially conceptualized the autotelic personality by associating it with specific attributes, including curiosity, persistence, low self-centeredness, intrinsic motivation, enjoyment of challenges, and attentional control (Csikszentmihalyi et al., 1993; Nakamura & Csikszentmihalyi, 2002). Building on these initial studies, subsequent studies tried to capture the autotelic personality through the lens of more well-known and extensively studied models, such as the Big Five model (Costa & McCrae, 1992). This model postulates the existence of five core personality dimensions or traits—openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (or emotional stability) — and suggests that individuals can be positioned along a spectrum for each of these traits (Costa & McCrae, 1992).

Analyzing the literature, it seems that personality traits are related to the flow state. Neuroticism tends to be negatively associated with the flow state, as negative emotions can disrupt its components (Ullén et al., 2012; Ross & Keiser, 2014; Vorkapić & Gović, 2016). In contrast, conscientiousness is

positively linked to experiencing flow, with individuals high in conscientiousness being more likely to dedicate time to flow-generating activities and excel in mastering challenging tasks (Ullén et al., 2012; Ross & Keiser, 2014; Vorkapić & Gović, 2016). Extraversion is also positively related to flow state, the positive affect component central to experiencing the extraversion (Ross & Keiser, 2014). A low level of neuroticism and increased conscientiousness, followed by increased extraversion, produced the greatest effects in experiencing flow (Ross & Keiser, 2014). As an exception, in addition to extraversion, consciousness, and neuroticism, Tatalović Vorkapić and Gović (2016) found a positive relationship between flow and openness to experience. Also, a recent meta-analysis that analyzed the connection between personality and flow at work identified an association between flow at work with conscientiousness, openness to experience, and extraversion but not with neuroticism (Liu et al., 2023). A possible explanation is the conceptual difference between flow state and flow at work. To summarize, the consistent finding across most studies is a relationship between the state of flow and three of the Big Five dimensions, namely extraversion, conscientiousness, and emotional stability.

Starting from the studies mentioned above and from the idea that beyond the elements related to personality, the flow experience is also about the effort made, we wonder if a person can adopt behavioral manifestations following certain personality traits. Understanding how personality traits manifest in everyday behavior is essential for the present study. Studies in the literature have investigated the behavioral manifestations of several personality traits, including the Big Five traits (Funder & Sneed, 1993; Margolis & Lyubomirsky, 2019). For example, a behavioral manifestation for extroverts is that they are often seen in group settings and are comfortable in such environments (Funder & Sneed, 1993). The literature on positive psychology showed that well-being, positive affects, and flow can increase if people adopt specific behaviors to extraversion (Jacques-Hamilton et al., 2018; Margolis & Lyubomirsky, 2019) and conscientiousness traits (Margolis & Lyubomirsky, 2019; Stieger et al., 2020; Stieger et al., 2021). These studies conclude that changing the behavior associated with personality is possible and may increase well-being and associated concepts, including flow. More than that, even those who do not possess the traits at the level associated with flow can increase the frequency of experiencing flow if they behave in a way that is consistent with those who do have the levels of traits that facilitate flow.

Moreover, the more effort a person puts in (e.g., adopting more behavioral manifestations specific to extraversion, conscientiousness, and emotional stability), the more chances he has to internalize the respective traits (Fleeson et al., 2002). Also, using several measurements during the intervention, we can observe how the behavioral change occurs regarding the three analyzed personality traits. Usually, it takes time for someone to act differently or to implement other behaviors than those they are used to. It can vary significantly depending on several factors, including the complexity of the behavior, the individual's motivation, the resources available, and their level of commitment to the activity. It is also important to note that behavior change is gradual and not always linear (Grimley et al., 1994). Various behavior change models, such as the trans-theoretical change model, suggest that individuals go through stages when changing behavior, including pre-contemplation, contemplation, preparation, action, and maintenance. The time spent in each stage can vary widely (Prochaska & DiClemente, 1983). Studies from the literature that addressed the induction of certain personality-specific manifestations and analyzed the impact on well-being also used at least one week (Jacques-Hamilton et al., 2018; Margolis & Lyubomirsky, 2019).

Building upon the foundational work of previous studies and identifying avenues for refinement, our study makes notable advancements by incorporating comprehensive instructions complete with examples of behaviors or activities for participants to follow. For instance, while studies like Margolis and Lyubomirsky (2019) have primarily encouraged participants to embrace talkativeness, assertiveness, or spontaneity, our approach delves deeper, capturing the entire scope of extraversion. By

embracing detailed instructions that consider all six facets of the concept, we not only provide clearer guidance to participants but also potentially pave the way for realizing more substantial effects.

Taking into account the literature studies previously mentioned, we can say that there is a relationship between personality traits, such as extraversion, conscientiousness, and emotional stability, and the state of flow (Ullén et al., 2012; Ross & Keiser, 2014; Vorkapić & Gović, 2016). Also, the studies by Margolis and Lyubomirsky (2019) and by Stieger et al. (2020, 2021) have shown that behavioral manifestations of several personality traits are possible and lead to an increased state of flow, which over time leads to an increase in general happiness (Engeser et al., 2023; Tappolet, 2022). Thus, based on experimental design, this study adds empirical evidence about the causal relationships between behavioral aspects of personality traits and experiencing the flow, based on behavioral change intervention.

2. The present study

Addressing noted gaps and extending the literature, the present study brings forward the following: Firstly, we investigate the relationship between personality traits (extraversion, neuroticism, and conscientiousness) and flow state, reinforcing the existing studies (Ullén et al., 2012; Ross & Keiser, 2014; Heller et al., 2015; Tse et al., 2021). Secondly, we propose an intervention encompassing behavioral manifestations related to increased extraversion, conscientiousness, and decreased neuroticism to examine whether individuals striving to adopt such behaviors experience enhanced flow and subjective happiness in their everyday lives. Using an experimental design, with an experimental group and a control group, we want to test the effectiveness of the intervention. Thirdly, using several measurements during the intervention, we can observe how the behavioral change occurs regarding the three analyzed personality traits. Lastly, we want to investigate if there is a relationship between how much effort the participants put in, how many behavioral manifestations they implement, and the flow level.

Taking into consideration what we mentioned above, we formulate the hypothesis:

H1: The flow state will be higher for the experimental group compared to the control group.

H2: A gradual increase in flow state will be reported during the intervention for the experimental group.

H3: The number of activities performed by the experimental group will positively correlate with the level of flow state.

H4: The subjective happiness reported on day ten will be significantly higher for the experimental group compared to the control group.

3. Method

3.1. Procedure

The study's design is experimental, with a duration of ten days and randomization being present. The present study was carried out through a prior registration in which the participants were notified about the purpose, duration, conduct of the study, confidentiality of data, and benefits obtained from participating in this research. The objective of the study presented to the participants was to investigate how the flow level (the flow representing a state of total involvement in an activity is specific) is influenced by certain behavioral manifestations following certain personality traits. Regarding the duration and conduct of the study, participants were informed that it would take place over ten days and that they have to complete, on specific days, a series of questionnaires and possibly follow particular instructions sent by the researcher. The informed consent also included details on the confidentiality of the data and their use only for research purposes. Also, to stimulate participation in the study, we held a raffle for one shopping voucher worth 200 lei (approx. 40 euros). To win this award, the participants had to take part in all stages of the research during the ten days and then present themselves with the extracted code (code consisting of the initial name and surname, day, and month of birth). At the end

of this form, participants had to give their consent and provide their e-mail addresses to send them the questionnaires and instructions on the following days. Subsequently, the participants were randomized into two groups: experimental and control.

The experimental procedure for the experimental group and the control group took place as follows:

Experimental Group

On the first day, participants were administered a questionnaire to assess the dispositional experience of flow. Subsequently, after a few hours, they received instructions for their behavioral change (See Appendix 1). The participants were told that they had to try to change their behavior and do some activities for the next ten days. The activities were divided into three categories, one for each of the three personality traits, and the participants were guided to do exercises from each type. The intervention was created and adapted to include all 18 facets of the three personality dimensions demonstrated in previous studies that strongly correlate with the flow: increased extraversion, conscientiousness, and low neuroticism. They were described as general advice (e.g., "Be organized"), accompanied by a specific action (e.g., "Plan your activities for the current week, over time intervals").

