SFS Test Solutions

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SCHUHFRIED
psychometrics for you

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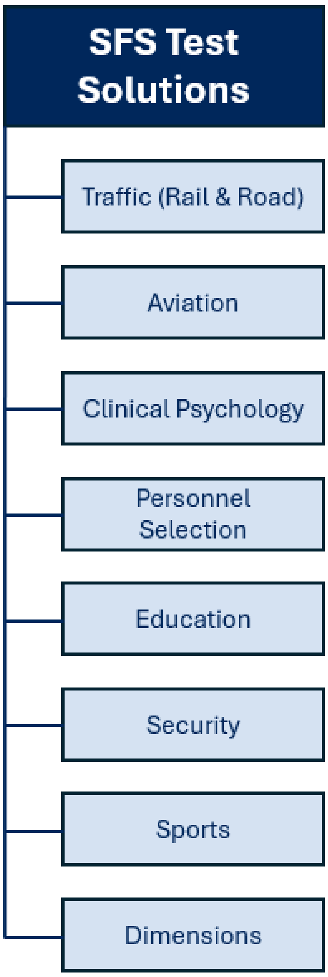
SFS Test Solutions aims to make psychometric procedures flexible, professional, and easily accessible in accordance with internationally recognized standards. Users receive a comprehensive and application-oriented portfolio of digital psychometric solutions that enables the precise assessment of relevant abilities, personality dimensions, and vocational interest profiles.

1 CONCEPT

SFS Test Solutions provides targeted solutions for relevant areas of application in the fields of occupational and training-related aptitude testing, the assessment of neuropsychological and clinical psychological performance impairments, sport and traffic psychology assessment. The solutions were compiled on the basis of extensive investigations about relevant application-related diagnostic issues, current research findings, legal requirements and practical experience.

The **SFS Test Solutions** page in the Vienna Test System provides all users with easy access to the complete portfolio of SFS Test Solutions. The target groups for the application of the solutions include psychologists responsible for human resources, traffic psychologists, clinical and neuropsychological psychologists, as well as sports psychologists. In addition, SFS Test Solutions may be used by trained users who have relevant qualifications in the field of aptitude assessment. This includes basic knowledge of statistics, test theory, quality criteria, and construction principles of psychometric tests. Standards such as DIN 33430 or comparable international guidelines provide detailed information on the necessary qualifications. In addition, international standards such as the *Performance requirements, context definitions and knowledge & skill specifications for the three EFPA levels of qualifications in psychological assessment* (European Federation of Psychologists‘ Associations [EFPA], 2013), *APA standards for educational and psychological testing* (2014), and the *International guidelines for test use* (International Test Commission, 2001) can be used.



SFS Test Solutions are specifically tailored to the requirements of relevant application areas and support decision-making in various contexts. Solutions are offered for the following application areas:

Traffic (Rail & Road)

Aviation

Clinical Psychology

Personnel Selection

Education

Security

Sports

In addition to the individual solutions, the SFS Dimensions are a supplement that can be used to create and apply individual diagnostic solutions.

Please consider the limitations when using the SFS Test Solutions and consider the information provided here beforehand.

All SFS Test Solutions are part of the SCHUHFRIED Selection **-** a license package that includes all SCHUHFRIED Selection tests. Only one license is required to use an SFS Test Solution (e.g., the entire SFS Assessment Airline Pilots). The proposed solutions can be supplemented with additional tests from the SCHUHFRIED Selection, with only one license being deducted per testing, regardless of its duration. The SCHUHFRIED Selection thus offers a high degree of flexibility for users.

2 INTRODUCTION

SCHUHFRIED GmbH has been offering high-quality, scientifically sound testing tests in the Vienna Test System (VTS) for over 75 years. With **SFS Test Solutions**, the Vienna Test System has been adapted even more closely to the needs and questions of users. SFS Test Solutions in the VTS represent a scientifically sound, digital offering for psychological assessments that has been specially adapted to the requirements of human resources (HR), clinical neuropsychological assessments, sports and traffic psychology assessments.

The aim of SFS Test Solutions is to support users in finding the best possible answers to their questions. Based on requirements analyses, scientific findings and SCHUHFRIED's expertise, test combinations (the *Test Solutions*) are available to answer many different diagnostic questions. For particularly relevant questions, SFS Test Solutions offers test combinations with extended functions, such as the calculation of a total score for easy assessment of the fit to an ideal profile, which has been created on the basis of extensive research. In addition, solutions are included for over 600 occupations, offering a test combination based on requirements analyses**.** The offering is rounded off by the option of configuring customized solutions from a wide range of individually testable dimensions.

SFS Test Solutions offer intuitive and user-friendly options for finding the right solution. A search function allows you to identify the optimal SFS Test Solution for your use-case and is primarily aimed at users who are not yet familiar with the wide range of tests offered by SCHUHFRIED. In addition, the test solutions relevant for a specific area of application are clearly assigned to the corresponding categories and can therefore be easily found.

2.1 Goals and application areas

SFS Test Solutions aims to provide users with the best possible support in selecting the optimal test procedures for their specific needs. They make psychometric tests flexible, professional and accessible in accordance with internationally recognised standards. This enables users to select tests efficiently and validly. To facilitate the selection of the appropriate solution, the Test Solutions are divided into the following areas of application:

- **Traffic (rail & road):** Test solutions for use in traffic psychology and personnel selection or aptitude assessment for transport-specific professions in the field of road and rail transport.
- **Aviation:** Test solutions for use in aptitude assessment and personnel selection for professions in aviation.
- **Clinical psychology:** Test solutions for use in clinical psychology and neuropsychology to assess neurocognitive functioning.
- **Personnel selection:** Test Solutions for use in personnel selection and aptitude assessment for a wide range of professions in industry and other specialist areas (over 600 occupations available).
- **Education:** Test Solutions for use in career counselling.
- **Security:** Test Solutions for use in aptitude assessment and personnel selection for security forces (police and military).
- **Sport:** Test solutions for use in sports psychology and for personnel selection or aptitude assessment for professions in sport.

- **Dimensions:** The tests used for the test solutions and the dimensions they cover (personality traits, cognitive and psychomotor abilities as well as vocational interests) can be used for user-defined solutions. For details, see: Dimensions.

The aim of the development was to create diagnostics solutions (the Test Solutions) that are valid in terms of content, effective and easy to use for all relevant areas of application. The available solutions differ in terms of content, depending on which tests from the VTS portfolio are included or which dimensions are covered, and they have different features. The test selection can be based either purely on a requirements analysis or on scientific findings regarding the relevance of the dimensions included for a specific question. Where appropriate or necessary, legal requirements and professional guidelines were also taken into account. In the case of the 'Professional Drivers' test solution, for example, those dimensions were taken into account that must be tested in accordance with country-specific laws when determining driving aptitude.

To enable easy application and evaluation of the results, some test solutions feature advanced scoring that allows for an overall assessment based on all relevant dimensions using an additionally calculated total score. These test solutions also feature a simple color scheme (**traffic light system**: red-yellow-green) for easier interpretation. This marks the results for each dimension as below average (red), slightly below average (yellow) or average to above average (green). Details on scoring and interpretation can be found in the chapter Notes on evaluation and interpretation.

The features of a test solution can be easily identified in VTS by means of different icons that characterise the test solutions. See: Notes on administration for more information.

This provides the user with a solution that allows them to answer a specific question in a targeted and well-founded manner. Details on the development and content of the solutions available for the various areas of application can be found in the chapter: Test Solutions.

The following chapters contain next information on the use of psychological testing procedures in various fields of application, the appropriateness and admissibility of their use, and the quality standards relevant to the testing procedures used and the use of SFS Test Solutions.

2.2 Use of psychological tests in job-related aptitude assessments

Predicting the success of candidates is relevant in many areas of HR. DIN 33430 (DIN, 2016) defines aptitude as the degree to which a person possesses the aptitude characteristics that are prerequisites for the required level of professional performance and enable satisfaction with the job to be filled, the field of activity, the training or study program, or the profession. SFS Test Solutions can therefore be used to provide support in various areas:

- Personnel and student selection: Selection of suitable or the best candidates for a profession or course of study
- Personnel development: Clarification of the strengths and development potential of the existing work team as a basis for tailor-made personnel development measures
- Career counseling/outplacement: Advising candidates on their future careers

Qualified **personnel and student selection** is a factual decision that can range from the selection of trainees to the selection of managers. The relevance of psychologically sound job and study placements results both from the large number of positions and study places to be filled and from the considerable consequences of wrong decisions.

Placing the right person or suitable student in the right job or study program represents an important competitive advantage. Good selection tests therefore contribute significantly to the economic and academic success of an organization or educational institution. However, it is not only in the interest of companies and universities to optimize the selection process, but also in the interest of employees and students. A well-founded selection process helps to prevent employees and students from being over- or underchallenged, thereby increasing job and study satisfaction (e.g., John & Maier, 2007).

Psychological tests are used not only for personnel selection, but also for **personnel development** in companies. Existing personnel can be assessed for strengths and development potential and thus receive targeted support (e.g., Schuler, 2006). Furthermore, potential analyses help to identify future high performers and managers. Psychological tests provide a solid foundation for personnel development.

Another area of application for psychological tests is **career counseling**. Psychological tests can be used in counseling situations to help candidates make future career decisions. They are also used in **vocational rehabilitation** to identify individual skills, interests, and potential, thereby promoting suitable vocational (re)integration. Psychological tests help candidates recognize their potential and interests and thus make optimal career decisions. Career counseling can also be used as part of outplacement measures to offer professional help to departing employees in their career reorientation.

SFS Test Solutions supports users in selecting the tests from the portfolio that best suit their individual needs. HR managers have access to solutions for many different career and education-related questions.

2.3 Use of psychological tests in clinical- and neuropsychological assessments

Neuropsychological assessments in a clinical context should always be hypothesis-driven. Based on self-reported information about perceived impairments, information about the underlying disease, biographical data, behavioral observations, and, if applicable, information from third-party sources, cognitive functions to be tested are selected depending on the specific issue at hand. On the other hand, clinical practice shows that certain cognitive sub-functions should be routinely assessed in every neuropsychological diagnosis because, regardless of the individual issues at hand, they are so clinically relevant that a neuropsychological profile would be incomplete and therefore only interpretable to a limited extent without taking these functions into account.

Clinical- and neuropsychological assessments use psychological tests to assess individual functional profiles that are relevant for diagnosis, therapy planning, and progress monitoring (Kubinger, 2019). According to the basic principles of psychological assessments, tests help to map cognitive, emotional, and behavioral aspects in a differentiated manner and enable standardized recording of psychological characteristics under controlled conditions (Schmidt-Atzert et al., 2021).

SFS Test Solutions help users select the neuropsychological and clinical psychological tests from the portfolio that best suit their individual needs. The Clinical Psychology application area offers various test solutions that can be used in the fields of clinical psychology and neuropsychology to identify possible impairments of relevant neurocognitive functions. In addition, VTS Analytics offers additional functions for monitoring disease progression, such as comparing test values over time (VTS Analytics → Comparison over time).

Psychological tests are also used in clinical psychological assessments as a basis for therapy evaluation and rehabilitation measures. Studies confirm the effectiveness of evidence-based neuropsychological therapy approaches, with computer-assisted testing playing a central role in treatment planning (Cicerone et al., 2011). Computer-assisted testing enable a high degree of standardization and objectivity, making assessment decisions transparent and comprehensible (Brezovsky, 2009). In neuropsychological rehabilitation in particular, psychological tests can be used to specifically identify individual deficits and derive tailor-made therapy programs that enable the best possible reintegration into everyday life, working life, and the social environment (Cramon & Zihl, 2013).

2.4 Use of psychological tests in sports psychology assessments

In the field of sports psychology assessments, psychological tests are primarily used to record individual performance and personality profiles of athletes. The tests help to record mental abilities, attention functions, emotional stability, motivation, and cognitive skills that are important for performance in different sports and disciplines (Beckmann & Elbe, 2024). A key concern is to recognize talent, tap into potential, and identify specific weaknesses in order to enable targeted training and development planning. The importance of psychological factors for athletic performance is underscored by current research, which shows that mental strength often determines victory or defeat (Beckmann & Kellmann, 2003; Höner, Bergmann & Leyhr, 2025).

In the application area "Sports," SFS Test Solutions offers multiple solution specifically designed for sports psychology. For example, a test solution is available for analyzing the potential of professional athletes, as well as a test solution for analyzing the potential of young athletes. Empirical studies confirm the effectiveness of such standardized tests for talent identification and development (Raab, Schlapkohl, Gärtner & Zastrow, 2011; Beckmann et al., 2009). The broad applicability of the test battery allows diagnoses to be efficiently carried out for different target groups – from young athletes to top athletes.

In practice, psychological tests are used in sports to measure individual strengths and weaknesses in areas such as responsiveness, concentration, memory, and resilience, as well as to assess personality traits such as motivation, self-control, anxiety management, and social skills. Current intervention studies show that sports psychology programs based on assessment findings can bring about significant improvements in self-efficacy expectations and stress management in young competitive athletes (Preis, 2014). The integration of such assessment findings into training and support programs promotes performance optimization and at the same time helps athletes cope with the psychological stress associated with competitive sports (Kellmann, Beckmann & Kopczynski, 2006).

2.5 Quality standards

In developing SFS Test Solutions, great importance was attached to adhering to the highest possible quality standards. Criteria that can be used to assess in advance how good a psychological test is include the so-called test quality criteria (objectivity, reliability, validity, standardization, scaling, economy, usefulness, reasonableness, authenticity, fairness), which should be specified for all scientifically based tests (cf. EFPA, 2025; DIN 33430). Information about the quality criteria can be found in the chapter: Evaluation.

In addition, there are approaches to applying a quality standard not only to individual tests, but to the entire selection process, or rather the entire clinical/neuropsychological assessment process, including the requirements for the persons conducting the tests. In German-speaking countries, these approaches include DIN 33430 entitled "Requirements for tests and their use in job-related aptitude assessment" (DIN, 2016) and "Requirements for processes and methods in personnel selection and development"

(Austrian Standards Institute, 2017). DIN 33430 refers only to aptitude testing, while ÖNORM D4000 also refers to work-related interventions and evaluations. In addition, DIN 33430 and other national and international standards have been further developed into ISO norm 10667 "Assessment service delivery – Procedures and methods to assess people in work and organizational settings." However, ISO 10667 is more tailored to the American market.

In the field of clinical psychological assessments, the guidelines of the current assessment manuals DSM-5-TR (American Psychiatric Association, 2022) and ICD-11 (WHO, 2022), as well as national guidelines, form the basis for quality standards, such as the guidelines for diagnosis and therapy of the German Society of Neurology for memory disorders (Thöne-Otto et al., 2020), attention disorders (Fimm et al., 2023), and executive dysfunction (Müller et al., 2019).

2.5.1 Job-related aptitude assessment

The aim of DIN 33430 is to bring greater certainty to the use of job-related aptitude assessment. It thus serves as a necessary basis for good personnel decisions. The norm covers the entire selection process: from planning, selecting procedures, implementation, evaluation, and interpretation to decision-making and feedback to candidates (e.g., Westhoff et al., 2005). For example, DIN 33430 stipulates that the standardization of psychological tests should be reviewed every 8 years. In order to meet this criterion, SCHUHFRIED has its own test center for empirical data collection, whose task is to collect up-to-date norm data for the tests.

According to DIN 33430, the requirements of the professional activity, including the necessary degrees of proficiency, must be recorded. As explained in more detail here, the requirement analyses for the SFS Occupations are based on such data and considerations. The necessary degree of proficiency was always taken into account when selecting the requirements for each profession. DIN conformity was always taken into account in the design and implementation of the SFS Test Solutions. All tests were tested according to DIN criteria.

Similarly, foreseeable future developments in technology, the economy, and society should be taken into account when determining requirements in order to assess whether and how activities, working conditions, and environmental conditions may change and affect the required or desired aptitude characteristics. For this reason, the data used in SFS Test Solutions is also based on current, government-funded sources and study results. In order to continue to meet this criterion in the future, SFS Test Solutions are continuously updated.

Furthermore, the aptitude characteristics should not only be formulated in abstract terms, but also specified in concrete terms through behavior-oriented descriptions of sample statements and/or sample behaviors. In creating the test batteries, sources were used whose requirement profiles list typical behaviors (see table at SFS Dimensions, as well as here).

Users are advised to note that SFS Test Solutions only lists requirements that can be covered by tests from the SCHUHFRIED Selection. Not all job analysis methods are used in the current version. Therefore, missing requirements must be covered by other suitable procedures and additional tests outside the SCHUHFRIED Selection. According to DIN 33430, various analysis methods should be used where appropriate, such as experience-based assessments (based on interviews with supervisors, colleagues, etc., and/or document analyses) as well as (partially) standardized oral interviews and similar methods. More detailed information can be found here.

2.5.2 Clinical psychological and neuropsychological assessments

The highest possible quality standards were also pursued for the use of SFS Test Solutions in the field of clinical psychological and neuropsychological assessments.

Modern clinical neuropsychology is based on the guidelines of the current assessment manuals DSM-5-TR (American Psychiatric Association, 2022) and ICD-11 (WHO, 2022), which define the testing of basic neuropsychological functions as an important pillar of neuropsychological and clinical psychological assessments, as well as national guidelines, such as those published by the German Society of Neurology for the diagnosis and treatment of memory disorders (Thöne-Otto et al., 2020), attention disorders (Fimm et al., 2023), and executive dysfunction (Müller et al., 2019).

SFS Test Solutions implements these requirements by providing practicing neuropsychologists and clinical psychologists with a computer-based test collection of specific and sensitive tests that can be used to assess the cognitive status of patients with neurological diseases and/or mental disorders on the basis of neurocognitive dimensions.

However, due to the limitation of the selection to the tests available in the SCHUHFRIED Selection, SFS Test Solutions does not claim to be complete in the sense of comprehensive, guideline-based cognitive performance assessments. In contexts where this is required (e.g., social medical performance assessment, insurance law issues), this should be supplemented by other tests outside the SCHUHFRIED Selection, if necessary. Furthermore, individual assessment questions often require the use of targeted additional tests that go beyond the basic neurocognitive dimensions as defined in the DSM-5-TR. Finally, it should be noted that the ultimate responsibility for neuropsychological or clinical psychological assessments and the conclusions and therapy goals derived from them must remain with the clinical user, as the assessment process is a complex one in which information from a wide variety of sources and the individual circumstances of the client must be integrated (cf. Psychologists Act, 2013).