On days 4, 7, and 10, participants were given a scale to measure the flow state. It was accompanied by a reminder about the need to follow the instructions and a self-report checklist to analyze their activities. The participants were informed that the number of declared activities would not influence their participation in the raffle, and they were encouraged to answer as honestly as possible.

Control group

Participants in the control group were given the questionnaire to assess the dispositional experience of flow but did not receive the intervention. Subsequently, similar to the experimental group, they were given the flow state scale on days 4, 7, and 10 without the reminder or the checklist. The data collection and the transmission of the information related to this study were carried out online (Google Forms and e-mail) without the need to travel to the laboratory.

3.2. Participants

The initial sample consisted of 136 participants. However, 35 participants dropped out, failing to complete the 10-day tasks. The study analyzed data from 101 participants (56 in the experimental group and 45 in the control group), selected from the general population, aged between 18 and 52 years (M = 23.1). Figure 1 presents an experiment overview based on CONSORT Flow Diagram (Moher et al., 2001).

Of these 101 participants, 75 were women (74.3%) and 26 - men (25.7%). The reported environment was 68.3% for urban areas and 31.7% for rural areas. In terms of participants' occupation, most of them were students (87.1%) belonging to 19 different fields of study, followed by a much lower percentage of employees (11.9%) and unemployed (1%).

We calculated using G*Power for a large effect of .80, and this study needs 126 participants (Faul et al., 2009). However, we concluded that a sample size of 101 participants is sufficient to detect medium effect sizes in an ANOVA analysis.

3.3. Measures

Dispositional flow was measured with Dispositional Flow Scale-2 (DFS-2; Jackson & Eklund, 2002). The scale has nine subscales: challenge-ability balance (e.g., "I face challenges, but I think my skills allow me to cope with them."), merging of action and awareness (e.g., "I perform daily tasks correctly without thinking about doing so."), clear goals (e.g., "I know clearly what I want to do."), unambiguous feedback (e.g., "I'm really clear about the level of my daily performance."), concentration on the task at hand (e.g., "My attention is fully focused on what I do."), control sense (e.g., "I have a sense of control over what I do."), loss of self-consciousness (e.g., "I don't care what others might think of me."), transformation of time (e.g., "Time seems to change, either slow down or accelerate.") and autotelic experience (e.g., "I like my daily experiences."). DFS-2

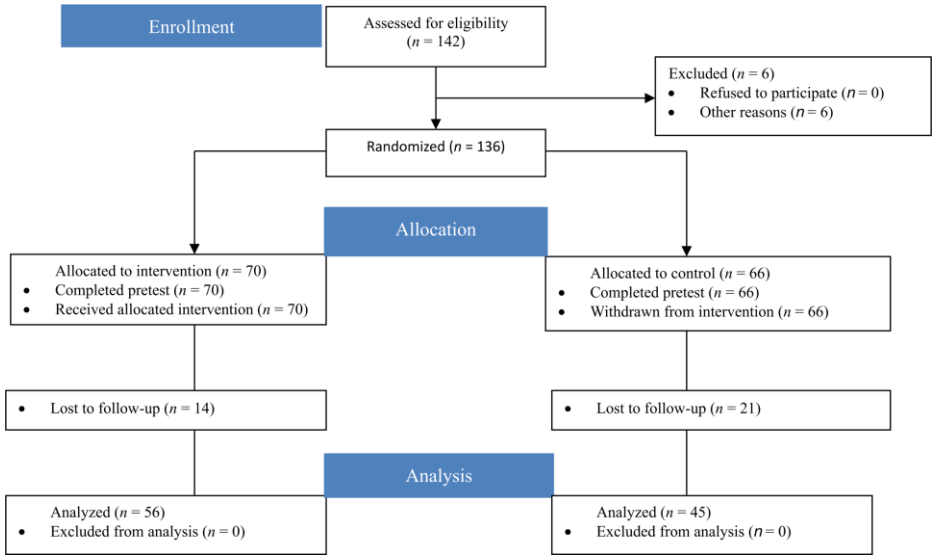

Figure 1. CONSORT Flow Diagram

was typically designed to analyze flow in a particular field of activity, for example, sports, music, or art. However, the scale can be easily adapted to assess general dispositional tendencies, i.e., everyday life (Johnson et al., 2014). In this sense, the scale used in the present study was translated into Romanian and adapted to relate to the daily experience. The scale consists of 36 items, four for each of the nine subscales of flow. The responses were coded using a 5-point Likert scale ranging from 1 - *never* to 5 - *always*, assessing how often respondents experience the flow state. Thus, the overall score of the participants will be in the range of 36 -180. In addition to this overall score, DFS-2 provides a score for each of the nine subscales of the flow. The internal consistency for DFS-2 used in the present study was high (α = .93). Good internal consistency has also been reported for all nine subscales: CSB (α=.75), MAA (α=.68), OG (α=.90), UF (α=.76), CTAH (α=.87), SC (α=.81), LSC (α=.89), TT (α=.82), AE (α=.78).

Flow state was measured using Flow State Scale-2 (FSS-2; Jackson & Eklund, 2002). This scale has been designed to assess the intensity of the flow state over a specific period, in this case - during the intervention. This scale was also translated into Romanian and adapted for this research. Like DFS-2, FSS-2 has 36 items, four for each of the nine subscales of the flow. The difference between the DFS-2 and FSS-2 items is that in the first case, the general disposition of the flow state is targeted (e.g., "I have a feeling of control over what I do.") and in the second - state of flow during the intervention (e.g., "I had a feeling of total control."). The FSS-2 respondents were asked to indicate how much they agreed with each statement on a 5-point Likert scale ranging from 1 - *strongly disagree* to 5 - *strongly agree*. In this case, FFS-2 provides an individual score for each subscale and the global score. Regarding the internal consistency of the present study for the FSS-2, we can state that it is very high both for the questionnaire as a whole (α = .95) and for the nine subscales: CSB (α = .82), MAA (α = .77), OG (α =.87), UF (α =.89), CTAH (α =.90), SC (α =.88), LSC (α =.90), TT (α =.88), AE (α =.95).

Personality traits were measured using the short version (10 items) of the Romanian IPIP scale (NEO-PI-R) (Rusu et al., 2012) for the three dimensions: extraversion (e.g., "I feel comfortable around people."), neuroticism (e.g., "I often feel sad."), and conscientiousness (e.g., "I'm very attentive to details."). The response format was a Likert scale ranging from 1 - *strongly disagree* to 5 - *strongly agree*. Regarding the internal

consistency for this scale, we can say that it was a high one: neuroticism (α=.86), extraversion (α=.88), and conscientiousness (α=.86).

To assess *the subjective level of happiness*, the participants were asked, on days 1 and 10, the following question: "How happy have you felt over the last 10 days?". The responses were coded using a 10-point Likert scale ranging from 1 - *not happy at all* to 10 - *extremely happy*.

Additionally, to measure the *number of activities performed by the participants in the experimental group*, they were asked on days 4, 7, and 10 the following question: "How many activities have you completed in the last three days?". This question also had the role of checking the involvement of the experimental group in the proposed activities.

Results

Before testing the hypotheses, some preliminary correlational analyses were carried out between the three personality traits (extraversion, conscientiousness, neuroticism) and the level of dispositional flow (see Table 1). A positive, statistically significant relationship was identified between the level of extraversion and the level of flow state, r (99) = .56, $p < .001$, having a shared variance of 31%. Also, a positive and statistically significant relationship was highlighted between conscientiousness and flow state, r (99) = .65, $p < .001$, the common variance being 42%. Regarding the relationship between neuroticism and flow level, a negative correlation was identified, statistically significant, r (99) = -.49, $p < .001$, the shared variance being 24%. Relative to the size of the effect, the results highlight strong effects between the flow state and the three personality dimensions, the strongest effect being between flow and consciousness r^2 = .42, followed by flow and extraversion r^2 = .31, respectively flow and neuroticism r^2 = .24.