2.6 Advantages of psychological tests in aptitude testing & psychological assessments

While other assessment methods of **aptitude testing**, such as interviews, assessment centers, or CV analyses, provide information about the behavioral repertoire that test takers currently possess or have demonstrated in the past, psychological tests focus on more permanent and fundamental characteristics of individuals. The statements that can be made through psychological tests can not only be used to explain current behavior, but also shed light on statements about the potential of individuals that may not yet have been realized. Potential assessments can thus not only be used to distinguish between currently suitable and unsuitable individuals, but also to identify those individuals who show increased development potential in line with the requirement profile. Depending on the results of the requirements analysis, several assessment procedures may be useful in answering the question. In this case, an approach that integrates all available sources of information is recommended.

Psychological tests also offer incremental advantages for **clinical and neuropsychological assessments** compared to other methods such as interviews, exploratory conversations, or purely observation-based procedures. While interviews and anamnestic procedures primarily provide retrospective or subjective information, tests capture the patient's fundamental, measurable characteristics and abilities in a standardized and objective manner. Psychological tests enable a differentiated and quantifiable assessment of cognitive, emotional, and behavioral characteristics that can be compared with age- and population-specific reference groups through standardization. This objectivity and reliability minimize the distortions that can arise from subjective assessments or situational influences (Fimm et al., 2023; Thöne-Otto et al., 2020; Müller et al., 2019). For example, the guidelines of the German Society of Neurology explicitly emphasize that attention performance cannot be assessed on the basis of clinical impression alone and that standardized testing procedures are therefore indispensable (Fimm et al., 2023).

While interviews and observations provide important contextual information, tests create a reliable basis for valid, comprehensible, and reproducible statements about the assessment condition, as emphasized in the guidelines for neuropsychological assessment of the Society for Neuropsychology (GNP) (Neumann-Zielke et al., 2015).

The following criteria for psychological tests are of utmost importance in practice: objectivity, reliability, criterion validity, fairness, and economy. The advantages of the SFS Test Solutions with regard to these criteria are explained in the chapter: Evaluation.

3 EVALUATION

3.1 Objectivity

The objectivity of a test means that the results obtained with the test are independent of the examiner (Ziegler & Bühner, 2012). A distinction is made between implementation objectivity (the result is independent of the test administrator or the examination situation), evaluation objectivity (the result is independent of the person evaluating it), and interpretation objectivity (different interpreters arrive at the same conclusion based on the results). If objectivity is insufficient, a test may also be invalid, i.e., it may not predict the success of candidates. Computer tests such as those in the Vienna Test System exhibit maximum objectivity in all three types due to the standardized specifications on the computer, automated evaluation, and standardization.

3.2 Reliability

The reliability of a test describes the degree of accuracy with which a suitability characteristic is measured (Ziegler & Bühner, 2012). Reliability coefficients can range from 0 to 1, with a higher value indicating greater accuracy. According to the test evaluation guidelines of the European Federation of Psychologists' Associations (EFPA, 2025), reliability values above 0.7 are considered adequate, above 0.8 are considered good, and above 0.9 are considered excellent. However, tests with lower reliability can be used for screening characteristics.

The tests in the Vienna Test System (VTS) all have at least adequate reliability. However, some tests in the VTS that were constructed based on item response theory and are designed as an adaptive test based on large item pools, offer the option of adjusting the reliability by the test administrator.

3.3 Criterion validity

Criterion validity means that test values of the respective psychometric test correlate with an external criterion relevant to the aptitude characteristic. For example, the test should be able to predict future professional success (e.g., sales, supervisor evaluations, grades in training tests, etc.), neuropsychological or clinical psychological diagnoses, or athletic performance. The following chapters explain the relationship between psychological tests and relevant external criteria in the areas of aptitude testing, clinical psychological assessments, and sports psychological assessments.

3.3.1 Aptitude Assessment

Although psychological tests cannot perfectly predict success in a particular job or training program, they can predict professional success with above-average accuracy, thereby enabling well-founded, objective selection decisions. Compared to other HR procedures, psychological tests have a high predictive power for professional success: A meta-analysis by Schmidt and Hunter (1998) analyzed the criterion validity of various aptitude testing procedures, including cognitive performance tests, personality tests, structured interviews, unstructured interviews, assessment centers, references, and graphology. It was found that when the procedures are used in isolation, cognitive performance tests and structured interviews have the highest predictive validity for predicting training and career success. However, the Schmidt-Hunter study also showed that predictive validity can be best increased by combining cognitive performance tests with a structured interview or personality tests. The authors therefore suggest using other methods to supplement cognitive performance tests. One advantage of cognitive performance tests over labor-intensive interviews is that psychometric methods can be used across positions and efficiently in group testing. In summary, it can be said that career success can best be predicted by combining various tests and other HR instruments. The results of the Schmidt-Hunter study have been confirmed by other independent meta-analyses (e.g., Bertua, Anderson & Salgado, 2005). Sackett et al. (2021) reviewed the original conclusions of Schmidt and Hunter (1998) in a recent revision, particularly with regard to the effects of statistical corrections for variance restriction of validity estimates. The authors concluded that these corrections for variance restriction present significant problems and that the validity of many procedures has been overestimated as a result. Even after methodological adjustments to the calculation of the respective validity parameters, selection procedures that ranked highly in earlier studies continue to rank highly. However, as can be seen in *Figure 1* the mean validity estimates were reduced by 10 to 20 percentage points.

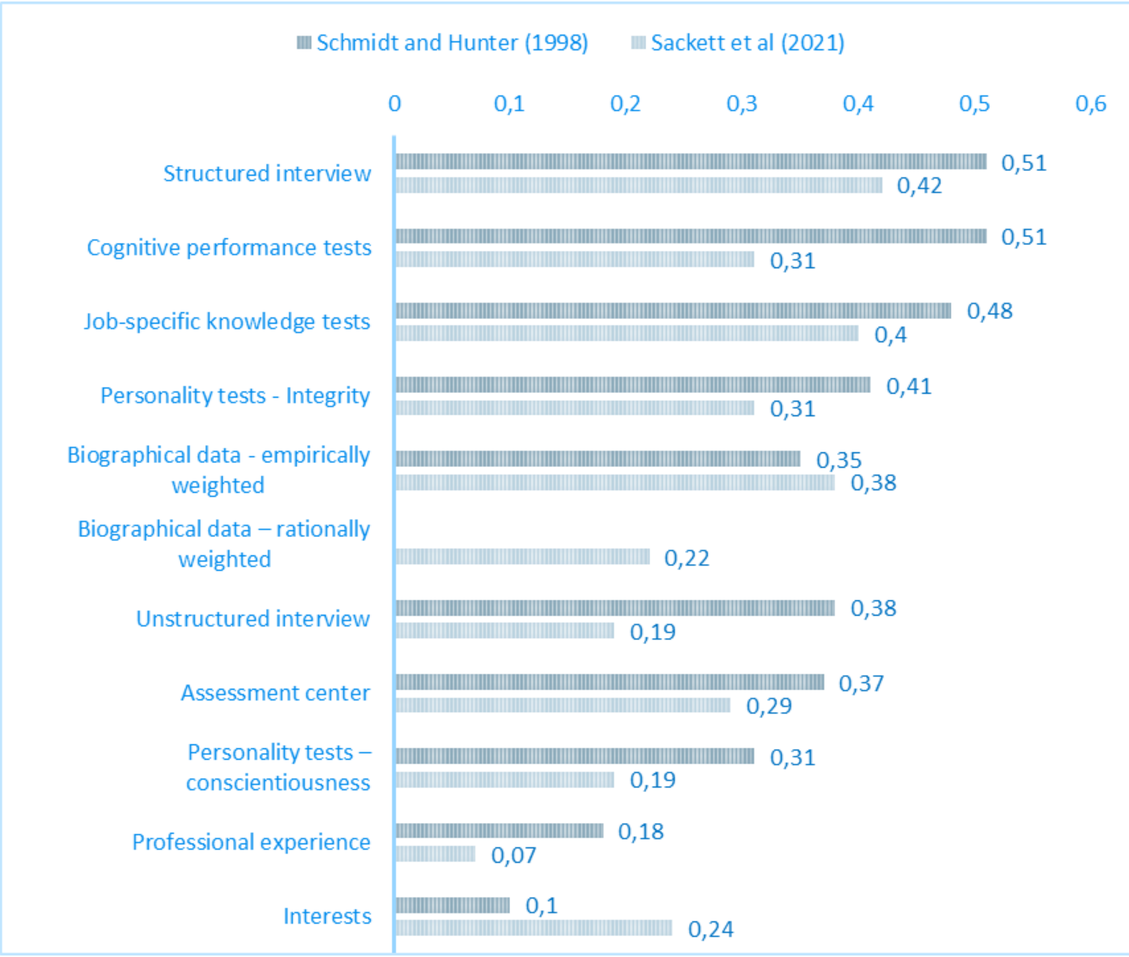


Figure 1 Figure 1: Revision by Sackett et al. (2021)

A recent study by Hambrick, Burgoyne, and Oswald (2024) confirms the continuing relevance of cognitive abilities for predicting job performance—regardless of work experience. Based on a large data set covering 31 different military occupations (N = 10,088), they examined the stability of the predictive validity of cognitive abilities across different levels of experience. While it is often argued that the influence of general cognitive abilities (g factor) decreases with increasing experience, the results show that g remains a significant predictor of job-specific performance even with high job experience. Although the predictive power of g tended to be slightly weaker in occupations with a high proportion of manual work, the predictive validity was consistently present across all military occupations examined. The authors conclude that many complex work tasks not only involve constant demands, but also variable challenges that require continuous adaptation and problem-solving skills—traits that are closely linked to cognitive performance. These results are consistent with previous meta-analyses, although Sackett et al. (2021) point out that earlier estimates of the validity of g may have been overestimated.

Cognitive performance tests can also be used to predict suitability for school and university education, teaching, and similar fields. Zisman and Ganzach (2022) provide current findings on educational success. In a replication of the study by Borghans et al. (2016), they examined the predictive power of cognitive performance tests and personality tests on educational success (Figure 2).

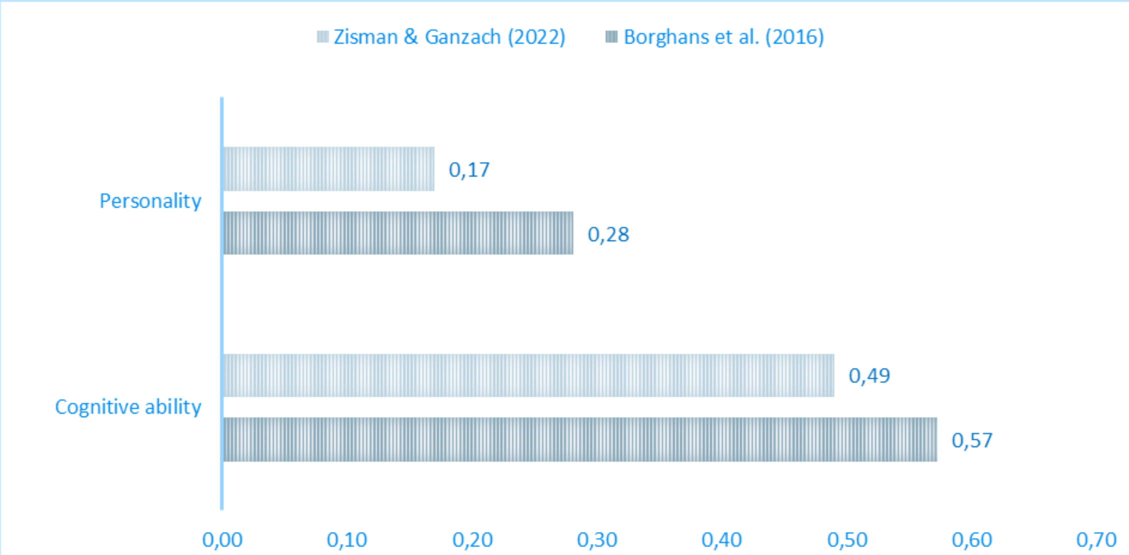


Figure 2 Figure 2: Predictive power of cognitive abilities and personality on training success

In the data sets they analyzed, the predictive power of intelligence in relation to academic and professional success was far higher than the predictive power of the Big Five personality dimensions. More detailed information on educational success can be found each training-related aptitude assessment.

Since personality questionnaires are used as a selection criterion in addition to cognitive performance (g), the question arises as to which personality dimensions are the strongest predictors of success. A large meta-analysis with N = 413,074 participants examined the correlations (*ρ)* between the Big Five and academic success, which is a predictor of professional success, corrected for measurement errors (Mammadov, 2022). Since personality dimensions can correlate with g — which can lead to an overestimation of their influence — reported correlations were additionally adjusted for the effect of g. These were ρ = .16 for openness, ρ = .27 for conscientiousness, ρ = .01 for extraversion, ρ = .09 for agreeableness, and ρ = .02 for emotional stability. In summary, both extraversion and emotional stability showed negligible effects, while conscientiousness, openness, and potentially also agreeableness can be interpreted as valuable predictors. In addition, g continued to be the strongest predictor with ρ = .42.

Another recent study analyzed the average personality traits of 68,540 participants in 263 different occupational groups and showed that many occupations have distinct personality profiles (Anni et al., 2025). In general, the personality traits of the various occupational groups in the study were largely as expected. For example, jobs in advertising and sales showed a high average extraversion, while people in engineering professions tended to score low on this dimension. The study also referred to the "work styles" from the O*NET database (O*NET OnLine, n.d.). O*NET is one of the most important platforms for occupational information in the US; more details are provided in SFS Occupations. The "work styles" are a collection of requirements that are considered relevant to performance and success in various occupations and are based on the assessments of experts and job holders. These include, for example, leadership orientation, self-control, and initiative. The study was able to show that the "work style" requirements of the individual occupational groups correlate with the observed Big Five personality dimensions. The strongest correlations were found between perseverance/stamina and openness (ρ = .59), leadership ability and conscientiousness (ρ = .25), self-control and extraversion (ρ = .50), and integrity/righteousness and emotional stability (ρ = .28). Agreeableness showed no significant correlations, while extraversion and openness showed significant effects with most of O*NET's dimensions (Anni et al., 2025).

In summary, it can be said that aptitude testing methods such as cognitive performance tests are among the most effective instruments for career and training-related aptitude testing due to their high criterion validity. Current research findings confirm the high relevance of cognitive abilities (g) as the strongest single predictor of training and career success. Among personality traits, conscientiousness and openness are important complementary predictors, while the other dimensions show only minor additional effects. The above-mentioned studies indicate that personality questionnaires are criterion-valid with regard to work style and career success and have an incremental predictive value compared to cognitive abilities. Overall, the available evidence underscores the central role of empirically based, standardized selection procedures for valid, fair, and efficient personnel decisions.

3.3.2 Clinical/neuropsychological assessments

In neuropsychological assessments, determining the level of neurocognitive functioning according to the definitions in the current manuals, ICD-11 or DSM-5, is necessary for the diagnosis and treatment planning of neurocognitive disorders such as dementia, as well as some developmental disorders such as ADHD (see Clinical-/neurospychological assessment). For example, a meta-analysis with a total of 3,734 participants with and 2,969 without ADHD showed that executive functions are moderately impaired in ADHD (d or g ≈ 0.46–0.69), especially in inhibition, Vigilance, working memory, and planning—classic target constructs of STROOP, VIGIL, SPAN, and flexibility tasks such as the TMT-S (Willcutt et al., 2005).

Even in the clinical psychological diagnosis and therapy of disorders in which neurocognitive impairment is not a core symptom, determining the level of neurocognitive function can provide additional information. Psychological tests show robust group differences between healthy individuals and those with clinical diagnoses across numerous disorders—core evidence for their disorder-related criterion validity.

For example, meta-analyses comparing 9,048 patients with schizophrenia and 8,814 healthy individuals show a pronounced, generalized deterioration in performance (global mean Hedges' $g \approx -1.03$), most pronounced in processing speed (g ≈ −1.25) and episodic memory (g ≈ −1.23). Tests such as the TMT-S (processing speed and cognitive flexibility) and SPAN (working memory) measure precisely those domains in which the greatest group assessment effects are found (Schaefer et al., 2013).

For affective disorders, meta-analyses showed that n = 784 individuals with major depression versus n= 727 healthy individuals had moderate deficits in executive functions, memory, and attention (Cohen's $d \approx -0.34$ to -0.65); these differences persisted to a lesser extent even in remission (n = 168) – a strong indication that the test values reflect time-stable group differences and cannot be fully explained by temporary mood or motivation effects (Rock et al., 2013). In another meta-analysis consisting of 689 patients with bipolar disorder in euthymia and 721 individuals in the control group, medium to large effects (in some cases d ≥ -0.80) were found (even in the euthymic state), including in executive functions and verbal learning (Robinson et al., 2006).

In some cases, personality traits also show disorder-specific profiles: A meta-analysis (*N* = 30,036 to 33,054) of numerous anxiety, depression, and substance use disorders compared clinically conspicuous individuals with inconspicuous individuals (Kotov et al., 2010). The clinical sample showed lower emotional stability (mean d = -1.65) and conscientiousness (mean d = -1.01). Furthermore, personality traits prospectively predict neurocognitive diagnoses: higher neuroticism increased the risk of dementia (hazard ratio (*HR)* = 1.24), while higher conscientiousness reduced it (*HR* = 0.77; Aschwanden et al., 2021). Personality traits are not included as standard in SFS Solutions for the clinical and neuro field, but can be recorded for specific assessment questions using the FCB5 personality questionnaire, for example.

In summary, meta-analyses across different disorders, domains, and instruments show consistent group differences between clinically diagnosed individuals and healthy control samples. Thus, criterion validity with regard to clinical status can be interpreted as given for the aforementioned ability and personality constructs.

3.3.3 Sports psychology assessments

Psychological tests show consistent correlations with athletic performance—core evidence for their criterion validity. A large meta-analysis (N = 8,860) found that more skilled athletes perform better on cognitive tests than less skilled athletes (total Hedges' g = 0.59, 95% CI [0.49; 0.69]). The effects are particularly pronounced in decision-making tasks (g = 0.77) and sport-specific tasks (Kalén et al., 2021). In another meta-analysis of 1,410 athletes from 17 studies, professionals across all sports showed higher cognitive performance than amateurs (r = 0.22; Scharfen et al., 2019). This supports the validity of domain-general tests such as TMT-S (processing speed), SPAN (working memory), and STROOP (interference control) for differentiating athletic performance levels. In addition, a meta-analysis by Liu et al. (2024) with 1,453 participants in multiple object tracking showed clear advantages for athletes over non-athletes (g = 0.56) and for experts over novices (g = 0.92). These results support the criterion validity of tests that address overview acquisition and reactive stress tolerance (e.g., ATAVT-2, DT, RT).

Personality also contributes to athletic performance: Big Five factors and athletic performance are significantly positively correlated, especially in the dimensions of conscientiousness (*r* = 0.178) and extraversion (*r* = 0.145) (Yang et al., 2024). This effect remains consistent in both team and individual sports.

In summary, meta-analytic evidence shows medium to large effects of cognitive performance and small but statistically significant correlations between personality and athletic performance. Taken together, these findings can be interpreted as criterion validity of the tests used in the context of sports psychology.

3.4 Fairness

Test fairness describes the extent to which the values resulting from a test do not lead to systematic discrimination against certain test takers. Systematic discrimination can arise, for example, on the basis of ethnic, sociocultural, or gender-specific affiliation (Kubinger, 2019).

Test fairness can refer not only to the content of the test items, but in principle to all aspects of a test procedure – from its construction and implementation to its evaluation. An overarching understanding of test fairness therefore involves equal treatment of all test takers in terms of test conditions, access to practice materials, feedback, and other aspects of test administration.

The Vienna Test System contributes to fairness by enabling a standardized test experience and test administrator independence. The fairness of the test items is examined for each individual test in the Vienna Test System with regard to gender, age, and educational level and reported in the respective test manuals. Since the Vienna Test

System is designed for worldwide use, fairness across different cultures also plays a central role, which is explicitly taken into account in test construction and development.

3.5 Economy

Economy is understood as how resource-efficient a test is in comparison to the information gained (Kubinger, 2019). Compared to other instruments (e.g., assessment centers/work samples), psychological tests are usually much more economical. Computer tests are particularly economical because the test is administered in computerized form, the evaluation and reporting are automated, data management is simple, and group testing is possible.

Cost-benefit analyses show that the use of tests in personnel selection can massively increase the hit rate for suitable candidates – while simultaneously increasing productivity and reducing bad investments. The costs saved in this way mean that the investment in purchasing the tests pays for itself within a very short time.

4 LIMITATIONS

The limitations described here apply to all users of SFS Test Solutions, regardless of the area of application, whether in aptitude testing or in clinical-psychological or neuropsychological assessments. It is particularly important to note that the ultimate responsibility for the selection, implementation, and interpretation of the tests, as well as for the entire assessment or aptitude-related process, lies with the users. SFS Test Solutions are a supporting component that, according to the relevant guidelines, do not fulfill the requirements of a complete and conclusive aptitude testing or diagnosis.

As already explained in the chapter "Use of psychological tests in job-related aptitude assessments", SFS Test Solutions cover only a subarea of the possible assessment procedures and therefore do not constitute complete aptitude assessment according to DIN 33430. In most cases, an isolated consideration of performance and personality assessment test parameters is not sufficient for a well-founded suitability assessment. If relevant and independent findings can be determined in this way, different perspectives for the profession in question should be taken into account.

In clinical practice, the clinician must also adapt the test selection to the clinical question. The "Brief Neurocognitive Assessment" can provide an overview of a person's neurocognitive function profile but does not cover all neurocognitive domains listed in DSM-5 (see Clinical-/neuropsychological assessment).

In order to make the entire range of SFS Test Solutions available to all users, only tests from the SCHUHFRIED Selection have been included. Other tests available via the Vienna Test System can be combined and expanded with the SFS Test Solutions batteries. Instructions for adapting the ready-made batteries can be found in the chapter Specifying individual dimensions. Therefore, some of the SFS Test Solutions, especially those based purely on requirements analyses, may be too general and unspecific for specific cases and questions, as not all necessary dimensions can be covered by the test procedures from the SCHUHFRIED Selection. The SFS Test Solutions are therefore intended to support users in selecting the appropriate tests for their specific application. However, according to DIN 33430, the user remains responsible for selecting the methods (tests) used, ensuring that the selected methods and tests are appropriate for the specific application, and for the entire assessment process and the quality requirements associated with it (see also: Quality standards).

For job-related aptitude assessment, the current version focuses primarily on success factors that are relevant to the selected issue. The interests of the test takers, which would provide information about their later job satisfaction, are only included in training-specific applications (academic aptitude & apprentice testing) and can also be added to all other applications as required.

SFS Test Solutions currently represent only one of several steps in aptitude testing and traffic, clinical/neuropsychological and sports psychology assessments—support in selecting the right test battery. In order to provide you with the best possible support in all further steps, SCHUHFRIED offers additional Test Services by trained and DIN 33430-certified psychologists. As part of these services, you will receive support in integrating digital tests into your selection and assessment processes in the best possible way. The focus is particularly on:

- **User qualification:** SCHUHFRIED offers training courses specifically for test administrators, HR managers, clinical, neuro, and sports psychologists to train them in the use of digital tests and the Vienna Test System.

- **Refining the requirement profile:** If the test battery does not fully cover your requirement profile, our SCHUHFRIED consultants can help you refine the requirement profile so that you can select the most suitable test battery.
- **Optimizing the basis for decision-making:** Our SCHUHFRIED consultants support you in establishing decision-making rules that allow you to rank all applicants precisely so that you can quickly and efficiently select the best candidates, even when there is a high volume of applicants. In addition, individual norms can be calculated based on your sample in order to differentiate even more precisely between applicants, as well as between different patient groups and different sports. If additional performance criteria (e.g., work success, training success) or clinical diagnoses are available, a validation study can be conducted to further increase the predictive power of the tests used by optimizing the evaluation of results.
- **Increasing acceptance:** In order to increase the acceptance of the tests used by applicants, SCHUHFRIED consultants can develop customized reports that can be generated automatically after testing and assist in providing feedback on the results. The reports can be tailored to the target group of applicants or the target group of HR managers in terms of both wording and information content. All reports can be designed to match your organization's branding.
- **Integrating your own test content into the Vienna Test System:** Digitizing existing tests or questionnaires, which can be standardized and validated in the SCHUHFRIED Test Center if necessary, is part of the Test Services offering. Translations of these tests can be carried out using the highly qualified translation processes of SCHUHFRIED's Translation Management.

If you would like individual advice beyond the services offered by SFS Test Solutions, please contact our SCHUHFRIED product information & psychological consulting team.

5 TEST SOLUTIONS

5.1 Traffic (Rail & Road)

The application area "Traffic (Rail & Road)" provides test solutions for use in traffic psychology and personnel selection or aptitude assessment for transport-specific professions in the field of road and rail transport.

The test solutions in this area of application include:

- **Test solutions that have been developed on the basis of in-depth, advanced research**, incorporating SCHUHFRIED's many years of practical experience in applying the tests, and which have specific features, such as extended scoring (for details, see: Notes on administration).

  These solutions are described in detail in this section. It explains which scientific findings and / or empirical analyses form the theoretical basis for the selection of the tests and dimensions included, what the application and objective of each test solution is, and what limitations there are. It also explains how the dimensions are weighted if an extended scoring with an overall assessment is available.

- **Test solutions created purely on the basis of a requirements analysis**. How these were created is described on the page Solutions for occupations based solely on a requirements analysis.

5.1.1 Professional Drivers

The Test Solution "Professional Drivers" provides a test battery that can be used to assess a person's psychological suitability for the profession of professional drivers. Although the focus is on professional driving, the dimensions covered also include aspects that are relevant to driving aptitude in private traffic. This makes the test battery suitable for assessing a person's aptitude for private individual transport. The selection of dimensions is based on established models of driving safety and driving behavior (Groeger, 2000; Hatakka et al., 2002, 2003; Michon, 1979), empirical validation studies (e.g., Vetter et al., 2018; Risser et al., 2008) as well as current meta-analyses and reviews (Luo et al., 2023; Zhang et al., 2023; Pergantis et al., 2024) and national and EU-wide guidelines and legal requirements.

Classic theoretical models conceptualize driving a vehicle as a complex process with different cognitive requirements, some of which also take personality traits into account (Hatakka et al., 2002, 2003; Groeger, 2000; Michon, 1979). The GDE (Goals for Driver Education) matrix, which is particularly suitable in the context of professional driving, distinguishes between four hierarchical levels of driving behavior (Hatakka et al., 2002, 2003). For the two lower levels, execution and interaction, basic cognitive functions such as concentration, attention, responsiveness, overview, and resilience can be considered significant, while the decision-making level requires more complex cognitive abilities such as logical reasoning. In addition, personality traits are relevant at the prerequisite level.

In a validation study with professional bus drivers, the dimensions of overview, reactive stress tolerance, and logical reasoning proved to be significant predictors of driving performance with small to medium effect sizes (Vetter et al., 2018). Even though concentration and reaction ability did not show any significant effects in this study, their predictive validity for driving behavior is supported by further work (see, for example, Sommer et al., 2008; Risser et al., 2008; SCHUHFRIED, 2025a). In a recent review, Pergantis et al. (2024) emphasize the importance of executive functions, such as attention and working memory, for driving behavior; the latter is also underscored by Zhang et al. (2023). In the context of Professional Drivers (trucks and buses, as well as lighter vehicles), Scott et al. (2023) were able to show that driving performance in a driving test could be predicted by tests of reaction speed, memory, and sensorimotor control.

The importance of personality has also been empirically proven. A recent meta-analysis (Luo et al., 2023) shows that the Big Five dimensions of conscientiousness, agreeableness, openness, and emotional stability are associated with less risky and aggressive driving behavior. In addition, the personality dimensions specifically relevant to traffic, such as sense of responsibility, psychological stability, self-control, and risk avoidance, can predict driving behavior (Vetter et al., 2018; Sommer et al., 2004; Sommer et al., 2005; Vogelsinger, 2005; Schützhofer et al., 2008; Hergovich et al., 2008; Sommer et al., 2008; Sommer et al., 2010).

In addition to empirical studies, both EU directives (2006/126/EC) and various national regulations, such as the Austrian FSG-GV §18, the German assessment guidelines on driving aptitude (BGL) of the BASt (Federal Highway Research Institute, 2022) or the French regulation NOR: INTS1621322A Requirements or psychological dimensions and abilities that must be met in order to be fit to drive. These regulations usually require sufficient (i.e., at least average) abilities in the areas of responsiveness, resilience, attention, intelligence, memory, and, in some cases, suitable personality traits (e.g., mental stability and self-control).

The Test Solution 'Professional Drivers' was compiled based on these findings and guidelines or legal regulations. The following dimensions are covered:

- Reactive stress tolerance (DT) & obtaining an overview (ATAVT-2)
- Logical reasoning (INT), working memory (SPAN), ability to react (RT), and concentration (TACO)
- Personality: Mental stability, sense of responsibility, self-control, risk avoidance (IVPE-R in the standard form) or conscientiousness, agreeableness, emotional stability, extraversion, and openness (FCB5 in the screening form)

The best available effect sizes in terms of criterion validity were identified for the weightings used to calculate the overall score, taking into account results from validation studies and meta-analyses in the field of road traffic. The dimensions of reactive stress tolerance and overview acquisition are given the highest weighting in the calculation of the overall score. The second most important dimensions are logical reasoning, working memory, and responsiveness. These are followed by the dimension of concentration and traffic-related personality traits (Vetter et al., 2018; Risser et al., 2008; Pergantis et al., 2024; Egeto et al., 2019; Luo et al., 2023). The table below provides a complete overview of the specific weightings of the individual tests used to calculate the overall score for the Test Solution for Professional Drivers. Further information on the calculation of the results and its interpretation can be found on the page: Notes on evaluation and interpretation.

Professional Drivers	Weightings Standard form	Weightings screening form
Cognitive abilities	**80**	**80**
Logical reasoning	12	56
Working memory	12	-
Reactive stress tolerance	16	-

Professional Drivers	Weightings Standard form	Weightings screening form
Ability to react – reaction speed	12	-
Ability to react – motor speed	7	-
Ability to concentrate - Selective attention	5	24
Obtaining an overview	16	-
Personality (standard form)	**20**	**-**
Mental stability	5	-
Sense of responsibility	7	-
Self-control	6	-
Risk avoidance	2	-
Personality (screening form)	**-**	**20**
Conscientiousness	-	6
Emotional stability	-	2
Extraversion	-	2
Agreeableness	-	7
Openness	-	3

For testing Professional Drivers, there is a standard form for both right-hand and left-hand traffic, as well as a more time-efficient screening form that does not require additional hardware and is open mode capable. The standard form covers a comprehensive range of cognitive and traffic-related personality traits, while the screening form focuses on a few key cognitive dimensions (logical reasoning and concentration) and basic personality traits. The standard form takes about 50 minutes to complete, while the screening form takes about 28 minutes.

5.1.2 Fitness to Drive

With the Test Solution “Fitness to Drive”, fundamental cognitive dimensions relevant for safe participation in road traffic can be assessed. The selection of dimensions is based on established models of driving safety and driving behavior (Groeger, 2000; Hatakka et al., 2002, 2003; Michon, 1979), empirical validation studies (e.g., Sommer et al., 2008; Risser et al., 2008; Ledger et al., 2019), as well as recent meta-analyses and reviews (Anstey et al., 2005; Quintas et al., 2023; Zhang et al., 2023; Pergantis et al., 2024; Asimakopulos et al., 2011), and is aligned with national guidelines and legal requirements. Care was taken to design a compact assessment that covers key core dimensions.

Classical theoretical models conceptualize driving a motor vehicle as a multifaceted process involving different cognitive demands, partly including personality characteristics (Hatakka et al., 2002, 2003; Groeger, 2000; Michon, 1979). An action-theoretical model of driving behavior proposed by Groeger (2000) describes various cognitive processes underlying driving behavior. One central process concerns the “handling of current goal interruptions and conflicts.” This involves recognizing unexpected or dangerous situations. Particularly relevant for evaluating the current traffic situation and initiating an adequate response are observational ability and obtaining an overview. Ability to react and reactive stress tolerance also play an essential role, as they enable individuals to respond quickly to immediate hazards. Based on the four-level GDE matrix (Goals for Driver Education; Hatakka et al., 2002, 2003), basic cognitive functions such as concentration, attention, ability to react, obtaining an overview, and stress tolerance can be defined as important for the lower levels of execution and interaction.

Several studies in road traffic contexts have demonstrated the importance of obtaining an overview, which is closely linked to the dimension of attention (SCHUHFRIED, 2025a) (Sommer et al., 2008; Risser et al., 2008). The predictive validity of attention and concentration ability, as well as reaction ability, for driving behavior has been confirmed by various studies (Sommer et al., 2008; Risser et al., 2008; Schuhfried, 2025). In a comprehensive review, Anstey et al. (2005) also identified attention and reaction time as important factors for driving safety in older adults, alongside additional cognitive components including memory and executive functions. Pergantis et al. (2024) likewise emphasize the relevance of executive functions, such as attentional performance and working memory, for driving behavior. The importance of working memory is further supported by a review by Zhang et al. (2023). Another study showed that working memory is also the most frequently assessed executive function in common procedures for evaluating “fitness to drive” (Asimakopulos et al., 2011). Ledger et al. (2019) demonstrated the overall importance of cognitive functions for driving behavior in both older and younger drivers, including attention, executive functions, memory, spatial abilities, and general mental status. Depending on the study results, different dimensions showed particular relevance. Quintas et al. (2023) showed that in individuals with MCI or Alzheimer’s disease, attention, processing speed, executive functions, and spatial abilities were most strongly impaired in relation to unsafe driving behavior. Within executive functions, cognitive flexibility and processing speed are strongly related to obtaining an overview and working memory (SCHUHFRIED, 2025a).

An overview of legal frameworks and guidelines across various European countries shows that numerous cognitive domains are considered relevant for fitness-to-drive assessment. In Germany, BASt highlights the importance of concentration/attention, reaction ability, stress tolerance, and visual orientation. The French regulation NOR: INTS1621322A addresses reaction speed, visual attention, sensorimotor functions, executive functions, and processing speed. In Austria, observational ability/obtaining an overview, reaction behavior and stress tolerance, concentration, sensorimotor functions, intelligence, and memory are regarded as relevant areas. Overall, these national regulations frequently emphasize the importance of attention and concentration (e.g., Denmark: Indenrigs- og Sundhedsministeriet, 2022; Portugal: Regulamento da Habilitação Legal para Conduzir, 2014; Sweden: TSFS 2010:125, Transportstyrelsen, 2010), as well as psycho- and sensorimotor abilities (e.g., Portugal: Regulamento da Habilitação Legal para Conduzir, 2014; Sweden: TSFS 2010:125, Transportstyrelsen, 2010). Depending on the country, additional areas are considered, such as reaction ability and stress tolerance (e.g., Portugal: Regulamento da Habilitação Legal para Conduzir, 2014; Denmark: Indenrigs- og Sundhedsministeriet, 2022), general intelligence, or logical reasoning (e.g., Portugal: Regulamento da Habilitação Legal para Conduzir, 2014).

Based on these findings, the Test Solution “Fitness to Drive” includes the following dimensions and tests:

- Motor and reaction speed (RT)
- Reactive stress tolerance (DT)
- Concentration ability (TACO)
- Obtaining an overview (ATAVT-2)

This covers key areas that emerge as particularly relevant across theoretical models, scientific studies, and national guidelines. Within the area of psychomotor performance, the RT allows interpretation of the main variable “motor speed.” In accordance with the German BASt guideline, the results report uses a traffic-light system to indicate for each main variable whether the tested person performed below average (red, < percentile rank 16), in the lower average range (yellow, percentile rank 16–33), or in the average to above-average range (green, > percentile rank 33).

In addition, the joint results overview provides a concise verbal summary indicating how the tested person’s driving-related cognitive performance across the specified tests should be interpreted. The following applies:

- Sufficient driving-related cognitive performance if no main variable is below percentile rank 16.
- Restricted driving-related cognitive performance if values below percentile rank 16 occur in up to half — that is, two or fewer — of the main variables. In such cases, it should be considered that individuals may use compensatory strategies that buffer or compensate for weaker cognitive areas. These should be evaluated separately.
- Insufficient driving-related cognitive performance if more than half — that is, three or more — of the main variables fall below percentile rank 16.

This additional element facilitates a rapid assessment of the extent to which the tested person shows risk factors in performance areas relevant to driving and whether a more detailed evaluation or individual measures may be necessary.

Depending on country-specific requirements, additional tests may be administered together with the Test Solution “Fitness to Drive,” for example supplementary dimensions such as logical reasoning (BMT or INT logical reasoning), spatial visualization ability (INT spatial visualization), processing speed and cognitive flexibility (TMT-S), working memory (SPAN), or eye–hand coordination (2HAND). In addition, personality tests such as the FCB5 or, specifically for assessing driving-related personality traits, the IVPE-R may be included, as this area is also frequently referenced in national guidelines (e.g., Italy, Austria, Poland). However, these additional tests are not included in the overall evaluation and are not automatically displayed in the joint results overview (see Notes on evaluation and interpretation).