Table 1. *Correlations between personality traits and the level of dispositional flow*

	Extraversion		Conscientiousness		Neuroticism	
Scale	*r*	R^2	*r*	R^2	*r*	R^2
DFS-2	.56**	.31	.65**	.42	-.49**	.24
CSB	.54**	.29	.56**	.31	-.49**	.24
MAA	.35**	.12	.33**	.10	-.24*	.05
OG	.52**	.27	.62**	.38	-.39**	.15
UF	.38**	.14	.50**	.25	-.40**	.16
CTAH	.35**	.12	.70**	.49	-.42**	.17
SC	.44**	.19	.61**	.37	-.53**	.28
LSC	.29**	.08	.19	.03	-.27**	.07
TT	.14	-	-.01	-	.21*	.04
AE	.50**	.25	.64**	.40	-.56**	.31

Note: n=101. DFS-2= Dispositional Flow Scale-2, CBS= Challenge-Ability Balance, MAA= Merging of Action and Awareness, OG= Clear goals, UF = Unambiguous Feedback, CTAH= Concentration on the Task at Hand, SC= Control sense, LSC= Loss of Self-Consciousness, TT = Transformation of Time, AE= Autotelic Experience.
*p<.05 **p<.01

To test hypothesis one, the Mixed Factorial ANCOVA analysis was used, the assumptions being partially fulfilled through the presence of outliners (see Table 2). However, they were not excluded in order not to truncate the data. The results identified marginally significant differences between the two groups on days 4 (p = .06) and 7 (p = .07). Statistically significant differences between the experimental (M =3.85, SD =.56) and control group (M =3.51, SD =.68), however, have been highlighted on day 10, $F(2;745)$ =7.775, p=.006, having a mean effect size, Cohen's d = .54 The means of the flow state in the experimental and control group are presented in Figure 2. Therefore, H1 was partially supported by our data.

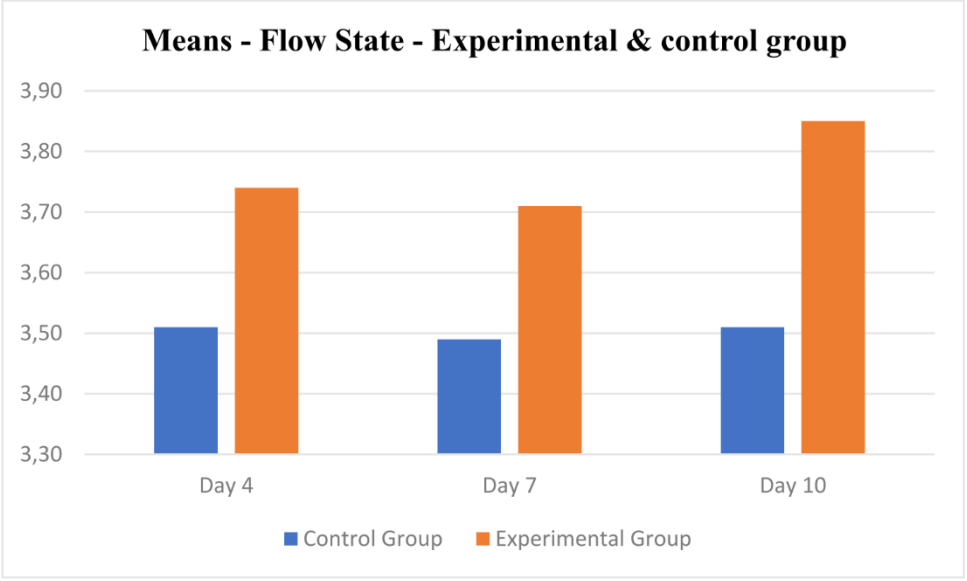

Figure 2. The means of the flow state in the experimental and control group

Similarly, to test hypothesis two, we used the Mixed Factorial ANCOVA analysis, the assumptions being partially fulfilled through the presence of outliners. This hypothesis assumed a gradual increase in flow state for the experimental group (See Table 2). The data showed that the flow state for days 4 (M = 3.74, SD =.60) and 7 (M = 3.71, SD =.60) remained relatively constant, an exponential increase being observed on day 10 *(*M =3.85, SD =.56*)*. H2 was also partially supported by our data.

The Pearson correlation (unidirectional) was used to verify hypothesis three, the assumptions being met. The results show a positive and statistically significant correlation between the number of activities and the level of flow state for all three measurements, from day 4 - $r(54)$ =.40, p = .001, r^2 =.16, day 7 - r(54) =.52, p < .001, r^2 =.27, and day 10 - $r(54)$ =.54, p < .001, r^2 = .29. Therefore, H3 was supported by our data.

The t-test for independent samples was used to test the fourth hypothesis, with the homogeneity assumptions being partially met. As expected, the level of subjective happiness reported on day ten was higher for the experimental group (M = 8.00, SD =1.37) compared to the control group (M =7.02, SD =2.16), the difference being statistically significant $t(99)$ = -2.62, p < .01, having a mean effect size, Cohen's d = .54. Therefore, this last research hypothesis is also supported (see Table 3).

Table 2. *Mixed Factorial ANCOVA - the level of flow during the intervention for the experimental and control group*

	Experimental		Control				
	M	*SD*	*M*	*SD*	*F*(2,745)	*p*	*Cohen's d*
FSS-2 (Day 4)	3.74	.60	3.51	.63	2.32	.06	
FSS-2 (Day 7)	3.71	.60	3.49	.62	2.08	.07	
FSS-2 (Day 10)	3.85	.56	3.51	.68	7.77*	<.001	.54

Note: n(control group)=45, n(experimental group)=56, FSS 2= Flow State Scale-2.

Table 3. *The level of subjective happiness (day 10) - Control and experimental group comparison*

	Control group		Experimental group					
	M	*SD*	*M*	*SD*	*t*	*df*	*p*	*Cohen's d*
"How happy have you felt over the last 10 days?"	7.02	2.16	8.00	1.37	-2.62*	71	.005	.54

4. Discussion

The main objective of the present study was to investigate experimentally, by proposing an intervention with examples of behavioral manifestations for participants to follow, how the flow level is influenced by the induction of states specific to conscientiousness, extraversion, and emotional stability. The study's results based on the theory of optimal experience (Csikszentmihalyi, 2008) supported all research hypotheses, totally or partially. We expected differences between groups from the first days regarding flow and the increase in flow level for the experimental group to be gradual. However, most of the results met expectations and aligned with previous research. Firstly, we identified a strong relationship between the conscientiousness dimension and the flow state, followed by extraversion and flow, neuroticism and flow, respectively. This result reinforces those existing in the literature and once again motivates the choice of the three personality dimensions in the development of the intervention. Ullén et al. (2012) also identified close relationships between the neuroticism (-) and conscientiousness (+) dimensions and the flow state. The difference is that in the case of the present research, a strong relationship was also found between extraversion and flow. The present study is more like meeting the results obtained by Ross and Keiser (2014), which identify a negative correlation between neuroticism and flow, a positive one between conscientiousness and flow, and a slightly lower positive correlation between extraversion and flow, the present research highlighting even stronger effects for all three dimensions. The relationship between conscientiousness and flow can be explained by the fact that conscientious people tend to put more effort into what they do and are perseverant, which meets the theory of flow, which supports the need to maintain a balance between skills and challenges. High conscientiousness involves emotional and motivational mechanisms that cause an individual to engage in flow-enhancing activities (Tian & Ou, 2023). Also, people with increased extraversion tend to be more active and experience more positive effects

necessary for the flow state. Last but not least, as Heller's study, Bullerjahn and von Georgi (2015) argued, people with increased neuroticism experience negative affections and anxiety more often, which makes it difficult to detach from external events and worries. Detachment is another essential feature of the flow state. Thus, neuroticism affects cognitive and emotional processes of general importance for flow, regardless of task (Tian & Ou, 2023).