The test duration of the standard form for right-hand and left-hand traffic is approximately 30 minutes.

5.1.3 Train Drivers

The Test Solution “Train Drivers” is used to determine the suitability of train drivers. The Test Solution can be used both to select applicants for training and for testing existing staff. The selection of dimensions and the determination of dimension weightings for calculating the overall score follow a systematic approach that combines regulatory requirements with relevant empirical findings. The starting point is the minimum requirements for train drivers laid down in EU Directive 2007/59/EC, which include logical reasoning, attention and concentration, memory, responsiveness, perception, eye-hand coordination, and relevant personality dimensions. These were supplemented by the extended catalog of requirements of the Community of European Railways (CER) and the European Transport Workers' Federation (ETF) to include verbal skills, resilience of reaction time, and specific personality traits such as emotional self-control, reliability, and conscientiousness (CER, 2009).

To determine the weightings, the best available effect sizes in terms of criterion validity were first identified for all resulting dimensions, with preference given to results from validation studies in the field of rail transport. The meta-analyses by Salgado et al. (2003)

for cognitive abilities in technical professions and the Rail Safety and Standards Board studies by Evans & Johnson (2010) and Johnson & Evans (2011) formed the primary empirical basis for this. This was supplemented by current research results from Chu et al. (2019), Guo et al. (2016), Guo et al. (2019), Hani Tabai et al. (2018), and Hickey et al. (2017) were also included, which provided specific validity coefficients for the performance of Train Drivers.

The resulting weighting distribution reflects empirical evidence for the relative importance of various psychological constructs in rail transport. Accordingly, Vigilance (Sustained Attention) and concentration (selective attention) are given the highest weighting, followed by reactive stress tolerance. This prioritization corresponds to the results of extensive accident analyses in European rail transport between 1980 and 2009, according to which more than two-thirds of human factors in safety-critical events can be attributed to attention and perception deficits (Evans, 2011). The next highest relevance in the overall weighting is logical reasoning as an indicator of fluid intelligence, which underlines the importance of basic cognitive abilities for complex decision-making processes.

Overall, personality dimensions are given moderate weightings in line with their empirically proven relevance for individual safety performance: conscientiousness as the strongest predictor among the Big Five factors, followed by emotional stability, account for the majority of the weightings allocated to personality dimensions. The very low weightings for extraversion, agreeableness, and openness to experience reflect the limited predictive power of these dimensions for safety-critical individual workplaces in rail transport. This distribution is consistent with the meta-analyses by Barrick & Mount (1991) and other meta-analytical Europe-specific findings in transport psychology (Clarke & Robertson, 2005).

The Test Solution “Train Drivers” covers the following dimensions:

- Logical reasoning, long-term memory & verbal ability (INT)
- Concentration (TACO)
- Vigilance (VIGIL)
- Eye-hand coordination (2HAND)
- Obtaining an overview (ATAVT-2)
- Ability to react (RT)
- Reactive stress tolerance (DT)
- Personality: conscientiousness, agreeableness, emotional stability, extraversion, and openness (FCB5)

The table below provides a complete overview of the specific weightings of the individual tests used to calculate the overall score for the Test Solution “Train Drivers”. Further information on the calculation of the results and its interpretation can be found on the page: Notes on evaluation and interpretation.

Train Drivers	**Weightings Standard form**	**Weightings screening form**
Cognitive abilities	**80**	**80**
Logical reasoning	10	29
Long-term memory	6	-
Verbal ability	6	20

Train Drivers	Weightings Standard form	Weightings screening form
Concentration ability – Selective attention	10	31
Vigilance	10	-
Eye-hand coordination	7	-
Obtaining an overview	7	-
Ability to react – reaction speed	7	-
Ability to react – motor speed	7	-
Reactive stress tolerance	10	-
Personality	**20**	**20**
Conscientiousness	9	9
Emotional stability	7	7
Extraversion	2	2
Agreeableness	1	1
Openness	1	1

For the aptitude testing of train drivers, both a standard form, which covers all of the above-mentioned cognitive and personality-related characteristics, and a screening form are available, which focuses on key cognitive dimensions and personality traits (INT, TACO, FCB5), does not require additional hardware, and is open mode capable. The standard form takes about 109 minutes to complete, while the screening form takes about 42 minutes.

5.1.4 Train Dispatchers

The Test Solution "Train Dispatchers" is used for aptitude testing of persons who work in train traffic control or who are applying for corresponding training. It can be used both for the selection of applicants and for the testing of existing staff. The selection of the assessed dimensions and the definition of the dimension weightings for calculating the overall score follow a systematic approach that combines operational requirements, empirical findings, and insights from related safety-critical domains.

While binding minimum requirements for psychological fitness exist for train drivers under EU Directive 2007/59/EC and several concrete standards are established internationally, the requirements for train dispatchers are considerably less specific (see Train Drivers). The EU Directive merely states that the psychological basic principles defined for train drivers may serve as guidance for other safety-relevant activities in rail transport. However, empirical findings show that performance failures in train traffic control are frequently attributable to deficits in attention, incorrect prioritization, and insufficient coping with psychological strain, with consequences ranging from delays of individual trains to serious accidents (Guo et al., 2020; Lei et al., 2021). For defining the dimension weightings, those psychological constructs were prioritized whose predictive validity for performance and safety behavior in train traffic control is best empirically supported: multi-tasking, cognitive flexibility, and working memory (Lei et al., 2021). In addition, findings from aptitude testing of air traffic controllers were considered, since both professional groups monitor safe and coordinated traffic operations, act under high information density and time pressure, and must make decisions with immediate safety relevance. Meta-analyses on air traffic control show that especially divided attention, working memory, communication skills, and stress tolerance resilience are associated with training and occupational success (Mouratille et al., 2022; Martinussen et al., 2000).

Personality dimensions receive moderate weightings, whereby emotional stability and agreeableness were weighted more strongly, as they contribute to maintaining safety-oriented behavior under strain and to promoting teamwork and communication performance (cf. findings from aviation psychology: Mouratille et al., 2022).

The Test Solution “Train Dispatchers” therefore comprises the following dimensions:

- Multi-tasking ability (M-Task)
- Working memory (SPAN)
- Logical reasoning, quantitative and verbal ability (INT)
- Sustained attention (TACO)
- Cognitive flexibility (TMT-B)
- Reactive stress tolerance (DT)
- Personality: conscientiousness, agreeableness, emotional stability, extraversion, and openness (FCB5)

The table below provides a complete overview of the specific weightings of the individual tests used to calculate the overall score for the Test Solution “Train Dispatchers”. Further information on the calculation and interpretation of the result of a testing can be found on the page: Notes on administration

Train Dispatcher	Weighting standard form	Weighting screening form
Cognitive abilities	**86**	**86**
logical reasoning	7	-
quantitative ability	10	-
verbal ability	5	-
working memory	16	31
sustained attention	10	-
multi-tasking ability	20	-
divided attention	-	38
reactive stress tolerance	9	-
cognitive flexibility	9	17
Personality	**14**	**14**
conscientiousness	2	2
emotional stability	4	4
extraversion	2	2
agreeableness	4	4
openness	2	2

For aptitude testing of train dispatchers, both a standard form - covering all cognitive and personality-related characteristics mentioned above - and a screening form are available. The screening form focuses on central cognitive dimensions (TACO, SPAN, TMT-B) and basic personality traits (FCB5), does not require additional hardware, and is open mode capable. Since no parallel form exists for multi-tasking ability, practice effects and familiarization with the material cannot be ruled out in open-mode administration; therefore, the convergently valid dimension divided attention is administered instead. The test duration of the standard form is approximately 114 minutes, and that of the screening form approximately 37 minutes.

5.1.5 Rail Track Safety Personnel

The Test Solutions “Rail Track Safety Personnel – Supervisor” and “Rail Track Safety Personnel – Operator” serve for aptitude testing of personnel in the track area who are either responsible for the planning, coordination and monitoring of track works or for the operational safeguarding and monitoring of the track section.

While binding minimum requirements for psychological fitness exist for train drivers under EU Directive 2007/59/EC and several concrete standards are established internationally, the requirements for safety personnel in the track area are considerably less explicit at the international level. The EU Directive merely states that the psychological basic principles defined for train drivers may serve as guidance for other safety-relevant activities in rail transport (see Train Drivers). International regulations such as the Australian National Standard for Health Assessment of Rail Safety Workers or the Canadian Railway Medical Rules for Positions Critical to Safe Railway Operators prescribe standardized, safety-related selection of safety-relevant personnel, but do not specify concrete psychometric ability or personality requirements.

Germany represents a special case in this context: In addition to the general DGUV regulation 77/78 “*Arbeiten im Bereich von Gleisen*” (UVB, 2025), a concrete recommendation for aptitude testing of track area safety personnel was already published in 1994 by the Research Society for Applied System Safety and Occupational Medicine (FSA), showing that management and operational personnel in track safety are highly relevant for the prevention of accidents in the track area (Müller, 1994). This study formed the basis for systematic and comprehensive aptitude testing of safety-relevant personnel within the area of responsibility of Deutsche Bahn. The FSA guideline was recently revised and expanded on the basis of an empirical requirements analysis and validation study (Manteuffel & Kutschbach, 2020). The updated guideline forms the central conceptual basis for the selection of diagnostic dimensions of the Test Solutions “Rail Track Safety Personnel – Supervisor” (corresponds in Germany to: *Sicherheitsaufsichtskraft*, SAKRA) and “Rail Track Safety Personnel – Operator” (Germany: *Sicherheitsposten*, SIPO). Due to the lack of international research, the use of these Test Solutions for similar occupational groups beyond the German national context is recommended by the authors of this document as evidence-based procedures for aptitude testing of safety-relevant personnel in the track area.

The findings of the new FSA study show that the requirements for management and operational personnel in track safety differ with regard to cognitive complexity, responsibility and scope for action (Manteuffel & Kutschbach, 2020). The safety management (Supervisor) bears overall responsibility for planning, coordination, monitoring and situational adaptation of safety measures and makes independent decisions. Accordingly, this activity requires not only alertness and attention, but in particular divided attention, logical reasoning, memory performance and verbal ability. The safety lookout (Operator) implements the safety measures operationally; this activity is more strongly standardized and characterized by longer phases of uniform observation. Central requirements here are pronounced sustained attention (vigilance), high resistance to distraction and reliability. Common to both occupational groups are selective attention (concentration), memory performance, and alertness. In the present Test Solution, reaction speed in the sense of pure reaction time measures is deliberately not assessed. Instead, in accordance with the recommendations of Manteuffel and Kutschbach, general alertness (phasic alertness, operationalized as the difference between reaction times with and without a cue) is assessed as a requirement-relevant aspect of attention, since for the activities of safety personnel it is not millisecond differences that are decisive, but rather timely perception, correct assessment and situation-appropriate reaction to relevant signals.

Regarding personality, the requirements profile by Manteuffel and Kutschbach is based on the facet model of the Big Five personality. The facet model postulates that each of the Big Five personality dimensions comprises six facets, i.e., subfactors. Empirically, it shows low incremental validity in predicting occupational success compared to the broad Big Five factors (cf. Judge et al., 2013). In the requirements profile of safety-relevant personality traits, the FSA study describes the following facets (dimensions) as relevant: sociableness (extraversion), assertiveness (extraversion), stress tolerance resilience (emotional stability), diligence / persistence (conscientiousness), reliability / sense of responsibility (conscientiousness), as well as rule and sense of duty (conscientiousness), whereby conscientiousness and emotional stability were assessed as the most important factors. However, Manteuffel and Kutschbach found no robust relationships between self-reported personality facets and safety-relevant work performance in the FSA validation study. The authors attribute this to response distortion in terms of social desirability and conclude that rating scale procedures in the context of high-stakes assessments may be less suitable. They therefore recommend *“For determining the aptitude characteristic ‘personality’ […] a narrow measurement instrument that is directly derived from the requirement area ‘personality’.”* (Manteuffel & Kutschbach, 2020).

In terms of content, the personality assessment of the Test Solutions “Rail Track Safety Personnel” therefore focuses on the dimensions conscientiousness and emotional stability, which have been identified both in the occupational requirements profile and in the empirical literature as central for general work performance (cf. Barrick et al., 2001; He et al., 2019). Extraversion is deliberately not assessed, as empirical evidence here is less consistent and it was identified as safety-relevant in the requirements profile only at the facet level, not at the dimension level (cf. Manteuffel & Kutschbach, 2020). To reduce socially desirable responding in the high-risk context of aptitude testing, a forced-choice response format is used in the present Test Solutions (FCB5, test form S1), which can reduce response distortion due to social desirability (e.g., Cao & Drasgow, 2019; Wetzel et al., 2021).

The Test Solutions “Rail Track Safety Personnel – Supervisor” and “Rail Track Safety Personnel – Operator” therefore comprise the following dimensions:

Rail Track Safety Personnel – Supervisor

- Alertness (RT)
- Ability to concentrate (TACO)
- Divided attention (TACO)
- Logical reasoning, long-term memory and verbal ability (INT)
- Personality: conscientiousness and emotional stability (FCB5)

Rail Track Safety Personnel – Operator

- Alertness (RT)
- Ability to concentrate (TACO)
- Vigilance / sustained attention (VIGIL)
- Long-term memory (INT)

- Personality: conscientiousness and emotional stability (FCB5)

Aptitude assessment is not based on a cross-dimensional weighting, but follows the minimum requirements according to the FSA guideline. This approach reflects the safety-critical nature of the activity, where deficits in individual central ability areas should not be compensated by strengths in other areas. Therefore, a minimum level of percentile rank (PR) > 15 is required for all cognitive ability dimensions as well as for exclusion-relevant personality traits. This threshold corresponds to a convention established in traffic psychology for distinguishing below-average ability and is based on the definition of the below-average range as a deviation of more than one standard deviation from the mean of the norm sample. For vigilance, an increased minimum value of PR > 32 is set for the Test Solution “Rail Track Safety Personnel – Operator”, in line with the emphasized importance of sustained attention in the requirements profile (cf. Müller, 1994; Manteuffel & Kutschbach, 2020). The overall assessment is based on fulfillment of the minimum requirements in the individual dimensions as well as on a professional psychological overall interpretation of the result profiles.

The test duration is approximately 77 minutes for the Test Solution “Rail Track Safety Personnel – Supervisor” and approximately 73 minutes for the Test Solution “Rail Track Safety Personnel – Operator”.

5.2 Aviation

The application area “Aviation” provides test solutions for use in aptitude assessment and personnel selection for professions in aviation.

5.2.1 Airline Pilots

The Test Solution “Airline Pilots” provides a test battery that can be used to assess a person's psychological suitability for the profession of airline pilots. The focus is on professional airline pilots who fly aircraft (especially in passenger or cargo transport). The Test Solution “Airline Pilots” is designed to be suitable for testing both individuals applying for pilot training and applicants who already have professional experience as airline pilots. Therefore, the selection of test dimensions was based on the guidelines of the International Air Transport Association (IATA, 2019) and findings from individual empirical studies (Martinussen et al., 2022; ALMamari & Traynor, 2021; Wang et al., 2018; Zierke, 2014; Arendasy et al., 2007) and meta-analyses on the relationship between psychometric test results and flight performance or training success of civil and military Airline Pilots (Breuer et al., 2023; ALMamari et al., 2019; Johnson et al., 2017; Martinussen, 1996; Hunter & Burke, 1994).

To assess the basic cognitive abilities of pilot candidates, IATA (2019) recommends the use of computer-based psychometric tests, with logical reasoning and sustained attention considered important across all levels of experience among applicants. In addition, testing of memory capacity, information processing, and visualization is recommended for experienced and ab initio candidates, among others. The importance of these cognitive dimensions is also supported by a large number of empirical studies. Meta-analyses show that both general (Hunter & Burke, 1994; Martinussen, 1996; ALMamari et al., 2019) and specific cognitive abilities, such as visualization, quantitative ability (Hunter & Burke, 1994; Johnson et al. 2017), information processing (Hunter & Burke, 1994; Martinussen, 1996; Johnson et al., 2017; ALMamari et al., 2019), reaction speed (Hunter & Burke, 1994), and attention (ALMamari et al., 2019) are relevant to the job profile of Airline Pilots. In addition, (sensory and psychomotor) motor skills are central (Hunter & Burke, 1994; Martinussen, 1996; ALMamari et al., 2019; Martinussen et al., 2022).

Working and short-term memory are also important in the selection of Airline Pilots, as Wang et al. (2019) were able to show, for example. In a study by Arendasy et al. (2007), a combination of psychometric tests on logical reasoning, visual-spatial ability, working memory, reactive stress tolerance, and sensomotor coordination achieved a high classification accuracy (89.8%) and high prognostic validity (R = 0.79) in relation to performance in a flight simulator.

In addition to the importance of cognitive abilities, the relevance of personality-related characteristics is also discussed. A recent meta-analysis by Breuer et al. (2023) shows that of the Big Five personality factors, conscientiousness and emotional stability in particular play a role in the selection and training of airline pilots, especially in civil aviation. The importance of these personality traits is also reflected in IATA (2019), which emphasizes the personality aspects of stress resistance and professionalism (e.g., self-discipline, self-organization).

The Test Solution “Airline Pilots” was compiled based on these findings. In accordance with the implementation recommendations for compliance with the legal safety requirements of the European Union Aviation Safety Agency (AMC1 CAT.GEN.MPA.175(b) Endangering safety), the Test Solution covers both cognitive performance areas and key personality traits. In addition, it is recommended that technical and social skills be assessed in accordance with the principles of Crew Resource Management (CRM) – these aspects are not covered by this test battery. The following dimensions are assessed:

- Divided attention (TACO) and eye-hand coordination (2HAND)
- Visual-spatial ability (INT), reactive stress tolerance (DT), logical reasoning & numerical ability (both INT)
- Working memory (SPAN) & sustained attention (TACO)
- Personality: conscientiousness, agreeableness, emotional stability, extraversion, and openness (FCB5)

The best available effect sizes in terms of criterion validity were identified for the weightings used to calculate the overall score, taking into account results from validation studies and meta-analyses in the field of training and professional success of airline pilots. The dimensions of divided attention and eye-hand coordination are given the highest weighting in the calculation of the overall score. The second most important dimensions are visual-spatial ability, reactive stress tolerance, logical reasoning, and numerical ability. These are followed by the dimensions of sustained attention and working memory, as well as personality traits (ALMamari et al., 2019; Breuer et al., 2023; Hunter & Burke, 1994; Johnson et al., 2017; Martinussen, 1996; Martinussen et al., 2022; Wang et al., 2018). The table below provides a complete overview of the specific weightings of the individual tests used to calculate the overall score for the Test Solution “Airline Pilots”. Further information on the calculation of the results and its interpretation can be found on the page: Notes on evaluation and interpretation.

Airline Pilots	**Weightings standard form**	**Weightings screening form**
Cognitive abilities	**75**	**75**
Logical reasoning	9	18
Visual-spatial ability	10	29
Numerical ability	9	-
Working memory	6	-
Ability to concentrate – divided attention	13	28

Airline Pilots	Weightings standard form	Weightings screening form
Ability to concentrate – sustained attention	5	-
Reactive stress tolerance	10	-
Eye-hand coordination	13	-
Personality	**25**	**25**
Conscientiousness	7	7
Emotional stability	10	10
Extraversion	4	4
Agreeableness	2	2
Openness	2	2

Both a standard form and a more time-efficient screening form are available for testing Airline Pilots, which does not require additional hardware and is open-mode capable. The standard form covers a comprehensive range of cognitive and traffic-related personality traits, while the screening form focuses on a few key cognitive dimensions (logical reasoning, visual-spatial ability, and concentration) and basic personality traits. The tests included have been selected to allow for open mode administration. The standard form takes about 102 minutes to complete, while the screening form takes about 37 minutes.

5.2.2 Drone Pilots

The Test Solution "Drone Pilots" can be used to assess psychological aptitude for the profession of drone pilots. The procedure is suitable both for applicants with and without prior experience. The selection of test dimensions is based on international standards and regulations of the European Union Aviation Safety Agency (EASA Regulation: European Union Aviation Safety Agency, 2024), on research findings from the United States military (Barron et al., 2016; Carretta & Rose, 2017; Carretta et al., 2015; Rose et al., 2013; Rose et al., 2014), as well as on requirements analyses and empirical findings on aptitude testing of drone pilots (Adams & Hagl, 2025; Biggerstaff et al., 1998; Duvillard-Monternier et al., 2023; Pagan et al., 2015; Qi et al., 2018; Trent & Barron, 2021). A study by the Norwegian police on personnel selection in the field of drone flight using the Vienna Test System by SCHUHFRIED was also considered in the development of the Test Solution (Johnsen et al., 2023). The EASA Regulation requires pilots to be able to manage their workload and flight path effectively, perform operational procedures correctly, possess good situational awareness, and demonstrate personality traits that support good leadership behavior, teamwork, and self-management.

In order to control unmanned aircraft safely and successfully, spatial visualization ability (Adams & Hagl, 2025; Biggerstaff et al., 1998; Carretta & Rose, 2017; Duvillard-Monternier et al., 2023; Johnsen et al., 2023; Rose et al., 2013; Rose et al., 2014; Trent & Barron, 2021) and Ability to concentrate (Carretta & Rose, 2017; Johnsen et al., 2023; Rose et al., 2013; Rose et al., 2014) play a central role and represent valid predictors of occupational success in training missions (Trent & Barron, 2021). Ability to concentrate has been investigated in empirical studies and requirements profiles on the one hand as selective, focused attention or sustained attention (Carretta & Rose, 2017; Duvillard-Monternier et al., 2023; Johnsen et al., 2023) and on the other hand as divided attention or multi-tasking (Carretta & Rose, 2017; Johnsen et al., 2023; Rose et al., 2013; Rose et al., 2014; Trent & Barron, 2021). Both sustained attention and multi-tasking ability /

divided attention are therefore relevant for successful professional performance. Beyond spatial visualization ability and attention, the cognitive dimension of logical reasoning is also included in most requirements analyses (Adams & Hagl, 2025; Barron et al., 2016; Carretta & Rose, 2017; Johnsen et al., 2023) and correlates empirically with training and mission success in military contexts (Trent & Barron, 2021).

In order to make correct decisions even in ambivalent and time-critical situations, fast information processing and the ability to react quickly under strain as well as good attentional control and reactive stress tolerance are required (Barron et al., 2016; Carretta & Rose, 2017; Duvillard-Monternier et al., 2023; Pagan et al., 2015; Rose et al., 2013). In addition to the ability to react under strain, good situational awareness is essential to avoid incorrect decisions (Adams & Hagl, 2025; Carretta & Rose, 2017; Duvillard-Monternier et al., 2023; Pagan et al., 2015; Rose et al., 2013). Furthermore, psychomotor skills such as eye-hand coordination are highly important for precise control of unmanned aircraft for drone pilots (Carretta & Rose, 2017; Pagan et al., 2015; Rose et al., 2013; Rose et al., 2014). Initial empirical results also indicate that working memory in drone pilots is associated with performance in simulated as well as real standardized flight tests (Ramallo-Luna et al., 2025).

In addition to cognitive factors, personality traits also show meaningful associations with successful drone pilot performance. Across different job analyses and empirical studies, conscientiousness and emotional stability are consistently highlighted as key predictors, as they are linked to reliability, self-discipline, rule-compliant behavior, and resilience under stress (Carretta & Rose, 2017; Duvillard-Monternier et al., 2023; Pagan et al., 2015; Qi et al., 2018; Rose et al., 2013). Agreeableness, and to some extent extraversion, show additional but less consistent associations, particularly in the context of teamwork, communication, and coordinated crew operations (Barron et al., 2016; Duvillard-Monternier et al., 2023; Pagan et al., 2015). In contrast, findings for openness are mixed: while some job analyses discuss it as potentially relevant, empirical studies generally report weak or inconsistent relationships with performance; in specific training contexts, higher openness has even been associated with lower performance (Barron et al., 2016; Rose et al., 2014). Overall, the evidence suggests that conscientiousness and emotional stability represent the most robust personality-based predictors of success in the drone pilot context.

The Test Solution “Drone Pilots” therefore comprises the following dimensions:

- Reactive stress tolerance (DT)
- Multi-tasking ability (M-TASK), screening: divided attention (TACO)
- Sustained attention (TACO)
- Logical reasoning (INT)
- Spatial visualization ability (INT)
- Eye-hand coordination (2HAND)
- Working memory (SPAN)
- Obtaining an overview (ATAVT-2)
- Personality: conscientiousness, extraversion, agreeableness, emotional stability (FCB5)

The table below provides a complete overview of the specific weightings of the individual tests used to calculate the overall score for the Test Solution “Drone Pilots”. For the weightings used to calculate the overall score, the best available effect sizes with regard to criterion validity were identified. Further information on the calculation and interpretation of the result of a testing can be found on the page: Notes on evaluation and interpretation

Drone Pilots	Weighting standard form	Weighting screening form
Cognitive abilities	**75**	**75**
Reactive stress tolerance	11	-
Multi-tasking ability	14	-
Divided attention	-	26
Sustained attention	7	-
Logical reasoning	9	23
Spatial visualization ability	14	26
Eye-hand coordination	9	-
Working memory	4	-
Obtaining an overview	7	-
Personality	**25**	**25**
Conscientiousness	9	9
Emotional stability	9	9
Extraversion	3	3
Agreeableness	4	4
Openness	-	-

A standard form and a screening form are available. The standard form covers the entire ability and personality profile and is intended for comprehensive aptitude testing. The screening form focuses on the central cognitive dimensions (spatial visualization ability, logical reasoning and divided attention), as well as the relevant personality traits. No parallel form exists for multi-tasking, therefore practice effects and familiarization with the material cannot be ruled out in open mode administration, so the convergently valid dimension divided attention is administered instead. The test duration is approximately 113 minutes for the standard form and 37 minutes for the screening form.

5.2.3 Helicopter Pilots

The Test Solution “Helicopter Pilots” can be used to assess the psychological aptitude of a person for the profession of helicopter pilot. The focus is on professional pilots who operate helicopters in passenger transport, rescue, or operational flights. The procedure is suitable for applicants both without and with prior experience. The selection of test dimensions is based on the guidelines of the *International Air Transport Association* (IATA, 2019), the recommendations of the *European Union Aviation Safety Agency* (EASA, 2019), as well as empirical findings on the cognitive, motor, and personality-related requirements of helicopter pilots (Bushby & Gaydos, 2023; Ceschi et al., 2019; Dickens, 2014; Dickens & Farrell, 2019; Grice & Katz, 2006; Grice & Katz, 2007; Hamlet et al., 2020; Hamlet et al., 2023; Pennings et al., 2020). The guideline for pilot requirements by the IATA includes, in the category of basic mental abilities, processing speed, memory capacity, spatial visualization ability, Ability to concentrate, and logical reasoning. In addition, operational abilities include manual control, effective work sharing, problem solving, as well as mixed abilities such as multi-tasking, psychomotor skills, attentional control, and spatial visualization ability. Furthermore, findings from research on general pilot aptitude (Al Mamari & Traynor, 2019, 2021; Breuer et al., 2023; Hunter & Burke, 1994; Johnson et al., 2017; Martinussen et al., 2022; Wang et al., 2018; Zierke, 2014) were considered, as the fundamental requirements overlap.

A central psychophysiological risk is spatial disorientation. Bushby and Gaydos (2023) report that 68 % of helicopter crews experienced disorientation during a training flight. Pennings et al. (2020) also show that the risk of spatial disorientation is significantly higher in helicopter operations than in fixed-wing operations due to low flight altitudes, restricted visibility conditions, and the use of night vision systems. Accordingly, spatial visualization ability and situational awareness represent central dimensions in the present Test Solution (Bushby & Gaydos, 2023; Dickens & Farrell, 2019; Pennings et al., 2020; Al Mamari & Traynor, 2021; Hunter & Burke, 1994; Johnson et al., 2017; Martinussen et al., 2022).

Both studies in the field of general aviation psychology (Al Mamari & Traynor, 2019; Hunter & Burke, 1994; Johnson et al., 2017; Martinussen et al., 2022) and requirements analyses for helicopter pilots (Hamlet et al., 2020; Hamlet et al., 2023) emphasize the importance of multi-tasking ability as well as Ability to concentrate (Zierke, 2014).

Similar to airplane operations (Hunter & Burke, 1994), the ability to react, i.e. reactive stress tolerance, meaning the ability to react quickly and correctly under strain, is also relevant in helicopter operations. This dimension plays a greater role in helicopter operations than in airplane pilots due to lower flight altitude and generally more adverse conditions (Dickens & Farrell, 2019).

Another difference compared to flying an airplane lies in the necessity of almost continuously controlling the aircraft during manual operation in order not to deviate from the intended flight path and to maintain a stable position while hovering without drifting. Accordingly, continuously precise eye-hand coordination is relevant in order to follow the intended flight path (Al Mamari & Traynor, 2019; Dickens & Farrell, 2019; Martinussen, 1996).

Studies on civil and military pilot selection further show that logical reasoning, numerical ability, and working memory correlate with training and occupational success (Al Mamari & Traynor, 2019; Hunter & Burke, 1994; Martinussen, 1996; Wang et al., 2018; Zierke, 2014). According to Ceschi et al. (2019), these cognitive abilities are also relevant for helicopter pilots.

Personality also plays an important role in the competency profile of rotary-wing pilots. Empirical research highlights the particular relevance of emotional stability and conscientiousness, as experienced rotary-wing pilots consistently show low levels of neuroticism and average to elevated levels of conscientiousness, while openness tends to be lower (Grice & Katz, 2006, 2007; Dickens & Farrell, 2019). These trait patterns reflect controlled, rule-oriented behavior and resilience in safety-critical situations. In addition, requirement analyses and models of non-technical skills emphasize the central importance of teamwork, communication, and coordinated decision-making (Ceschi et al., 2019; Hamlet et al., 2023), thereby supporting the relevance of agreeableness and extraversion as additional personality dimensions. Overall, this personality profile promotes calm behavior under stress, stable decision-making processes, and effective collaboration in operational settings.

The Test Solution “Helicopter Pilots” therefore comprises the following dimensions:

- Reactive stress tolerance (DT)
- Multi-tasking ability (M-TASK), screening: divided attention (TACO)
- Sustained attention (TACO)

- Logical reasoning (INT)
- Numerical ability (INT)
- Spatial visualization ability (INT)
- Eye-hand coordination (2HAND)
- Working memory (SPAN)
- Obtaining an overview (ATAVT-2)
- Personality: conscientiousness, extraversion, agreeableness, emotional stability (FCB5)

The table below provides a complete overview of the specific weightings of the individual tests used to calculate the overall score for the Test Solution “Helicopter Pilots”. For the weightings used to calculate the overall score, the best available effect sizes with regard to criterion validity were identified. Further information on the calculation and interpretation of the result of a testing can be found on the page: Notes on evaluation and interpretation

Helicopter Pilots	Weighting standard form	Weighting screening form
Cognitive abilities	**75**	**75**
Reactive stress tolerance	10	-
Multi-tasking ability	13	-
Divided attention	-	23
Sustained attention	4	-
Logical reasoning	6	11
Numerical ability	6	-
Spatial visualization ability	12	26
Eye-hand coordination	12	-
Working memory	5	-
Obtaining an overview	7	15
Personality	**25**	**25**
Conscientiousness	7	7
Emotional stability	10	10
Extraversion	4	4
Agreeableness	4	4
Openness	-	-

A standard form and a screening form are available. The standard form covers the entire ability and personality profile and is intended for comprehensive aptitude testing. The screening form focuses on the central cognitive dimensions (spatial visualization ability, logical reasoning, obtaining an overview and divided attention), as well as the relevant personality traits. No parallel test form exists for multi-tasking ability, therefore practice effects and familiarization with the material cannot be ruled out in open mode administration, so the convergently valid dimension divided attention is administered instead. The test duration is approximately 128 minutes for the standard form and 40 minutes for the screening form.

5.2.4 Air Traffic Controllers

With the Test Solution “Air Traffic Controllers”, the psychological aptitude of a person for the profession of air traffic controller can be assessed. It is suitable both for testing persons applying for training and for selecting applicants with prior professional experience. Therefore, the selection of test dimensions is based on international standards for testing prospective air traffic controllers (Eurocontrol, FAA), the competencies identified as relevant in the guidelines of the International Civil Aviation Organization (ICAO, 2020), as well as findings from empirical individual studies (Seemüller et al., 2025; Roodbandi et al., 2025; Pecena et al., 2013) and meta-analyses on the relationship between psychometric test results and training success or work performance of air traffic controllers (Mouratille et al., 2022; Martinussen et al., 2000).

Cognitive abilities represent central predictors of training success for air traffic controllers (Mouratille et al., 2022; Seemüller et al., 2025) and generally show significant relationships with training success in technical-operational professions (Bertua et al., 2005). Meta-analyses have shown that spatial visualization ability plays a particularly important role in performance in this field (Mouratille et al., 2022; Martinussen et al., 2000). Experts also rate this ability as especially relevant for successful professional practice (Roodbandi et al., 2025). Accordingly, spatial visualization ability is also assessed in air traffic controller testing such as FEAST (Eurocontrol) and ATSA (FAA).

In addition to spatial visualization ability, quantitative, verbal and logical reasoning abilities are also correlated with the training success of prospective air traffic controllers. While an older meta-analysis found similarly high relationships of mathematical, verbal and general cognitive ability with training and occupational success (Martinussen et al., 2000), a more recent meta-analysis shows that quantitative knowledge correlates more strongly with training success than logical reasoning or verbal knowledge (Mouratille et al., 2022). These abilities can also be linked to the competencies according to the ICAO guidelines for air traffic controller training (2020), such as the importance of communication skills or problem solving abilities.

The profession of air traffic controllers places high demands on individuals: under conditions of high uncertainty and large information volume, rapid and accurate decisions must be made, often with safety-relevant consequences. Therefore, attention, working memory, as well as processing speed and reaction speed, often in the context of multi-tasking, are of high importance. These abilities are demonstrably related to training and occupational success or are considered central by experts (Mouratille et al., 2022; Martinussen et al., 2000; Seemüller et al., 2025; Roodbandi et al., 2025; Pecena et al., 2013) and are therefore regularly tested (FEAST, ATSA). Obtaining an overview can also be considered relevant. This can be viewed in connection with the ICAO (2020) competence definition of situational awareness, according to which effective situational perception consists of understanding the current situation and anticipating future events. Specifically, observable behavior of air traffic controllers is described, among other aspects, by monitoring relevant information, scanning systematically, and integrating the information obtained in order to make well-founded decisions.

In addition to cognitive factors, the relevance of personality is also discussed. While meta-analyses could not identify significant effects (Mouratille et al., 2022; Martinussen et al., 2000), traits such as self-control, persistence and reliability are rated as highly relevant by experts. Eurocontrol also provides an additional personality assessment with FEAST 3.

The Test Solution “Air Traffic Controllers” therefore comprises the following dimensions:

- Reactive stress tolerance (DT)

- Multi-tasking ability (M-TASK), screening: divided attention (TACO)
- Logical reasoning (INT)
- Numerical ability (INT)
- Verbal ability (INT)
- Spatial visualization ability (INT)
- Sustained attention (TACO)
- Working memory (SPAN)
- Obtaining an overview (ATAVT-2)
- Personality: openness, conscientiousness, extraversion, agreeableness, emotional stability (FCB5)

The table below provides a complete overview of the specific weightings of the individual tests used to calculate the overall score for the Test Solution “Air Traffic Controllers”. For the weightings used to calculate the overall score, the best available effect sizes with regard to criterion validity were identified, taking into account results from validation studies and meta-analyses in the area of training and occupational success of air traffic controllers. Further information on the calculation and interpretation of the result of a testing can be found on the page: Notes on evaluation and interpretation

Air Traffic Controller	**Weighting standard form**	**Weighting screening form**
Cognitive abilities	**86**	**86**
Reactive stress tolerance	9	-
Multi-tasking ability	14	-
Divided attention	-	32
Logical reasoning	10	-
Numerical ability	11	25
Verbal ability	5	-
Spatial visualization ability	13	29
Sustained attention	10	-
Working memory	7	-
Obtaining an overview	7	-
Personality	**14**	**14**
Conscientiousness	2	2
Emotional stability	4	4
Extraversion	2	2
Agreeableness	4	4
Openness	2	2

A standard form and a time-efficient screening form are available. The standard form covers the complete ability and personality profile and is intended for comprehensive aptitude testing. The screening form focuses on the central cognitive dimensions (spatial visualization ability, numerical ability and divided attention), as well as the relevant personality traits; for multi-tasking ability no parallel form exists, therefore practice effects and familiarization with the material cannot be ruled out in open mode administration, and thus the convergently valid dimension divided attention is administered. The test duration is approximately 129 minutes for the standard form and 38 minutes for the screening form.