Regarding the main hypotheses of the present study, those aimed at increasing the flow state through behavioral manifestations following certain personality traits, we can say that participants who acted based on the three personality dimensions traits (extraversion, conscientiousness, emotional stability) reported a higher flow level than those from the control group. Zelenski et al. (2012) demonstrated how simply acting like an extrovert for a short time increases well-being. Another study by Margolis and Lyubomirsky (2019) conducted over two weeks reveals the same result, analyzing other concepts, including flow. As a general idea, the fact that people perform behaviors specific to these three personality traits leads to increased flow. However, although the flow state was higher for those who benefited from the intervention than those in the control group, the difference was only visible at the last measurement (day 10). A possible explanation is that it takes a transition time for a person to behave differently or use behaviors other than usual. Someone must gradually adopt new behaviors or act in ways distinct from their usual ones (Grimley et al., 1994). It is also a process that requires dedication and effort, and individuals must stay committed to their goals and focus on the positive changes they want. The existence of outlines gives another explanation, but they have not been eliminated for reasons of research ethics.

Other data from this research reveal that the number of activities carried out by those in the experimental group is closely related to their flow level. In other words, the more the participants perform specific actions to high levels of extraversion, conscientiousness, and emotional stability, the more flow they will experience. Last but not least, the present study shows how participants who received the intervention reported higher happiness than those who did not benefit. Studies by Fritz and Avsec (2007) and Tse et al. (2021) highlighted a positive relationship between flow experience and well-being. Also, studies like the ones of Fleeson et al. (2002) or McNiel et al. (2010) showed how acting like an extrovert can increase reported happiness levels and even reduce depression. Expanding upon the groundwork laid by previous research and pinpointing areas for improvement, our study stands out for its significant contributions in incorporating comprehensive guidance. We provide participants with thorough instructions and practical examples of behaviors and activities to follow. In other words, current research shows that people who carry out activities specific to high levels of extraversion, conscientiousness, and emotional stability tend to become happier.

5.1. Theoretical and practical implications

Our study has several important theoretical and practical implications. Regarding the theoretical contribution of our paper, we managed to highlight once again the relationship between the three personality dimensions (conscientiousness, extraversion, neuroticism) and flow. But the most important discovery is the usefulness of behavioral manifestation intervention based on the three dimensions for increasing flow and, indirectly, happiness. Implicitly, it has been shown that by acting like extroverted, conscientious, and emotionally stable people, you can experience flow more frequently and overall be happier.

From a practical perspective, the current study offers support for implementing training and interventions at the organizational level to help employees adopt behaviors specific to certain personality traits and thereby experience more flow. Given the established correlation between the flow state and performance (Van den Hout et al., 2016; Liu et al., 2023), our findings underscore the indispensability of incorporating flow-enhancing strategies into organizational practices. The intervention crafted for this

study stands as a testament to our commitment to pushing the boundaries of knowledge. Its exclusivity, thus far confined to the realm of our research, beckons for future exploration and refinement. Subsequent studies have the potential to either replicate or build upon the novel facets uncovered, thereby advancing our understanding of the interplay between personality dimensions, behavioral interventions, and the state of flow.

We propose practical recommendations for organizational practice and policy in light of these findings. Firstly, organizations should consider integrating tailored training programs that focus on developing behaviors associated with extraversion, conscientiousness, and emotional stability. These programs can serve as a proactive means to enhance employee well-being and, in turn, organizational performance. Secondly, policies should be crafted to create a supportive and adaptive organizational culture that encourages an environment where individuals flourish in the flow state, ultimately contributing to a more vibrant and productive workplace.

5.2. Limits of the study and future approaches

A limitation of the current study is that no specific method was used to verify the degree of fulfillment of the activities carried out by the participants; they only received a self-report checklist. Further studies should address this limit by introducing more objective verification methods. A second limitation may be repeated measurements for the FSS-2 questionnaire. The solution would be to randomize the order of questions or use a parallel form. Another limitation is the existence of outlines for FSS-2 measurements and subjective happiness. However, they were not excluded from the research because they did not affect the assumptions about distribution and homogeneity, except for the FSS-2 measurement on day 4 (Skewness > 2) and subjective happiness (Levene <.05). Future studies should replicate the results and could use, in addition to the self-report measurements, some objective, observational measurements. Also, analyzing a possible mediation effect between personality and happiness through the flow experience may be of interest to future studies.

6. Conclusions

In summary, this paper carries significant implications for the domains of positive psychology and behavioral change. It introduces an intervention that provides tangible and practical examples of behaviors. By emphasizing concrete examples of behaviors that facilitate the state of flow, this study contributes to a deeper understanding of how to promote psychological experiences. This research not only sheds light on the concept of flow but also offers a valuable approach for individuals looking to improve their overall happiness.

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Appendix 1

Instructions - Behavioral Change Intervention

The intervention within this study aims for a behavioral change. In other words, we propose you change your behavior for the next ten days**.** Below, you will find three personality traits (extraversion, conscientiousness, emotional stability), each with six general advice and some examples of activities. Please try to do as many activities as possible from the table below in the next ten days. It is essential to focus on doing activities from each set and not just from one or two.

Personality traits	General advice	Instructions (these instructions are examples, but you can take any other actions that you feel will help you to achieve the general advice).	Done (X)
EXTRAVERSION	BE FRIENDLY	Initiate a conversation with a new person or person you haven't really interacted with. Maintain a friendly attitude.	
		Tell someone a personal story.	
	"I LIKE PEOPLE"	Participate in a group activity and/or in places with more people (e.g., class, concert, sports match, shopping mall, etc.) and enjoy being among them.	
	TAKE THE INITIATIVE AND SAY YOUR OPINION	Take the initiative/ take the first word in a discussion. Say and support your point of view (in the family, at school, at the workplace, etc.).	
		Make a presentation in front of several people. Present your arguments in front of others, enjoying the opportunity to show your influence on them (want that people see you, that they are paying attention to you, and listen to what you have to say).	
	BE ACTIVE	Do as much physical activity as possible - at least three different activities (e.g., walks, running in the park, gym, etc.).	
	STIMULATE YOUR SENSES	Try things and activities that stimulate your senses, even something you've never tried before. (e.g., loud rhythmic music, spicy food, very bright/flashy colors, activities that increase adrenaline, etc.).	
	BE HAPPY/ POSITIVE	Smile at least ten times/a day (either to people thinking about something pleasant or admiring something beautiful).	
		Tell someone a funny story.	

		Think of the good things in your life and think that good things will happen to you.	
		Enjoy the small and ordinary things (e.g., sunrise/sunset, coffee taste, etc.).	
CONSCIENTIOUSNESS	"BELIEVE THAT YOU CAN"	Take up a new activity or do something challenging, thinking you can do it. Tell yourself you can and do the job.	
	BE ORGANIZED	Plan your activities for the current week in time intervals (e.g., Tuesday, 2 - 4 p.m., I'm working on a presentation for the seminar). Stick to this schedule.	
		Maintain cleanliness and order around you (personal room, work environment, etc.).	
	RESPECT YOUR PRINCIPLES	Take responsibility for everything you (have to) do (keep your obligations/duties and promises, don't break the rules, be honest).	
	GIVE YOUR BEST TO ACHIEVE YOUR GOALS	Choose a goal/standard and give everything you can to achieve it. (e.g., "I will understand and master this course."). Be persistent; don't give up even if you fail on the first try.	
	DON'T LET YOURSELF DISTRACTED /DISTURBED FROM YOUR PURPOSE	Set a current, immediate goal and try to accomplish it, ignoring possible distractions (e.g., "I want to pay attention to this course. I ignore the mobile phone and do not get involved in discussions with my colleagues.").	
	THINK ABOUT THE CONSEQUENCES BEFORE YOU ACT	Before acting/making a decision, make a list of benefits and consequences, weigh them wisely, and choose the optimal alternative (e.g., When shopping, think about whether you need the thing you want to buy, if it's worth the price if you can find a better alternative, etc.).	
EMOTIONAL STABILITY	GIVE UP THE FEAR	Do not worry. Avoid thinking that something bad will happen. Refrain from worrying about anything.	
		Choose a minor activity you are afraid of and do it (e.g., speaking in a class, dancing in front of people, starting a conversation with a stranger, etc.).	
	STAY CALM	Treat any information calmly. If a person says or does something that bothers you, if things don't happen the way you want them to, or if you feel angry, try not to get affected. You can use specific relaxation techniques (e.g., breathing, counting).	
	DO NOT BE	Find your energy and strength to do what you set	

	DISCOURAGED	out to do. Don't get discouraged, and don't blame yourself when something goes wrong. Just think of solutions to solve that situation.	
	QUIT THINKING, "WHAT OTHERS WILL SAY ABOUT ME?"	Do an activity the way you want, without thinking about what other people think about you (e.g., Give your honest opinion about a topic). Try not to care about what other people think about you.	
	DON'T BURST OUT / DON'T GET MAD	Control your negative emotions. Don't let them manifest on the surface. If something negative happens to you or someone does something that bothers you, don't become violent (e.g., don't scream, cry, or use drugs or alcohol), but try to find within yourself the strength to calm down.	
	BE SURE OF YOURSELF	If you are faced with a stressful situation (e.g., giving a presentation), don't avoid it. Try to control the situation. Think of possible solutions to solve it.	