5.3 Clinical Psychology

The application area “Clinical Psychology” comprises test solutions for use in clinical psychology and neuropsychology to assess neurocognitive functioning. The “Brief Neurocognitive Assessment” serves as a general evaluation of basic cognitive functions. In addition, disorder-specific SFS test solutions are available that are based on the “Brief Neurocognitive Assessment” and include additional cognitive performance tests. Due to the complexity of individual diagnostic questions, index scores are not calculated from the individual test values for any of the neurocognitive SFS test solutions. Results are presented in a domain-specific manner, enabling a differentiated (disorder-specific) interpretation of clinically relevant strengths and weaknesses based on the relevant literature findings, which are summarized below.

5.3.1 Brief Neurocognitive Assessment

The SFS Test Solution "Brief Neurocognitive Assessment" can be applied in clinical psychology and neuropsychology in order to assess possible impairments of neurocognitive function. According to the ICD-11 (WHO, 2022), determining the level of neurocognitive functioning is required for the diagnosis of neurocognitive disorders, such as dementia, amnesia or delirium. Even in disorders where neurocognitive impairment is *not* a core diagnostic symptom, neurocognitive testing can substantially support diagnostics, prognosis and monitoring, for example in Parkinson’s disease (Pourzinal et al., 2025), multiple sclerosis (Meca-Lallana et al., 2021), stroke (Quinn et al., 2018), cranio-cerebral trauma (Halalmeh et al., 2024), epilepsy (Vogt et al., 2017), bipolar disorder (Tsitsipa et al., 2015), post-traumatic stress disorder (Scott et al., 2015), obsessive-compulsive disorder (Snyder et al., 2014), and autism spectrum disorder (Velikonja et al., 2019).

The basis of the "Brief Neurocognitive Assessment" is the DSM-V-TR (American Psychiatric Association, 2022), which defines six neurocognitive domains, attention, executive function, learning and memory, language, psychomotor function, and social cognition. Both the DSM-V-TR and the ICD-11 describe the testing of neuropsychological basic functions as an important pillar of neuropsychological and clinical psychological assessment, whereby cognitive profiles can differ substantially both between different neurological or psychiatric disorders and between individuals with the same diagnosis. The clinical cognitive short assessment is intended to enable a time-efficient assessment of neurocognitive functions, thereby supporting clinical diagnostics and follow-up assessment.

The selection of tests is based on the diagnostic standards mentioned above, the guidelines for diagnostics and treatment of the German Society for Neurology for memory impairments (Thöne-Otto et al., 2020), attention disorders (Fimm et al., 2023) and executive dysfunction (Müller et al., 2019), as well as current findings from the scientific literature. Regarding the factor structure of cognitive domains, a meta-analysis including 11,881 individuals concluded that the relationships between domains are best described by the CHC model of intelligence (Cattell-Horn-Carroll model; Schneider & McGrew, 2018) (Agelink van Rentergem et al., 2020). In particular, the construct of executive function shows similarities to fluid intelligence (van Aken et al., 2015), which has also been confirmed in lesion studies (Barbey et al., 2012). For example, a high correlation between the Tower of London test of planning ability and Raven’s matrices test of fluid intelligence of $r = .55$ was found in a sample of $n = 830$ (D'Antuono et al., 2016), which can be interpreted as evidence for convergent validity of the constructs. Based on these findings, it was decided to integrate a matrices test developed for clinical practice (BMT; SCHUHFRIED, 2024c) into the executive function domain of the "Brief Neurocognitive Assessment". The neurocognitive domains language, psychomotor function, long-term memory and social cognition are currently not covered. The following domains are assessed:

- Attention
    - Processing speed (TMT-S, Part A)
    - Ability to concentrate (TACO)
- Executive Function
    - Cognitive flexibility (TMT-S, Part B)
    - Verbal working memory (SPAN, Digit span backward)
- Learning and memory
    - Verbal short-term memory (SPAN, Digit span forward)
- Logical reasoning (BMT)

Depending on the assessment objective, additional tests outside the SCHUHFRIED Selection can be added to the test battery, for example Theory of Mind (TOM; Brüne, 2018) in cases of (suspected) autism spectrum disorder, or tests of figural long-term memory (FGT; Vetter et al., 2024) and verbal long-term memory and learning ability (AWLT; Heßler & Jahn, 2023) in cases of (suspected) dementia. It should be noted that when configuring the test sequence and adding tests that are not part of the SCHUHFRIED Selection, this joint results overview is no longer automatically available (see Notes on evaluation and interpretation).

The administration of the clinical cognitive short assessment takes approximately 40 minutes without additional tests.

5.3.2 Anxiety Disorders - Neurocognitive Assessment

In addition to the general Neurocognitive Brief Assessment, the SFS Test Solutions offer an assessment specifically designed for the evaluation of cognitive deficits in anxiety disorders. Although neurocognitive changes are not among the diagnostic core features of anxiety disorders, numerous studies indicate that certain cognitive functions may be impaired or altered, typically with small to moderate effect sizes (e.g., Millan et al., 2012; Suddell et al., 2023; Majeed et al., 2023).

The Test Solution *"Anxiety Disorders – Neurocognitive Assessment"* is not intended for diagnosing an anxiety disorder. Instead, its purpose is to make frequently affected functional domains visible, identify individual strengths and weaknesses, and highlight potential targets for intervention or psychoeducation. The selection of dimensions included in the test battery is based on current evidence regarding cognitive deficits associated with anxiety disorders as well as on the diagnostic standards of the DSM-5-TR (American Psychiatric Association, 2022) and the ICD-11 (WHO, 2022).

Among the most consistently described areas in the literature are changes in working memory. A large number of review articles (e.g., Millan et al., 2012; Moran et al., 2016; Gkintoni & Ortiz, 2023; Giomi et al., 2021), as well as recent cross-sectional (Karaca Cengiz et al., 2025) and longitudinal studies (Suddell et al., 2023), report mild but robust impairments across various anxiety disorders, such as generalized anxiety disorder, panic disorder, and social anxiety disorder. However, some reviews reach divergent conclusions. For example, O'Sullivan and Newman (2014) found no differences in working memory among individuals with panic disorder, whereas two other reviews reported poorer working memory performance (Millan et al., 2012; Giomi et al., 2021). Nevertheless, this cognitive domain appears valuable for clarifying specific deficits in individual patients, particularly because it can be significantly improved through targeted interventions, as demonstrated in a recent review and meta-analysis involving patients with generalized anxiety disorder or social anxiety disorder (Mokhtari et al., 2025). Verbal memory is also of interest. The review by Miller et al. (2012) reported mild impairments in individuals with generalized anxiety disorder and panic disorder. This tendency was also confirmed specifically for panic disorder in another systematic review (O'Sullivan & Newman, 2014). In addition, Nyberg (2021) showed that verbal short-term memory, measured by digit span forward, is significantly lower in individuals with anxiety disorders compared to a healthy normative population.

Findings regarding attention in anxiety disorders are heterogeneous. Different disorders show different attention-related patterns. While one cross-sectional study among students with generalized anxiety disorder even reported better attentional performance, review articles tend to indicate slightly reduced attention in generalized anxiety disorder (Millan et al., 2012; Gkintoni & Ortiz, 2023). Panic disorder, in contrast, is often characterized by increased attention toward threatening stimuli, which likely reflects a bias rather than a general performance enhancement (Millan et al., 2012). In children and adolescents with anxiety disorders, a review concluded that there is no evidence for significant deficits (Rabner et al., 2024). Despite inconsistent findings, attentional processes are generally regarded as central in anxiety disorders (Eysenck et al., 1987; Ferreri et al., 2011; Millan et al., 2012; Giomi et al., 2021), making their assessment clinically meaningful. At the same time, results from classical neuropsychological tests conducted under neutral conditions should be interpreted with caution, as they may insufficiently capture threat-specific processing tendencies.

As with attention, findings on executive function in anxiety disorders are mixed. In young adults, one review (Castaneda et al., 2008) summarized both evidence for impairments across anxiety disorders and opposing findings for specific disorders, while another review (Ferreri et al., 2011) identified executive functions as a central domain in anxiety disorders. A longitudinal study (Lindert et al., 2021) reported mild but significant impairments in executive functions. For specific disorders, findings tended toward either no deficits (GAD: Millan et al., 2012; Leonard & Abramovitch, 2019; PD: Castaneda et al., 2008; Giomi et al., 2021; O'Sullivan & Newman, 2014) or inconclusive results (PD: Millan et al., 2012). These heterogeneous findings may be explained by differential impairment across subcomponents of executive functioning. More recent reviews and individual studies suggest that cognitive flexibility may be impaired in children and adolescents with anxiety disorders (Rabner et al., 2024), individuals with panic disorder (Giomi et al., 2021), and adolescents with social anxiety disorder (Karaca Cengiz et al., 2025), whereas there is generally no evidence for deficits in inhibition (Suddell et al., 2023; Rabner et al., 2024). Reviews also suggest that information processing speed may be impaired in some cases (Millan et al., 2012; Rabner et al., 2024). Assessing cognitive flexibility and information processing speed therefore appears useful for the differentiated clarification of potential deficits in anxiety disorders.

Reaction ability represents another relevant variable. A recent meta-analysis (Majeed et al., 2023) reported significant reaction time deficits in executive-function tasks (inhibition, shifting, updating) among individuals with anxiety disorders compared to healthy controls. However, effects vary depending on the specific executive function and the type of anxiety disorder. Reaction time deficits were observed across all three executive domains as well as in individuals with generalized anxiety disorder. In contrast, significantly faster reaction times were found in panic disorder. Notably, accuracy in reaction time tasks was generally higher than in control groups, particularly in shifting and updating tasks and among individuals with panic disorder or selective mutism. A recent study (Huiyong & Xinping, 2025) on lexical processing likewise showed unchanged accuracy but reduced reaction speed under stress conditions in students with higher trait anxiety compared to those with lower levels. Accordingly, systematically assessing reaction ability under stress conditions appears meaningful.

Furthermore, although general cognitive ability in individuals with anxiety disorders is on average not impaired compared to healthy individuals (Rabner et al., 2024), it may still be relevant for individual treatment planning and prognosis, as cognitive performance is associated with short- and long-term treatment outcomes (cf. Knekt et al., 2014). Overall, however, findings remain heterogeneous.

Based on this evidence, the SFS Test Solution “Anxiety Disorders – Neurocognitive Assessment” assesses the following cognitive functions:

- Attention
  - Processing speed (TMT-S, Part A)
  - Ability to concentrate (Selective attention) (TACO)
  - Reactive stress tolerance (DT)
- Executive functions
  - Cognitive flexibility (TMT-S, Part B)
  - Verbal Working Memory (SPAN, Digit span backward)
- Learning and memory
  - Verbal short-term memory (SPAN, Digit span forward)
- Logical reasoning (BMT)

The Test Solution “Anxiety Disorders – Neurocognitive Assessment” thus covers central functional domains that may be impaired across different types of anxiety disorders. However, several additional abilities that may also be relevant for clarifying cognitive deficits are not included, such as memory functions beyond working and short-term memory, attentional biases (Castaneda et al., 2008; Ferreri et al., 2011; Millan et al., 2012; O’Sullivan & Newman, 2014; Rabner et al., 2024; Lindert et al., 2021), language (Millan et al., 2012; Rabner et al., 2024), motor skills (Rabner et al., 2024), or social cognition (Gkintoni & Ortiz, 2023). Depending on the assessment purpose, additional procedures outside the SCHUHFRIED Selection may be added, for example to assess figural long-term memory (FGT) or social cognition (TOM). In addition, the GAD-7 (Generalized Anxiety Disorder-7) is available as a free supplementary questionnaire for assessing anxiety-related symptoms (see (8.30-en) Open Access Tests).

Please note that when configuring the test sequence and adding tests that are not part of the SCHUHFRIED Selection, the combined results overview is no longer automatically available (see Notes on evaluation and interpretation).

The duration of the standard form is approximately 46 minutes.

5.3.3 Attention-Deficit/Hyperactivity Disorder - Neurocognitive Assessment

The Test Solution “Attention-Deficit/Hyperactivity Disorder - Neurocognitive Assessment” is designed to assess the cognitive functional profile of individuals with attention-deficit/hyperactivity disorder (ADHD) across childhood, adolescence, and adulthood. It is not intended for diagnostic purposes, but supports clinical classification through the systematic mapping of individual cognitive strengths and weaknesses. The selection of Dimensions for the test battery is based on current findings regarding cognitive deficits in ADHD as well as the diagnostic standards DSM-5-TR (American Psychiatric Association, 2022) and ICD-11 (WHO, 2022).

According to ICD-11 and DSM-5-TR, inattention and/or hyperactivity and impulsivity are central to the diagnosis. Neurocognitive assessments complement clinical diagnostics by providing objective information on relevant functional domains and contributing to a more differentiated evaluation. DSM-5-TR identifies working memory, set shifting, reaction time variability, inhibition, vigilance, as well as planning and organization as areas in which cognitive deficits may occur. In addition, numerous studies show differences in cognitive abilities between individuals with ADHD and healthy control groups, although differentiation from other clinical cohorts based solely on cognitive profiles is not possible, and there is substantial heterogeneity among affected individuals (Cortese et al., 2025). Furthermore, a meta-analysis demonstrated that frequently used single procedures such as Continuous Performance Tests (CPT) show only limited diagnostic validity in children and adolescents (Arrondo et al., 2024).

The importance of impairments in attention has been confirmed by numerous reviews. A second-order meta-analysis concluded that small to medium differences in vigilance and selective attention exist between individuals with ADHD and healthy control groups (Pievsky & McGrath, 2018), and a recent review also reports deficits in sustained and focused attention in adults (Cortese et al., 2025). This is consistent with findings from fMRI reviews showing that brain regions responsible for attentional control may be impaired in individuals with ADHD (Rubia, 2018). Based on meta-analytic results (Loyer Carbonneau et al., 2020), these impairments do not differ significantly between genders in children and adolescents under 18 years of age. Nevertheless, ICD-11 (WHO, 2022) describes that women tend to show more symptoms of inattention, whereas men more frequently show symptoms of hyperactivity. Another noteworthy meta-analytic finding based on RCT studies in individuals under 18 years indicates that VR-based training can significantly improve attention performance in this disorder. The effects are described as large, but should be interpreted with caution, as the underlying studies are often of lower quality (Corrigan et al., 2023).

Meta-analyses and reviews also report deficits in inhibition and interference control. Pievsky and McGrath (2018) found medium differences in inhibition between individuals with ADHD and healthy control groups. Neuroimaging findings also indicate that brain regions responsible for inhibitory control may be impaired in ADHD (Rubia et al., 2018). Gender-specific differences can also be observed, with boys showing stronger impairments. These differences are evident in motor inhibition and in the inattentive subtype of ADHD (Loyer Carbonneau et al., 2020).

A particularly robust finding in ADHD research concerns reaction times, and especially their variability. Early research already pointed out that increased variability in responses represents one of the most reliable cognitive characteristics of ADHD and cannot be explained solely by differences in executive functions or inhibition (Castellanos et al., 2006). A comprehensive meta-analytic review covering 319 studies on reaction time variability (Kofler et al., 2013) found small to medium differences between individuals with ADHD and healthy individuals. Mean reaction times, however, did not differ significantly once variability was statistically controlled. The second-order meta-analysis by Pievsky and McGrath (2018) likewise concluded that average reaction time is usually only slightly prolonged compared to control groups, whereas variability of reaction times showed the strongest effects among all investigated neurocognitive domains. fMRI studies additionally show that brain regions responsible for temporal control are frequently altered in ADHD (Rubia et al., 2018).

Individuals with ADHD also show moderate impairments in working memory compared to healthy control groups (Pievsky & McGrath, 2018; Cortese et al., 2025), with no gender differences observed (Loyer Carbonneau et al., 2020). fMRI findings likewise indicate alterations in regions central to working memory processes (Rubia et al., 2018). Other memory processes appear to play a smaller role, although relevant differences compared to control groups have also been identified (Pievsky & McGrath, 2018). Cortese et al. (2025) report findings on impairments in verbal memory in adults. In addition, Cerny et al. (2025) identified a subgroup within an ADHD sample showing specific deficits in learning and memory using latent class analysis.

Cognitive flexibility may also be impaired, although to a somewhat lesser extent. Pievsky and McGrath (2018) report small but significant differences in set shifting, which are supported by findings in adults (Cortese et al., 2025). Rubia et al. (2018) additionally describe alterations in brain regions relevant for temporal processing. Gender-specific differences have also been observed, suggesting stronger impairments in boys (Loyer Carbonneau et al., 2020).

To a lesser extent, higher executive functions such as logical reasoning, as well as planning and organization, also show differences (Pievsky & McGrath, 2018). Cortese et al. (2025) additionally report difficulties in decision-making in adults. Gender differences do not appear to be significant in these domains (Loyer Carbonneau et al., 2020).

The Test Solution "Attention-Deficit/Hyperactivity Disorder - Neurocognitive Assessment" therefore includes the following cognitive Domains:

- Attention
  - Processing speed (TMT-S, Part A)
  - Sustained attention (TACO)
  - Motor and reaction speed and their variability (RT)
- Executive functions
  - Verbal working memory (SPAN, Digit span backward)
  - Cognitive flexibility (TMT-S, Part B)
  - Interference tendency (STROOP)
- Learning and memory
  - Verbal short-term memory (SPAN, Digit span forward)
- Logical reasoning (BMT)

Beyond the cognitive Domains described above, research also regularly reports differences in verbal fluency (Pievsky & McGrath, 2018; Cortese et al., 2025), as well as the importance of abnormalities in motivational and emotional executive functions (Castellanos et al., 2006; Rubia et al., 2018). However, these areas are not part of the Test Solution "Attention-Deficit/Hyperactivity Disorder - Neurocognitive Assessment" and are therefore mentioned here only for completeness.

Depending on the assessment question, additional tests outside the SCHUHFRIED Selection may be added to the test battery, for example for assessing verbal fluency (WIWO). Please note that when configuring the test sequence and adding tests that are not part of the SCHUHFRIED Selection, the combined results overview is no longer automatically available (see Notes on evaluation and interpretation).

Please note that currently only norm-referenced scores for adults are available. Therefore, the results of the Test Solution "Attention-Deficit/Hyperactivity Disorder (ADHD)" in children and adolescents should be interpreted with caution. They provide valuable indications of cognitive strengths and weaknesses, but should be evaluated in the context of age-appropriate development and additional clinical information.