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RESEARCH ARTICLE

Designing Assessment Reports: How Proper Score Descriptions Can Improve Selection Decisions

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Abstract

This paper explores, through a quasi-experimental design, different ways of building employee assessment reports to determine which elements would lead to more efficient selection decisions. Two types of reports were built: (a) reports containing descriptions of the minimum and maximum scores (i.e., 1 vs. 10), and (b) reports containing the description of the exact score recorded by the participant (i.e., any score on a scale of 1 to 10). The efficiency of these report was evaluated in two scenarios: a difficult-decision scenario and an easy-decision scenario. A total of 269 hiring managers participated in a simulated selection decision setting. They were asked to choose the best candidate for a specific position, based on a job description and two personality profiles for two fictitious candidates. They were also asked about their perceived levels of comprehension and satisfaction with the report. The model was statistically significant, $\chi 2(3) = 110$, $p < .001$, R2N = .461. In both the difficult and the easy scenarios, reports containing descriptions of the minimum and maximum scores were more efficient than reports containing descriptions of the exact scores recorded by the participants, and they also led to higher levels of perceived comprehension and satisfaction with the report. The results were influenced by the participants' familiarity with the used personality questionnaire (the NEO PI-R). This study has both theoretical and practical implications, extending the existing organizational literature by drawing from cognitive psychology, and highlighting the critical role that assessment reports have in the process of organizational selection decisions.

Keywords

report design, assessment report, score description, selection, hiring decisions, decision-making, employee.

The success of both commercial and non-commercial organizations depends strongly on the quality of their human resources. Therefore, appropriate selection procedures are mandatory to the organization, as well as to the well-being of its employees. Despite extensive attention given to the psychometric properties of different selection procedures, there is a lack of research regarding how the information gained from these measurements is further used in decision-making processes. Unfortunately, the scientific literature does not offer much guidance on how to structure this information or design the assessment reports to communicate clear and actionable results to decision-makers. A few pointers in this direction can be found in the educational literature (e.g., Miller & Watkins, 2010; Wiener & Costaris, 2012), and even fewer in the I/O literature (e.g., Spînu & Iliescu, 2019; Spînu & Corbeanu, 2023), with a strong call to continue research on this topic (Mastoras et

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al., 2011). We address this issue in a quasi-experimental study by evaluating which elements in the design of assessment reports lead to more accurate selection decisions in organizations.

The way assessment results are reported has a significant impact on the hiring process, directly influencing the quality of selection decisions. While it is generally assumed that reports are error-free and they correctly communicate the intended information, reality seems to contradict this assumption. Based on the same assessment reports, different managers can make completely different decisions (Spînu & Corbeanu, 2023), and this may happen, at least in part, due to the misinterpretation of poorly communicated assessment results. In line with the notion of consequential validity (Messick, 1989; Iliescu & Greiff, 2021), we believe that the same importance that is now given to the selection process (i.e., the method and measures used) should also be invested in the development of the consequent assessment reports. We advance that the validity of the assessment process is not sufficient in and of itself. Therefore, using good and valid tests may still lead to less-than-optimal decisions if the assessment results are not clearly communicated to hiring managers, who ultimately make the hiring decisions.

In the present study, we examine two different ways of building assessment reports: (a) reports containing descriptions of minimum and maximum possible scores (i.e., 1 vs. 10), which is one of the conventional ways of reporting results (e.g., SHL, 2002), and (b) reports containing the description of the exact score recorded by the participant (i.e., any score on a scale of 1 to 10). Examples of both types of reports could be seen in Figure 1.

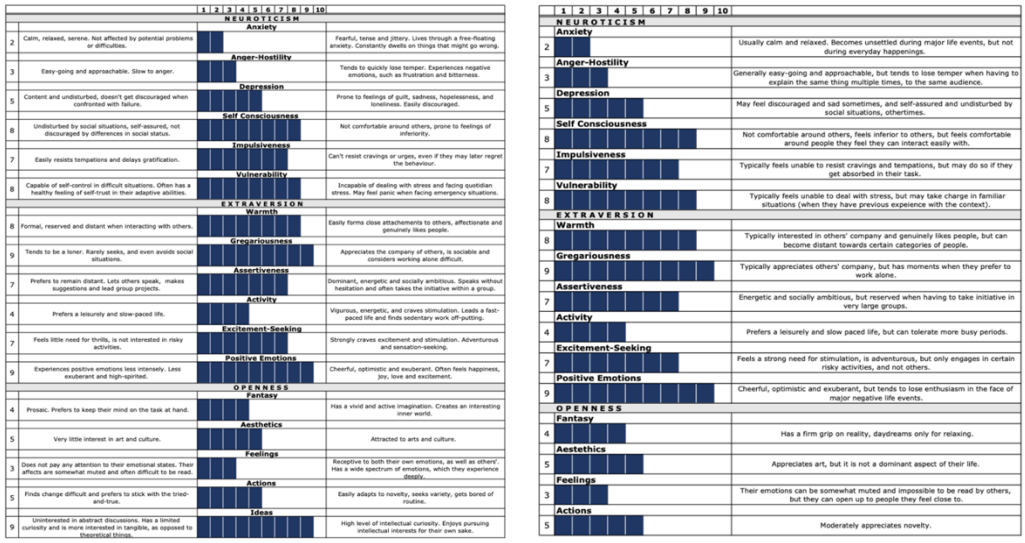

Figure 1. Examples of the Report Types Employed

Unfortunately, there is a scarcity of available literature that directly addresses this topic, and we were able to identify only two studies that have explored the issue of assessment reports so far (Spînu & Iliescu, 2019; Spînu & Corbeanu, 2023). This limited body of research poses a significant challenge in identifying appropriate theories to serve as a basis for our arguments. Since the specific nature of our research leans more towards the domain of ergonomics and cognitive psychology, rather than traditional work psychology, we believe that drawing upon the cognitive theories, specifically the bounded

rationality, would be a pertinent starting point in our paper, and a source of arguments for the methodological choices we made throughout the study.

Bounded Rationality Theories

In contrast to earlier theories of rational decision-making (Carter et al., 2007), it is now considered that the human ability to process information is governed by heuristics and biases (Kahneman & Tversky, 1979; Shah & Oppenheimer, 2008): decision-makers often encounter limitations in the cognitive resources required for making decisions, and therefore tend to rely on cognitive shortcuts to diminish the cognitive effort, especially in complex decisions or under uncertain conditions (Simon, 1990).

The earlier theories of rationality used to see decision-makers as ideal cognitive processing machines. Accordingly, when confronted with choices and decisions, individuals were expected to have access to all possible alternatives, possess accurate expectations about the future outcomes of their decisions, and use information in a systematic and logical manner (Samuelson, 1947). As such, complex algorithms were used to describe or simulate actual decision-making processes (Shah & Oppenheimer, 2008). An example of a complex algorithm is the weighted additive rule. Without getting into the mathematical details, this algorithm requires decision-makers to follow five steps: (1) identify all relevant pieces of information, (2) process all pieces of information, (3) determine the importance of each piece of information, (4) add up all the available information for each option, so as to gauge its overall value, and (5) compare all alternatives (Payne et al., 1993). However, subsequent research has shown that these complex algorithms cannot be realistically sustained due to the limited capacity of the human cognitive system (Garner, 1982). As a result, individuals tend to use specific strategies (i.e., heuristics) that help them simplify decisions and reduce the mental effort, while still obtaining satisfactory results (Tversky & Kahneman, 1974). This happens especially in conditions of uncertainty, or when the presented information is unclear (Jasko et al., 2015; Simon, 1976). In other words, heuristics (or biases) are simple mental processes that replace the complex algorithms that would have otherwise required too many cognitive resources (Newell & Simon, 1972).