The duration of the standard form is approximately 89 minutes.

5.3.4 Depression - Neurocognitive Assessment

The Test Solution “Depression - Neurocognitive Assessment” is used to assess the cognitive functional profile of individuals with depressive disorders as well as with subclinical symptoms (see chapter 6A70–73, ICD-11; WHO, 2022). The selection of dimensions for the Test Solution is based on current meta-analytic findings on cognitive changes before, during, and after depressive episodes, the diagnostic standards DSM-5-TR (American Psychiatric Association, 2022) and ICD-11 (WHO, 2022), as well as the S3 guideline for the diagnosis and treatment of unipolar depression (German Medical Association et al., 2022).

In addition to mood- and motivation-related core symptoms, both ICD-11 and DSM-5-TR describe two cognitive associated symptoms in depressive disorders: psychomotor slowing (or agitation) and concentration and decision-making problems. This is also reflected in the S3 guideline of the German Medical Association, which, in the chapter on the recognition of depression, lists memory impairments, psychomotor slowing, impairments in expressive language and language comprehension, as well as attention problems as diagnostically relevant alongside mood-related core symptoms. The diagnostic recommendations of the S3 guideline do not include psychometric ability tests, but emphasize self-assessment or targeted inquiry about concentration problems and slowing, which can be assessed objectively through testing. DSM-5-TR highlights that many patients report a markedly reduced ability to think clearly, concentrate, or make decisions during a depressive episode (criterion A8). Affected individuals often appear easily distractible or complain about memory problems, which can lead to noticeable impairments, particularly in activities with high cognitive demands. In childhood and adolescence, this may become visible through a decline in academic performance. In older individuals, pronounced memory complaints are often prominent and may be misinterpreted as “pseudodementia” (American Psychiatric Association, 2022).

In the scientific literature, cognitive performance impairments in depression are explained by two underlying models: the processing speed hypothesis and the effort hypothesis. The processing speed hypothesis states that slowing of processing speed, as a basic component of higher cognitive functions, impairs performance in more complex tasks. The effort hypothesis, on the other hand, assumes that impaired performance in executive tasks among individuals with depressive symptoms has motivational or mood-related causes, meaning that tasks requiring high cognitive effort are performed less well (see Nuño et al., 2021).

Research provides numerous, partly longitudinal meta-analyses on neurocognitive functional profiles, which can be divided into findings before, during, and after (i.e., remission) the occurrence of a depressive episode. These findings provide empirical evidence for both the processing speed hypothesis and the effort hypothesis and are discussed below across the temporal course of depressive episodes.

Before the occurrence of depressive episodes, a longitudinal meta-analysis covering $k = 29$ studies and $n = 121{,}749$ individuals showed that differences in cognitive and executive functions are only weakly associated with the occurrence or severity of a depressive episode ($r = .09$, $p < .001$), and that this relationship disappears completely when controlling for subclinical depressive symptoms (Scult et al., 2016). This suggests that cognitive functions are not causally involved in the development of depression.

During ongoing depressive symptoms, meta-analyses show clear impairments in executive functions. A large cross-sectional meta-analysis covering $k = 113$ studies comparing individuals with MDD to healthy control groups found that most executive functions were impaired, particularly inhibition ($d = 0.53$ [0.47–0.69]), verbal ($d = 0.45$

[0.34–0.56]) and visual working memory (d = 0.45 [0.30–0.59]), verbal fluency (0.55 [0.44–0.66]), processing speed (0.33 [0.15–0.50]), and cognitive flexibility (0.47 [0.39–0.55]) (Snyder, 2013). These results are consistent with a smaller meta-analysis of 13 studies and 644 individuals investigating cognitive profiles during the first depressive episode, which found small to medium executive impairments (Lee et al., 2012). Current findings also indicate that the neurocognitive profile of depressive disorders follows age-dependent patterns. A meta-analysis of adolescents and young adults (12–25 years) showed significant impairments in attention, verbal and visual memory, verbal reasoning, and general cognitive ability compared with healthy control groups (Goodall et al., 2018). In addition, several meta-analyses indicate that age and number of previous depressive episodes act as moderators of cognitive impairments, with both variables being confounded (Nuño et al., 2021; Semkovska et al., 2026).

After a depressive episode, small group differences remain between remitted individuals and those never affected by depressive episodes. A large meta-analysis of 244 studies with more than 10,000 individuals per group showed that differences in processing speed, inhibition, cognitive flexibility, numerical and verbal fluency, planning ability, and working memory persist even in remission. A moderator analysis from the same study showed that all these differences, except working memory, could be fully explained by processing speed, providing strong empirical evidence for the processing speed hypothesis. In working memory, small differences were observed (e.g., digit span forward: g = –0.28 [–0.41 to –0.14]; 53 studies, n = 3180 vs. 2307) (Semkovska et al., 2026). These findings replicate and extend results from the preceding study, which additionally found that differences in general cognitive ability were negligible and that recognition of emotional expressions in others was significantly better in remitted individuals (d = –0.83 in favor of the remitted group) (Semkovska et al., 2019). A meta-analysis of longitudinal data from individuals with depressive symptoms before and after treatment (k = 16 studies, n = 859 individuals) showed significant improvements in working memory, verbal memory, and verbal fluency, while processing speed and non-verbal memory remained unchanged, although retest effects could not be ruled out (Bernhardt et al., 2019). A prospective long-term study with n = 267 individuals found that cognitive symptoms persisted in about half of the affected individuals even after three years, whereas mood- and motivation-related aspects showed significantly stronger improvement (Conradi et al., 2010).

These findings underline the importance of monitoring depressive symptoms, which is also recommended by the S3 guideline. The guideline notes that monitoring is often not frequent enough and that psychometrically validated instruments should be used. The focus is on self- and observer ratings, particularly the PHQ-9. Executive functions may also be relevant for treatment planning. A systematic review of 39 studies showed that baseline cognitive function can, in some cases, predict the effectiveness of psychopharmacological treatment options (Groves et al., 2018). Although cognitive ability tests and training procedures are not currently part of the S3 guideline recommendations, these results indicate that executive functions may play a role not only in diagnostics but also in treatment planning and prognosis in depression. Initial findings also suggest that cognitive remediation, a combined method integrating cognitive training with other psychotherapeutic approaches, can lead to moderate improvements in executive functions, working memory, attention, and global cognition in patients (Thérond et al., 2021). Furthermore, although general cognitive ability in remitted individuals is on average not impaired compared to healthy individuals (Semkovska et al., 2019; 2025), it may still be relevant for individual therapy planning and prognosis, as cognitive ability is associated with short- and long-term treatment outcomes (see Knekt et al., 2014).

In summary, depression is associated with impairments in many areas of executive functions, which often persist during remission, and these effects can largely be explained by processing speed. The Test Solution “Depression - Neurocognitive Assessment” for acute depressive episodes therefore includes the following cognitive domains (see DSM-5-TR; APA, 2022):

- Attention
  - Processing speed (TMT-S, Part A)
  - Ability to concentrate (TACO)
- Executive Functions
  - Cognitive flexibility (TMT-S, Part B)
  - Interference (STROOP)
  - Verbal working memory (SPAN, digit span backward)
- Learning and memory
  - Verbal short-term memory (SPAN, digit span forward)
- Logical reasoning (BMT)

For monitoring neurocognitive impairments and resources in remission, the literature discussed above recommends assessing the central cognitive dimensions processing speed and working memory (TMT-A, SPAN). Multiple parallel forms and adaptive administration are available to avoid practice effects.

Depending on the assessment question, additional tests outside the SCHUHFRIED Selection may be added to the Test Solutions, for example to assess verbal fluency (WIWO). In addition, the PHQ-9 (Patient Health Questionnaire-9) is available as a free supplementary questionnaire for assessing depressive symptoms (see (8.30-en) Open Access Tests). Please note that when configuring the test sequence and adding tests that are not part of the SCHUHFRIED Selection, the combined results overview is no longer automatically available (see Notes on evaluation and interpretation).

The test duration of the standard form is approximately 55 minutes.

5.3.5 Schizophrenia Spectrum Disorders - Neurocognitive Assessment

The Test Solution “Schizophrenia Spectrum Disorders – Neurocognitive Assessment” is intended to assess the cognitive functional profile of individuals with schizophrenia. The selection of dimensions is based on current research findings on cognitive changes associated with schizophrenia, as well as on the diagnostic standards DSM-5-TR (American Psychiatric Association, 2022), ICD-11 (WHO, 2022), and a comprehensive recommendation for the assessment of cognitive impairments in schizophrenia issued by the European Psychiatric Association (EPA) (Vita et al., 2022).

Schizophrenia is a severe and highly burdensome mental disorder. Individuals affected by schizophrenia are often confronted with difficulties in everyday functioning (Galderisi et al., 2014; Harvey & Strassnig, 2012), report reduced quality of life (Dong et al., 2019), and frequently show limited participation in social and personal life (Correll et al., 2022; Vita et al., 2022). Cognitive impairments represent a central component of the symptomatic profile of schizophrenia and contribute substantially to functional limitations (McCutcheon et al., 2023). Unlike, for example, depression, cognitive impairments are often present prior to the first episode and occur independently of it (McCutcheon et al., 2023). A recent meta-analysis further indicates that these impairments show high temporal stability (Ghanem et al., 2025), highlighting the clinical relevance of assessing individual cognitive deficits.

While ICD-11 (WHO, 2022) does not explicitly focus on cognitive impairments, it allows them to be considered as a relevant symptom domain that may complement severity assessment. In contrast, DSM-5-TR (American Psychiatric Association, 2022) explicitly describes cognitive functional impairments as central and clinically significant dimensions of the disorder. Although the introduction of a cognitive criterion as a formal diagnostic feature was considered during DSM-5 development, this was not implemented due to limited diagnostic specificity, for example in comparison with bipolar disorders (McCutcheon et al., 2023). Nevertheless, international guidelines, particularly the EPA Guidance (Vita et al., 2022), emphasize that cognitive performance impairments should be systematically assessed, as they affect key functional areas, contribute substantially to social and occupational participation, and provide important additional diagnostic information. The EPA identifies the following dimensions as relevant for cognitive assessment in schizophrenia: processing speed, attention and vigilance, working memory, verbal and visuospatial learning, memory, logical reasoning, and problem-solving ability.

The most frequently impaired cognitive domain in schizophrenia is processing speed, which has been identified as a fundamentally affected ability in numerous empirical studies (Gebreegziabhere et al., 2022; Morrens et al., 2008; Nuechterlein et al., 2004; Ojeda et al., 2012; Seitz-Holland et al., 2022). The umbrella review by Gebreegziabhere et al. (2022) identified processing speed, alongside memory, as the most frequently reported impairment in schizophrenia. A recent meta-analysis by Ghanem et al. (2025) demonstrated the temporal stability of cognitive deficits and reported significant differences between patients and control groups across all examined domains, including processing speed, attention, working memory, verbal and visual learning, verbal memory, verbal fluency, and logical reasoning (see Supplementary Table 5 in Ghanem et al., 2025). Ojeda et al. (2012) identified processing speed as the most important ability for differentiating healthy individuals from individuals with schizophrenia. Morrens et al. (2008) further showed slowed information processing in individuals with schizophrenia compared to healthy controls. In addition, Mahurin et al. (2006) demonstrated poorer performance of individuals with schizophrenia on Part A of the Trail Making Test compared with both healthy controls and individuals with depression.

Reviews by Osborne et al. (2020) and Morrens et al. (2007) indicate that psychomotor speed may also be impaired in individuals with schizophrenia. In the literature, this impairment is often referred to as psychomotor slowing. Osborne et al. (2020) further describe psychomotor slowing as a multidimensional construct and suggest that it may represent an important biomarker in schizophrenia diagnostics. These facets include response selection and motor planning, motor inhibition, volition, motor speed, and fine motor coordination. Van Beilen et al. (2004) likewise emphasize that psychomotor speed correlates with cognitive test performance. Morrens et al. (2008) confirmed the relevance of psychomotor speed and linked it to processing speed. Based on this evidence, it appears meaningful to assess psychomotor speed and interpret it in combination with processing speed.

Another central cognitive ability that may be impaired in schizophrenia is working memory. Ghanem et al. (2025) report medium to large effect sizes indicating lower working memory performance in individuals with schizophrenia compared with healthy individuals. A further meta-analysis (Lee & Park, 2005) suggests that these differences occur independently of test modality. Additional evidence from the umbrella review by Gebreegziabhere et al. (2022), as well as earlier findings by Forbes et al. (2009) and Ojeda et al. (2012), supports the relevance of working memory in schizophrenia and justifies its assessment alongside processing speed.

Nuechterlein et al. (2004) showed that attention and vigilance also represent relevant dimensions that may be impaired in schizophrenia. Differences in attentional performance between healthy individuals and individuals with schizophrenia were likewise reported by Ojeda et al. (2012).

Logical reasoning also shows significant and persistent impairment in schizophrenia (Ghanem et al., 2025; Nuechterlein et al., 2004). This domain is likewise identified by the EPA Guidance as relevant for cognitive assessment (Vita et al., 2022).

Within executive functions, a meta-analysis (Westerhausen et al., 2011) found that global executive dysfunctions may partly be explained by reduced inhibitory control. Bielecki et al. (2024) additionally demonstrated reduced cognitive and motor inhibition in patients with cognitive deficits or negative symptoms (according to the dimensional description in ICD-11). Mahurin et al. (2006) further showed that individuals with schizophrenia performed worse on Part B of the Trail Making Test, which assesses executive functions, compared with both healthy controls and individuals with depression.

In summary, the evidence indicates that processing speed, attention, psychomotor speed, inhibition, and working memory belong to the central and empirically well-supported functional areas that are typically impaired in schizophrenia. A structured assessment of these domains is therefore essential for clinical evaluation, treatment planning, and prognosis. The Test Solution “Schizophrenia Spectrum Disorders – Neurocognitive Assessment” therefore includes the following cognitive domains:

- Attention
  - Processing speed (TMT-S, Part A)
  - Selective attention (TACO)
  - Motor and reaction speed (RT)
- Executive functions
  - Cognitive flexibility (TMT-S, Part B)
  - Verbal working memory (SPAN, digit span backward)
  - Interference tendency and inhibition (STROOP)
- Learning and memory
  - Verbal short-term memory (SPAN, digit span forward)
- Logical reasoning (BMT)

The Test Solution “Schizophrenia Spectrum Disorders – Neurocognitive Assessment” thus covers central cognitive domains that may be impaired in schizophrenia. However, some relevant domains are not included. Meta-analytic findings by Szöke et al. (2008), for example, identified semantic verbal fluency as one of the best predictors for differentiating individuals with schizophrenia from healthy controls, although this finding should be interpreted with caution due to the limited study quality noted by Gebreegziabhere et al. (2022). Verbal and visuospatial memory, as well as social cognition, are not included as standard components, although social cognition in particular is considered a relevant factor by the EPA Guidance.

Depending on the specific assessment question, additional procedures outside the SCHUHFRIED Selection may therefore be added to the Test Solution, for example to assess verbal fluency (WIWO), concretism (SMT; Barth, 2018; see Vita et al., 2022), verbal memory (AWLT), social cognition (TOM), or figural memory (FGT). Please note that when configuring the test sequence and adding tests that are not part of the SCHUHFRIED Selection, the combined results overview is no longer automatically available (see Notes on evaluation and interpretation).

The test duration of the standard form is approximately 61 minutes.

5.3.6 Substance Use Disorders - Neurocognitive Assessment

The Test Solution “Substance Use Disorders - Neurocognitive Assessment” is used to assess the cognitive functional profile of persons with substance-related disorders as defined by the DSM-5-TR and ICD-11. The diagnostic frameworks describe disorders due to substance use as a group of conditions that arise from the repeated consumption of psychoactive substances and encompass a broad spectrum of cognitive, behavioral, and physiological symptoms. A characteristic feature is the ability of these substances to activate central reward systems and thereby influence learning, memory, and decision-making processes. Both ICD-11 and DSM-5-TR differentiate substance-related disorders according to the substance consumed and include, among others, disorders related to alcohol, cannabis, opioids, cocaine, amphetamines, and nicotine (American Psychiatric Association, 2022; WHO, 2022).

In the scientific literature, extensive findings are available on trans-substance and substance-specific cognitive changes. The systematic review by Ramey et al. (2018) describes consistent impairments in attention, working memory, Response Inhibition, and planning-related executive functions as common characteristics across different substance use disorders. These impairments are expected, since addiction-related stimuli activate automatic attentional processes, inhibitory control mechanisms are strained by repeated consumption behavior, chronic substance use impairs working memory processes, and decision-making processes become increasingly driven by immediate, habitualized reactions rather than deliberative strategies. These cognitive limitations increase relapse risk, complicate treatment adherence, and impair everyday functioning. They therefore represent central targets for assessment and targeted therapeutic interventions. At the same time, recent meta-analyses indicate that the strength and manifestation of these cognitive changes vary depending on the substance class and that substance-specific patterns can be identified.

In alcohol dependency (AUD), a meta-analysis covering k = 62 studies showed that the profile of neurocognitive deficits largely recovers within one year after cessation of use. The most pronounced impairments immediately after cessation were found in planning ability (k = 20; n = 1816; d = 0,53 [0,44; 0,63]), attention (k = 3; n = 116; d = 0,70 [0,32; 1,08]), and working memory (k = 14; n = 818; d = 0,53 [0,36; 0,70]). Other executive functions such as inhibition, processing speed, as well as learning and memory performance showed smaller effects in the range of 0,37 < d < 0,47. Overall, these effects remained relatively stable during the first year of abstinence, whereas findings after more than one year of abstinence showed only small to negligible effect sizes (Stavro et al., 2012). The authors conclude that alcohol-related impairments are not selective but diffusely distributed across different neurocognitive domains, supporting the “diffuse brain hypothesis”.

In cannabis dependency (CUD), a meta-analysis across k = 23 studies showed clear impairments in several cognitive areas. The largest effects were found in general intelligence (d = 0,50 [0,33; 0,67]), verbal learning (d = 0,48 [0,32; 0,64]), processing speed (d = 0,40 [0,23; 0,58]), and working memory (d = 0,40 [0,26; 0,54]). Findings on attention, impulsiveness, and visuospatial abilities, however, showed mostly small to negligible effects (0,20 < d < 0,28). These results indicate a specific, focused pattern of cognitive impairments in CUD that differs from the more diffuse profiles of other substances (Pilon et al., 2025).