In the context of decisions based on assessment reports, we believe that solely providing behavioural explanations for the minimum and maximum scores (i.e., 1 and 10) create a challenging and uncertain environment that might determine decision-makers to resort to mental shortcuts when dealing with the exact scores obtained by the candidates. We argue that, without a clear linkage to performance indicators, it may be difficult to understand how an intermediate score (e.g., 4 or 7) corresponds to actual behaviors. According to the attenuation bias, which acts "to oversimplify a decision-making process by ignoring, overlooking or excluding certain information relevant to the decision" (Kiesling & Chong, 2020, p. 43), decision-makers may unintentionally choose to ignore intermediate scores that cannot be easily translated into behaviours. This raises important concerns, as they should ideally process all the information presented in a report, and make an informed decision only after fully understanding the assessment results.

The need to define the scores falling between the two extremes was also visible in the earlier stages of the development of behaviourally anchored rating scales (BARS; Grote, 1996). The frustration of dealing with missing intermediate anchors determined researchers and practitioners to stop defining only the minimum and maximum scores, and to add descriptions for all the other scores as well. Unfortunately, this procedure was not particularly successful as job experts seemed to provide more examples of good and poor behaviours than of average behaviours, with agreement being lower for the latter (Hauenstein et al., 2010). While it is clear that extreme behaviours are more salient than average ones (Debnath et al., 2015), we believe that ceasing to define the intermediate scores is not a justifiable rationale, as it may lead to significant cognitive biases that could be avoided.

The Present Study

The process of decision-making can be a cognitively demanding activity for individuals (Kool et al., 2010). Typically, assessment reports include only the descriptions of the minimum and maximum possible scores of a scale and miss descriptions for the specific scores obtained by the candidate. Besides the lack of evidence supporting the effectiveness of this traditional reporting approach, we believe that it actually makes information processing unnecessarily difficult.

In this paper, we evaluate the efficiency of designing assessment reports that enumerate the specific behaviours associated with the exact scores obtained by the test taker, compared to reports that define and describe only the minimum and maximum scores of the scale (pole-end scores). To this end, we have built two personality profiles corresponding to two fictitious candidates, having in mind two different scenarios, an easy-decision scenario (where the scores of the two candidates are very different apart) and a difficult-decision scenario (where the scores are very similar). We introduced these scenarios based on the premise that in difficult decisions, critical information necessary for making a correct decision would not be as readily available as in easier scenarios: while in easy scenarios almost anyone can reach the correct conclusion, more difficult scenarios require much sharper information. Therefore, in more difficult contexts, an effective design is particularly important to ensure a correct and complete understanding of the presented information.

We test these reports in a selection decision setting, and evaluate their efficiency from the perspective of decision accuracy, as well as from the perspective of participants' levels of comprehension and satisfaction with the reports. Selection accuracy holds particular significance for organizations (Kerr, 2021), as poor hiring decisions can have detrimental impact on various organizational areas (CareerBuilder, 2017). Additionally, empirical findings from educational testing domain showed that different types of reports lead to different levels of comprehension and satisfaction (e.g., Bucknavage, 2007). This is significant because it can influence the likelihood of practical implementation of specific designs, given that individuals are more inclined to use materials they like and understand (Cowburn & Stockley, 2005; Konradt et al., 2006).

Based on the information presented above, we advance the following hypotheses:

H1: Regardless of the report type, participants will make more accurate decisions in the easy scenario than in the difficult scenario.

H2: Regardless of the scenario, participants will make more accurate decisions when the report includes exact score descriptions, as opposed to reports that describe only the pole-end scores.

H3: In the easy scenario, both types of reports are efficient in selection decisions.

H4: In the difficult scenario, compared to the easy one, participants (a) will make better selection decisions, and will report higher levels of (b) comprehension and (c) satisfaction when the report includes exact score descriptions, as opposed to reports that describe only the pole-end scores.

Method

Participants

We targeted participants who held a managerial position. Invitations to participate were sent via emails, as well as posted on LinkedIn and Facebook groups. Participation was voluntary and anonymous. Participants had the chance to receive, through a random draw, a $25 Amazon gift card.

We collected data from 280 participants, however after removing the duplicates (n = 2), the missing data (n = 3), and the participants who did not meet the inclusion criteria (n = 6), the final sample consisted of 269 participants. Of the participants, 68% were women (n = 183), and 32% were men (n = 86), with an average age of 37 years (SD = 8.92), ranging from 19 to 61 years old. Participants had an average experience in a managerial position of 6 years (SD = 5.16), ranging from 0 to 25 years, and they had made between 0 and 100 hiring decisions in the last 12 months (M = 11.71, SD = 17.18). Unfortunately, due to insufficient data, we are unable to provide a comprehensive overview of the departments

in which they were employed. Only 15% of participants provided information about their department or role, which included internal audit (n = 6), consulting (n = 3), financial (n = 1), HR (n = 23), management (n = 1), payroll (n = 1), and sales (n = 3).

A 2x2 between-subject design was used for this study, with 4 experimental groups. Although we did not randomize participants, we did not observe any differences between the groups regarding participants' age, managerial experience, and their level of experience in making hiring decisions ($F(9, 640) = 1.25$, $p = .257$). However, we did observe a significant gender difference ($\chi^2(3) = 18.06$, $p = <.001$) – there were more women than men in the "easy scenario – pole-end score descriptions" and in the "difficult scenario – pole-end score descriptions" conditions.

Procedure

Overview

We simulated a selection decision setting where the participants were first presented with a job description for the role of Market Research Analyst (MRA). After studying the document, they received two personality profiles corresponding to two fictitious candidates, and were asked to choose which candidate they would hire for the MRA position. They were allowed as much time as they needed to make the decision. Additionally, the participants completed a short questionnaire regarding their level of comprehension and satisfaction with the reports.

The study was conducted online, using a proprietary html code. Two variables were manipulated: the report type (i.e., reports containing pole-end score descriptions vs exact score descriptions) and the decision scenario (i.e., participants were confronted with either an easy or a difficult decision). Detailed accounts of the job description, the personality profiles, and the manipulated variables follow below.

Job Description

We used O*NET indicators to build the job description for the role of Market Research Analyst. The description consisted of one and a half pages of bullet-lists, divided into three categories: responsibilities (e.g., "Measure the effectiveness of marketing programs and strategies"), requirements (e.g., "Background in business administration or social sciences"), and soft skills (e.g., "Persuasion skills, and an ability to convince and motivate others"). The complete job description can be found here: https://osf.io/eadx6/?view_only=343e296dd7644cc8a1ff765f0f2827dd.

The personality profiles

The personality profiles were developed based on the job description presented above. We developed two pairs of profiles, one pair for the easy scenario, and one pair for the difficult scenario. However, in both scenarios, we made sure that one candidate (Candidate 1) would be a better fit for the job than the other. We used a similar structure as the NEO PI-R questionnaire (Costa & McCrae, 1992), with five factors and six facets each. The scores were expressed in STEN scores ranging from 1 to 10.

To ensure that one candidate is indeed a better fit than the other, we conducted a pilot test with five experienced psychologists who had an average of 11 years of experience (SD = 3.28) in HR consultancy. They were asked to choose the best candidate for the job based on our job description. All five chose the Candidate 1 in both scenarios.

The decision scenario as a manipulated variable

The difference between the easy and the difficult scenarios relies on how similar or different apart the two profiles are. For the easy scenario, the difference between the two candidates were glaring, as the profiles were built at opposite extremes. Candidate 1 had high scores on desirable traits, such as extraversion or conscientiousness, and low scores on undesirable traits, such as

neuroticism. In contrast, Candidate 2 displayed the exact opposite pattern.

For the difficult scenario, the two profiles had very similar scores. However, upon careful examination, it become apparent that one profile was slightly better suited for the job than the other. Compared to the easy scenario, the task required more in-depth analysis and intense cognitive processing. The scores for all four personality profiles may be seen in Table 1.

Table 1. *The Personality Profiles*

	Difficult scenario		Easy scenario	
	Candidate 1	Candidate 2	Candidate 1	Candidate 2
Neuroticism	33	27	12	52
Extraversion	44	34	46	23
Openness	29	32	40	26
Agreeableness	32	32	41	26
Conscientiousness	47	46	49	18

Note. In both the difficult and the easy scenario, Candidate 1 is a better fit for the job.

The report type as a manipulated variable

The report types were designed having two perspectives in mind: (1) reports that include behavioural descriptions for the exact scores obtained (i.e., any score on a scale of 1 to 10), and (2) reports that include behavioural descriptions of only the pole-end scores of the scale (i.e., 1 vs. 10).

The reports based on pole-end score descriptions included a bar chart and the corresponding behavioural descriptions on the right and left sides. Each of these reports covered one and a half pages. The score descriptions were generated using the NEO PI-R standard report that already provides behavioural descriptions of minimum and maximum possible scores. Examples of descriptions for the Impulsivity scale are as follows: at low scores - “Easily resists temptations and delays gratification”, and at high scores - “Can't resist cravings or urges, even if they may later regret the behaviour”. When completing the task, participants were instructed that the respective descriptions correspond to the minimum and maximum possible scores.

The reports based on exact score descriptions included a bar chart and then the corresponding behavioural description for that specific score. The exact score descriptions were generated using several resources, including the NEO Job Profiler (Costa et al., 1995), the NEO PI-R standard report (Costa & McCrae, 1992), and the guidelines offered by Lord (2007). We used professional judgment to define each score on a scale of 1 to 10, with special attention given to balancing the need to provide sufficient details and the need to remain within a one-dimensional scale. The scores were defined in everyday language, without using professional jargon. An example for a score of 7 on the Impulsivity scale is as follows: “Typically feels unable to resist cravings and temptations but may do so if they get absorbed in their task”. The instructions for participants also indicated that these descriptions correspond to the exact scores obtained by the participants. All the reports can be found here: https://osf.io/fc24q/?view_only=05b61ee773364f2693c93b91d201f462.

Measures

We analyzed the efficiency of the report types employed using three indicators: the decision accuracy, as well as the self-reported levels of comprehension and satisfaction with the report. The decision accuracy was measured on a dichotomous scale, and employed either

a correct or an incorrect answer. The participants' comprehension level was analyzed using a questionnaire adapted from Bucknavage (2007). The questionnaire consisted in seven items measured on a 1-5 Likert scale (from strongly disagree to strongly agree), and had an internal consistency of .83. Similarly, the level of participants' satisfaction was measured using a questionnaire adapted from Pelco et al. (2009). It comprised six items measured on a 1-5 Likert scale, and had an internal consistency of .77. The comprehension and satisfaction items may be seen in table 2.

Table 2. *The Comprehension and Satisfaction Questionnaires Items*

	Comprehension Questionnaire
1.	These reports were easy to read.
2.	I easily understood the information that was presented.
3.	The writing style was too confusing for me to understand (R*).
4.	I have a clear picture of the candidates' strengths and weaknesses.
5.	The reports were well organized and coherent.
6.	Reading these reports was difficult for me (R*).
7.	I have an overall good understanding of the candidates.
	Satisfaction Questionnaire
1.	I am generally satisfied with these reports.
2.	The reports included all the information needed for me to make a decision.
3.	The information presented in the reports made sense to me.
4.	The reports relied too much on technical terms (R*).
5.	The reports presented information in a logical format.
6.	I learned a great deal about the candidates from these reports.

Note. *R = reversed items.

Statistical Approach

A logistic regression was conducted using the jamovi "GAMLj" module (Gallucci, 2019) to estimate the relationship between the decision scenario and the report type, and the accuracy of the selection decision. The level of participants' comprehension and satisfaction with the reports was analyzed using a multivariate multiple regression, with the help of jamovi "PATHj" module (Gallucci, 2021). Additionally, a TOST test (Caldwell, 2022) was conducted specifically for the easy scenario, in order to evaluate the level of equivalence between the two report types.

Results

A binomial logistic regression was performed to analyse the effects of the report type and the decision scenario on the likelihood that participants made a correct selection decision. The model was statistically significant, $\chi^2(3) = 110$, $p < .001$, and accounted for 46.1% (Nagelkerke R^2) of the variance in selection decisions. The model correctly classified 81.8% of cases, with a sensitivity index of 89% and a specificity of 69.1%.

Only the scenario and the report type were statistically significant, but not the interaction between them. The data supports our first hypothesis (*H1*), i.e., participants were more likely to make correct selection decisions in the easy scenario than in the difficult scenario.

However, contrary to our expectations (*H2*), it seemed that, regardless of the scenario, pole-end score descriptions were more efficient than exact score descriptions in enhancing accurate decisions. The odds of making a correct selection decision are .2 times lower when presented with exact rather than pole-end score descriptions. The results are shown in Table 3.

Table 3. *The Logistic Regression Model*

	B	95% CI	*SE*	*df*	*p*	Odds Ratio	95% CI for Odds Ratio
Constant	.75	[.43; 1.09]	.16	1	.001*	2.13	[1.54; 3.00]
Predictors							
Scenario	2.03	[1.38; 2.71]	.33	1	.001*	7.66	[3.99; 15.07]
Report type	-1.61	[-.95; .20]	.33	1	.001*	0.20	[2.60; 9.81]
Scenario * Report type	.77	[2.10; 2.16]	.67	1	.251	2.16	[.12; 1.73]

Note. Baseline categories were the easy scenario and the exact score descriptions. *$p < 0.05$

There was no significant interaction between decision scenario and the report type in regards to the decision accuracy (*H4a*). Therefore, the probability of making a correct decision based that one or the other type of report does not depend on the difficulty of the decision. In fact, in the easy scenario, although we hypothesized that both report types would be efficient in selection decisions (*H3*), the data suggests that they are not actually equivalent ($p = .747$) - reports containing pole-end score descriptions led to better decisions than exact score descriptions even in the easy scenario.

Overall, 87.2% of participants made a correct selection decision in the easy scenario, compared to only 35% in the difficult scenario. Considering both scenarios, 44.9% of participants made a correct decision when presented with pole-end score descriptions, compared to only 18.9% when presented with exact score descriptions. The probabilities of making a correct decision in each group may be seen in Table 4, and Figure 2 respectively.

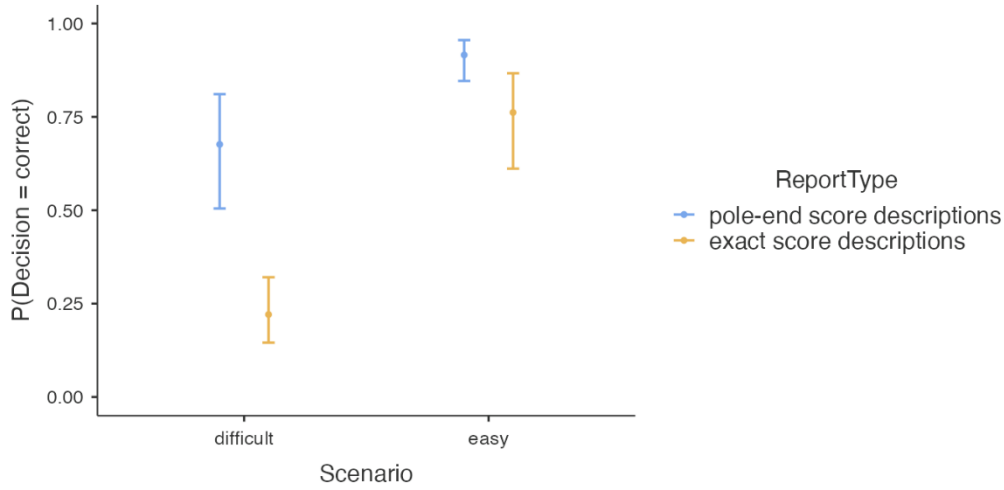

Figure 2. A Visual Representation of the Probabilities of Making a Correct Decision

Table 4. *The Probabilities of Making a Correct Decision*

Scenario	Report type	Probability	*SE*	95% CI
Difficult	Pole-end scores	.67	.08	[.50; .81]
	Exact scores	.22	.04	[.14; .32]
Easy	Pole-end scores	.91	.02	[.84; .95]
	Exact scores	.76	.06	[.61; .86]

We additionally controlled for the potentially confounding effects of the participants' response times, as well as their familiarity with the NEO-PI-R questionnaire, to thoroughly understand our results. The data suggests that there is no significant effect of how much time participants spent in the task, $\chi^2(1) = 3.31$, $p = .069$. However, there is a significant interaction between the report type, the decision scenario and the familiarity with the questionnaire ($p = .027$). As shown in Figure 3, in the difficult scenario, participants who were more familiar with the questionnaire made better decisions when provided with pole-end score descriptions. Conversely, for exact score descriptions, more familiarity with the questionnaire led to worse decisions.

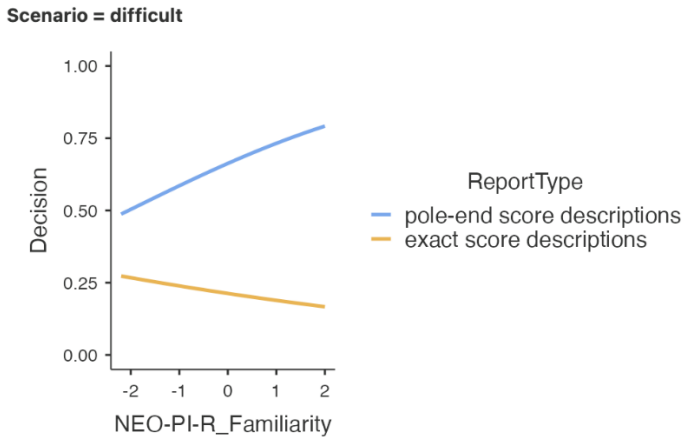

Figure 3. The Probability of Making a Correct Decision When Familiarized with the Questionnaire

To analyze participants' levels of self-reported comprehension and satisfaction with the report, we conducted a multivariate multiple regression. The model was statistically significant, $\chi^2(7) = 190$, $p = .001$, $CFI = 1.000$. Contrary to our expectations (*H4b* and *H4c*), the results suggest that participants had a higher level of comprehension when presented with pole-end score descriptions, rather than exact score descriptions, either alone ($\beta = -.21$, $p = .008$) or in interaction with the scenario ($\beta = .15$, $p = .007$). Similarly, reports containing pole-end score descriptions led to higher levels of satisfaction compared to reports containing exact score descriptions ($\beta = -.24$, $p = .002$). However, the interaction between scenario and report type does not significantly influence participants' satisfaction levels ($\beta = .08$, $p = .157$).

A post-hoc G*Power analysis suggested that our design was slightly underpowered (0.60). In order to detect a significant effect for

the exact score descriptions, we would have needed a sample size of 380 people.

Discussion

Summary of Findings

The current study explored different ways of designing employee assessment reports to determine which elements would lead to more efficient selection decisions. Two types of reports were evaluated, in two different scenarios.

As hypothesised, participants made more accurate selection decisions in the easy scenario compared to the difficult scenario. However, contrary to our expectations, reports containing pole-end score descriptions were more effective in terms of the accuracy of the selection decision than those containing exact score descriptions. This was true even in the easy scenario, where the most suitable candidate for the job should have been glaring in both reports. Furthermore, participants reported a higher level of perceived comprehension and satisfaction when presented with pole-end score descriptions in both the easy and the difficult scenario. There are several possible explanations for these results.

Firstly, data suggests that familiarity with the NEO-PI-R questionnaire influenced the likelihood of making a correct decision. Participants that were more familiarized with the questionnaire tended to make worse decisions when presented with exact score descriptions rather than pole-end score descriptions. It may be that participants were accustomed to a specific design of the questionnaire, and the fact it was differently structured in our study may have actually made the information processing much more difficult. It may also be that in order to make sense of the dimensionality of a personality trait, managers need the two extreme anchor points of the scale; significance of the points that lie in between the two extremes is then deducted easily – while exposure to only the exact description does not enable the decision maker to actually make sense of the dimensionality of the targeted trait. The questionnaire familiarity and the previous experience in working with it might also explain the higher reported levels of comprehension and satisfaction with the report when presented with pole-end score descriptions compared to exact score descriptions.

Secondly, according to the picture superiority effect (Stenberg, 2006), people seem to focus more on the visual elements of a document rather than on the text (Schnotz et al., 1993). Thus, it is possible that participants did not read the score descriptions carefully enough. However, a similar eye-tracking study on assessment reports, evaluating how the visual design of the reports can influence information integration from graphics and texts, showed that neither the number of fixations on the graphic or the text, nor the number of integrations between the graphic and the text were significant predictors of the accuracy of the selection decision (Spinu & Iliescu, 2019). It remains unclear how people use information from texts and graphics in decision-making processes, and what elements actually lead to more efficient decisions. We suggest including more eye-tracking designs to better understand this matter.

Theoretical and Practical Implications

From a theoretical standpoint, the main contribution of our study lies in its interdisciplinary nature, extending the applicability of a cognitive theory into the field of organizational psychology. The study challenges researchers to further investigate how pole-end and exact score descriptions fit with bounded rationality theories and cognitive biases, and which of them actually raises more uncertainty for decision-makers: describing only the extreme ends of a scale without a clear linkage to actual behaviours for intermediate scores, or describing the exact score obtained by the respondent without offering a framework of reference.

From a practical perspective, our study holds significant relevance within the realm organizational realities. It highlights the importance of effectively communicating results to decision-makers to ensure they are actionable, while also focusing on the consequences of the assessment process. The

correct understanding of the results and the decisions that are made subsequently depends strongly on the quality of the assessment report. Our study shows that current practices in designing assessment reports (i.e., designing reports that describe the minimum and maximum possible scores) are somewhat effective. However, the fact that a non-trivial volume of our sample has made an incorrect decision raises concerns, and suggests that other factors may have influenced the decision.

Limitations and Implications for Future Research

The main limitation of this study is the use of a standard and well-known assessment tool, the NEO-PI-R questionnaire, as our data has shown that familiarity with the test significantly influenced the outcomes of our design. We recommend that future studies use less popular questionnaires. Another limitation is the lack of randomization in allocating participants to groups. This resulted in significant differences between the groups, that could have been avoided with proper randomization. We also believe that measures that are specifically designed for a work context would yield a higher impact on research results, as they are closer to what actually happens in practice. Furthemore, future studies may include some other types of tests, such as cognitive abilities tests. One final recommendation for future studies would be to include eye-tracking methodologies in their design. This will contribute to a better understanding of how decision-makers acquire and use information in assessment reports.

To sum up, our study offers valuable insights into the realm of assessment reports and contribute to the existing body of knowledge in this area. Although assessment reports are frequently utilized in selection settings, their practical efficacy remains relatively unexplored. Despite its limitations, our research confirms that one of the traditional ways of designing assessment reports is actually effective in selection setting. Nevertheless, it is worth noting that only 87.2% of participants made a correct decision even in the easy scenario. This suggests the presence of additional factors that may have influenced participants' decisions. Considering this, we advocate for further research and a more in-depth investivation into this subject matter.

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Data Availability Statement

The data that support the findings of this study are openly available in OSF platform at https://osf.io/fc24q/?view_only=b1a53f44a90142a69508ec8f0870cfc5.

Psihologia Resurselor Umane, **21** (2023), 137-140

PUBLISHING STANDARDS

Psychology of Human Resources – guide for authors

THE EDITORS

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This "Guide for Authors" follows the 7th APA Publication Manual.

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To edit the manuscript please use Times New Roman 12-point type, 1.5 line spacing and the A4 page setting. Each page will be numbered in the upper right corner. The top and side margins should be left of at least one inch or 2.54 cm. A full example of a manuscript can be found in the 7th APA Publication Manual.

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This section evaluates and interprets the implications of the results, especially with respect to original hypotheses. Examine, interpret, and qualify the results and draw inferences and conclusions from them. Emphasize any theoretical or practical consequences of the results.

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(Johnny, 2011, p. 13)

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