In cocaine dependency, a meta-analysis covering k = 46 studies showed clear impairments across several cognitive domains depending on abstinence status. During short abstinence (positive urine sample), moderate deficits were found primarily in impulsiveness (d = 0,41 [0,21; 0,61]) and working memory (d = 0,44 [0,17; 0,71]), while effects in attention, processing speed, and visual abilities were mostly small (d < 0,30).

At ≤12 weeks of abstinence, several deficits became more pronounced, particularly in attention (d = 0,59 [0,32; 0,87]), impulsiveness (d = 0,58 [0,41; 0,76]), processing speed (d = 0,45 [0,29; 0,60]), and working memory (d = 0,52 [0,30; 0,75]). Verbal learning and memory showed consistently moderate effects (0,52 < d < 0,56). Overall, the findings indicate broadly distributed and abstinence-dependent impairments, with some deficits becoming more pronounced during early abstinence (Potvin et al., 2014).

In methamphetamine dependency (MUD), a meta-analysis across k = 44 studies showed broadly pronounced deficits in intelligence, attention, verbal fluency, long-term and working memory (0,43 < d < 0,59). Particularly strong impairments were found in impulsiveness (k = 8; d = 0,93 [0,72; 1,14]) and social cognition (k = 3; d = 1,12 [0,81; 1,42]), although the latter should be interpreted cautiously due to small sample sizes. Areas such as visual learning, processing speed, and visuospatial abilities showed smaller effects (0,27 < d < 0,38). Overall, the evidence demonstrates substance-related, broad cognitive deficits, with patterns comparable to or slightly more pronounced than those found in alcohol and cocaine dependency (Potvin et al., 2018).

In opioid dependency (OUD), a meta-analysis covering k = 61 studies showed clear impairments in complex psychomotor speed (k = 22; g = 0,97 [0,74; 1,20]). Further strong to moderate deficits were found in immediate visual memory (k = 7; g = 0,97 [0,70; 1,25]), visuospatial abilities (k = 4; g = 0,76 [0,45; 1,06]), verbal memory (k = 14–13; 0,56 < g < 0,60), working memory (k = 20; g = 0,77 [0,56; 0,98]), as well as planning ability (k = 12; g = 0,70 [0,53; 0,87]). Smaller effects were observed in cognitive flexibility (k = 22; g = 0,42 [0,27; 0,58]) and attention (k = 13; g = 0,57 [0,41; 0,72]), while motor and processing speed showed negligible differences (k = 10–5; g < 0,25). Meta-regressions suggest that longer abstinence is associated with a reduction in specific deficits, particularly in the psychomotor domain. Overall, a broad profile of cognitive impairments emerges, characterized by especially pronounced deficits in complex psychomotor functioning, memory performance, working memory, and planning (Wollman et al., 2018).

In tobacco dependency, a meta-analysis covering k = 24 studies on chronic or heavy tobacco use showed clear differences in cognitive impulsiveness (k = 5; d = 0,88 [0,31; 1,46]), while motor impulsiveness, for example measured by the Stroop, showed no significant group differences (k = 4; d = 0,11 [–0,07; 0,28]). Moderately impaired were long-term memory (k = 7; d = 0,62 [0,28; 0,96]), planning ability (k = 8; d = 0,51 [0,23; 0,78]), cognitive flexibility (k = 9; d = 0,45 [0,06; 0,84]), as well as working memory (k = 11; d = 0,41 [0,18; 0,64]). Negligible effects (d < 0,20) were found in attention and intelligence. The authors point out that lighter or moderate use is associated with smaller or no group differences (Conti et al., 2019).

Overall, substance-related disorders show both commonalities and clear differences in the nature and strength of their neurocognitive profiles. It should be considered that most of these findings are based on cross-sectional studies and therefore do not allow causal conclusions. However, a systematic review showed that neurocognitive disorders are often caused by substance use and highlighted the relevance of assessing impairments in everyday functioning (Toledo-Fernández et al., 2017).

The following domains cover those neurocognitive dysfunctions that occur most consistently across substances and are described in DSM-5-TR and ICD-11 as central functional areas related to substance-related disorders. The Test Solution “Substance Use Disorders - Neurocognitive Assessment” includes the following cognitive domains and associated tests:

- Attention
    - Selective attention (TACO)
    - Processing speed (TMT-S, Part A)

- Executive functions
    - Inhibition (STROOP)
    - Cognitive flexibility (TMT-S, Part B)
- Learning and memory
    - Working memory (SPAN)
- Fluid intelligence (BMT)

Depending on the assessment question, additional tests may be integrated, for example verbal fluency (WIWO) and social cognition (TOM) in methamphetamine dependency or (complex) psychomotor skills (2HAND) in opioid dependency. In addition, AUDIT (Alcohol Use Disorders Identification Test) and DUDIT (Drug Use Disorders Identification Test) are available as free supplementary questionnaires for symptom assessment (see (8.30-en) Open Access Tests). It should be noted that when configuring the test sequence and adding tests that are not part of the SCHUHFRIED Selection, the combined results overview is no longer automatically available (see Notes on evaluation and interpretation).

The test duration of the standard form is approximately 47 minutes.

5.4 Personnel Selection

The application area “Personnel Selection” provides test solutions for use in personnel selection and aptitude assessment for a wide range of professions in industry and other specialist areas (over 600 occupations available).

5.4.1 Leadership

With the Test Solution “Leadership”, the psychological prerequisites of a person for successful leadership behavior can be assessed. Leadership effectiveness is defined in common meta-analyses as a summary measure of fulfilling the leadership role, for example through objective performance and productivity measures, goal achievement, as well as satisfaction and evaluation by employees or supervisors. Integrative leadership models therefore assume that cognitive ability and personality together with leadership motivation represent those distal and proximal influencing factors that substantially determine the development and execution of competent leadership behavior (cf. DeRue et al., 2011; Badura et al., 2020).

General cognitive ability (g) facilitates successful leadership performance because it contributes substantially to solving complex problems, analyzing dynamic situations, and selecting appropriate action strategies. Leadership research has long provided clear evidence that cognitive abilities belong to the distal predictors of effective leadership. A comprehensive meta-analysis by Judge et al. (2004) with $k = 151$ samples and a total of $N = 40,652$ persons documents a corrected[1] relationship of $\rho = ,21$ between general cognitive ability and leadership effectiveness. A separate analysis by Badura et al. (2020) confirms smaller but stable relationships for the same ability of $\rho = ,15$ ($k = 38$), highlighting the role of cognitive abilities as a robust, although not the most important, influencing factor. The relative weighting of specific cognitive abilities in this Test Solution was determined on the basis of their respective loading on g (SCHUHFRIED, 2025b).

In addition to cognitive abilities, personality traits prove to be central distal influencing factors in the leadership process. A large-scale meta-analysis by Badura et al. (2020), which includes $k = 63$ samples with several thousand persons per variable, showed that in particular the Big Five dimensions Extraversion ($\rho = ,31$) and Conscientiousness ($\rho = ,28$) demonstrate substantial relationships with leadership effectiveness and leadership behavior. Openness ($\rho = ,24$) and Emotional stability ($\rho = ,24$) show similarly strong relationships, while Agreeableness shows a very small negative relationship of ρ = -,08. These findings are consistent with earlier meta-analyses that found very similar effect sizes for the prediction of leadership effectiveness (cf. DeRue et al., 2011). Overall, it becomes clear that the combination of cognitive abilities and the Big Five personality dimensions has substantial predictive power for leadership success - for example, the meta-analytic correlation matrix by Badura et al. (2020) shows an explained variance of R^2 = ,24 for cognitive abilities and personality with regard to leadership effectiveness, while leadership motivation plays a subordinate role after controlling for personality[2] - this empirically underlines the relevance of these distal predictors. Distal predictors also have the advantage over proximal predictors such as interests and motivation that they show greater temporal stability and therefore enable long-term prediction of leadership potential.

The Test Solution "Leadership" assesses the following dimensions:

- **Cognitive Ability:** Logical reasoning, numerical ability, and verbal ability (INT)
- **Personality:** Openness, Conscientiousness, Extraversion, Agreeableness, Emotional stability (FCB5)

The table below provides a complete overview of the specific weightings of the individual tests used to calculate the overall score for the Test Solution "Leadership". The weighting is based on the correlation matrix according to Badura et al. (2020), on which a Relative Importance Analysis (RIA) was recalculated (R package relaimpo: Grömping, 2006; linear RIA: Lindeman et al., 1980, p. 119ff), which is preferable to the use of meta-analytic regression weights (cf. Darr & Catano, 2016). Further information on the calculation and interpretation of the result of a testing can be found on the page: Notes on evaluation and interpretation.

Leadership	Weighting
Cognitive abilities	**27**
Logical reasoning	10
Numerical ability	9
Verbal ability	8
Personality	**73**
Conscientiousness	24
Emotional stability	10
Extraversion	26
Agreeableness	-
Openness	13

The Test Solution **Leadership** therefore enables a time-efficient, well-founded, and scientifically grounded assessment of a person's potential to develop and implement competent and effective leadership behavior in practice. For additional assessment of leadership motivation, the MAP (Management potential analysis) is available to you via the Marketplace. Please note that when configuring the test sequence and adding tests that are not part of the SCHUHFRIED Selection, the combined results overview is no longer automatically available (see Notes on evaluation and interpretation). The test duration is approximately 31 minutes.

[1] All reported effect sizes for the Test Solution **Leadership** are corrected for the reliability of the criterion and the predictor and are therefore denoted with ρ (cf. Schmidt & Hunter, 1998).

[2] Calculated based on: [formula image], with rxy: vector of the correlations between predictors X and criterion Y, Rxx: correlation matrix of the predictors among each other (derived from equation 3.5.2 and A1.1 in Cohen et al., 2003).

5.4.2 Safety Mining Industry

Compared with other industries, the mining industry represents a particularly hazardous work environment. Empirical findings show that employees in mining, compared with other industrial sectors, have a significantly increased risk of fatal workplace accidents (Feyer et al., 2001). Accidents involving non-fatal injuries also occur frequently in mining. In addition to the substantial physical and psychological strain on affected workers, such accidents represent a relevant economic factor, for example through production downtime, medical costs, and follow-up costs for companies and insurance systems (cf. Leigh et al., 2004). Accordingly, there has long been interest in reducing accident risk in mining through targeted preventive measures.

In the scientific literature, the occurrence of accidents in occupational contexts is usually modeled as a complex interaction of environmental conditions, organizational and social framework conditions, and individual influencing factors. A meta-analysis by Wang et al. (2023), including 51 studies on health- and safety-promoting behavior among miners, showed that structural and organizational measures in particular, such as personal protective equipment, noise reduction, and safety training, make a central contribution to improving safety.

Psychological factors are typically located sociologically within the context of organizational conditions in this field of research, particularly in the form of safety-related knowledge, attitudes, and behavior. Systemic analyses of accident events in mining show that individual human errors are usually not the primary cause, but rather the final link in a longer causal chain: on an individual-psychological explanatory level, insufficient professional, cognitive, and psychomotor competence can be understood as distal predictors (Lenné et al., 2012), and fatigue (Bauerle et al., 2018) as proximal triggers of mining accidents. A meta-analytic path model on general occupational safety showed that systematic overstrain of workers through fatigue can lead to a reduction of cognitive resources, which in turn increases the probability of errors, injuries, and accidents (Techera et al., 2016). In addition, accidents may also result from intentional violations of safety standards, often with the intention of increasing productivity. At the organizational level, this may be attributed to management pressure or an insufficient safety culture, and at the individual level, for example, to safety-relevant personality traits (Lenné et al., 2012). In this sense, mining accidents cannot be explained solely by systemic-organizational factors, but are also linked to the current and dispositional ability, personality, as well as safety-related knowledge and attitudes of the acting individuals. Psychological aptitude testing therefore does not aim to replace organizational responsibility for operational safety, but provides complementary information about whether basic prerequisites for safety-relevant behavior are present.

Despite operational diversity, safety-relevant activities in the mining industry can be categorized into three central occupational groups according to their requirements: Mining Vehicle Operators, Mining Machine Operators, and Mining Technicians. This is also reflected in official documents of resource-producing countries, such as Zimbabwe's *Mining Career Guide*, which differentiates between these three groups in addition to support workers and sales staff (MQA, 2018).

The weighting and selection of the dimensions included in the present Test Solutions are therefore based on available empirical evidence on general and mining-specific operational safety, as well as on the requirement-related relevance of each dimension for the safe and competent execution of the respective occupational groups. In addition, the authors of this document had access to samples from several South African mining companies, including “Mining Vehicle Operators” (n = 325) and “Mining Machine Operators” (n = 341). Using these data, the number of workplace accidents involving injuries could be related to cognitive performance measures at the time of hiring. Personality traits were included as a complementary component with lower weighting, as they are associated with safety-relevant behavior and accident frequency in the empirical literature, but play a subordinate role compared with organizational and performance-related factors and may additionally be subject to linguistic or cultural limitations depending on the application context, which can compromise test fairness.

Accordingly, for the present Test Solutions, both a standard version without personality and a version with personality are offered for different application contexts. Overall, the selection and weighting of dimensions follow the goal of ensuring both accident prevention and suitability for safe, reliable, and competent performance in the respective occupations. The requirements, empirical evidence of validity, and the resulting selection and weighting of dimensions are described below for each occupational group.

5.4.2.1 Mining Vehicle Operators

Mining Vehicle Operators are responsible for driving locomotives and other heavy transport vehicles used to move ore, materials, and equipment within the mine. The work is characterized by dynamic, time-critical hazard situations in which safety-relevant events often occur unexpectedly. Work phases in which people regularly cross driving routes or rail tracks are particularly safety-critical. At the same time, work takes place in a noisy environment with high visual and auditory demands, limited visibility, and changing environmental conditions. Mining Vehicle Operators must continuously monitor their surroundings, detect relevant hazard signals early, and execute steering or braking maneuvers precisely. Errors or delays can immediately lead to severe accidents. This requirement profile implies a high relevance of basic cognitive functions, as also described in traffic psychology research on driving safety.

For Mining Vehicle Operators, stable reaction performance under strain is particularly safety-relevant. Empirical findings from the mining context show that reactive stress tolerance demonstrates the most consistent relationships with accident and injury events across different accident criteria (Vorster et al., 2011; Aguilera-Vanderheyden, 2013). In the present sample of Mining Vehicle Operators (n = 325), a clear relationship was also found between reactive stress tolerance and the total number of injuries (Spearman ρ = .28). In contrast, simple reaction speed was not a significant predictor of accident events in the studies by Aguilera-Vanderheyden (2013), Vorster et al. (2011), or in the present sample, although traffic psychology meta-analyses show that simple reaction speed generally has moderate associations with safe driving behavior (Stefanidis et al., 2023).

In addition, operating heavy mining vehicles requires reliable obtaining an overview, a working-memory-related ability needed to detect relevant signals, movements of persons, and hazard cues early. Studies with professional drivers in hazard courses show clear relationships between obtaining an overview and driving behavior (r = .25; Vetter et al., 2018), while broader systematic reviews emphasize the central role of working memory performance and attentional control for safe driving under complex conditions (Pergantis et al., 2024; Zhang et al., 2023). The data from the present sample also show relationships between safety-relevant criteria and concentration performance (ρ = .13) as well as eye-hand coordination (ρ = .21), underlining the importance of stable attention control and precise sensorimotor execution under real working conditions.

As discussed above, personality traits complement cognitive performance measures insofar as they are not prerequisites for safety behavior but dispositionally influence the likelihood of intentional violations of safety standards or rules. Findings on general occupational safety show that personality traits such as emotional stability ($r = .15$), conscientiousness ($r = .22$), internal locus of control ($r = .20$), and low risk-taking ($r = .16$) are consistently associated with workplace accidents and injuries (Christian et al., 2009). This aligns with findings on driving-related personality, which show associations in on-road driving tests of professional drivers for sense of responsibility (Pearson $r = .29$) and self-control ($r = .17$). These personality traits are therefore understood as distal individual influencing factors that may provide complementary indications of safety-relevant behavior when operating vehicles in occupational contexts.

Therefore, the Test Solution “Mining Vehicle Operators” consists of the following tests:

- Reactive stress tolerance (DT)
- Ability to react (motor speed) (RT)
- Ability to concentrate (TACO)
- Obtaining an overview (ATAVT-2): right-hand or left-hand traffic
- Eye-hand coordination (2HAND)
- Optional: Driving-related personality (IVPE-R): mental stability, sense of responsibility, self-control, and risk avoidance

The table below provides a complete overview of the specific weightings of the individual tests used to calculate the overall score for the Test Solution “Mining Vehicle Operators”.

> Please note that the dimension *reaction speed* is measured by the test RT and is displayed in the result table and profile but does not contribute to the overall score. Depending on the precise requirements of the job it can be considered as an additional information when interpreting the results.

Further information on the calculation and interpretation of testing results can be found on the page: Notes on evaluation and interpretation.

Mining Vehicle Operators	Weighting standard form	Weighting form with personality
Cognitive ability	**100**	**85**
Ability to react (motor speed)	10	8
Reactive stress tolerance	29	25
Ability to concentrate	13	12
Obtaining an overview	25	21
Eye-hand coordination	23	19
Personality	**0**	**15**
Mental stability	-	3
Risk avoidance	-	3
Self-control	-	4
Sense of responsibility	-	5

The total test duration of the Test Solution “Mining Vehicle Operators” is approximately 45 minutes and is reduced to 33 minutes if personality assessment is omitted. In addition, two variants are available for right-hand and left-hand traffic due to the traffic scenes shown in ATAVT-2.

5.4.2.2 Mining Machine Operators

Mining Machine Operators operate various heavy machines, including rock drilling machines, scraper and drum winches, loading machines, and many others. The activities are often characterized by repetitive, methodical operating actions over extended periods. Safety-critical situations arise particularly in cases of loss of concentration, faulty coordination, or delayed reactions to unexpected events. Work usually takes place in spatially confined areas under high environmental strain from noise, vibrations, and distractions. The focus is therefore on stable and controlled machine operation under strain. These requirements highlight the importance of maintaining attention and readiness to react even under monotonous or demanding conditions.

For Mining Machine Operators, empirical evidence also shows that reactive stress tolerance is the central cognitive predictor of safety-relevant behavior (Vorster et al., 2011; Aguilera-Vanderheyden, 2013). In the present sample ($n = 341$), a significant relationship was found between reactive stress tolerance and the total number of injuries (Spearman $\rho = .17$). Motor reaction speed is additionally relevant because it enables timely execution of safety-relevant actions, with a similar association observed in the sample ($\rho = .17$). Operating complex machinery under spatially restricted and sensorily demanding conditions also requires obtaining an overview in order to reliably detect relevant cues, warning signals, or movements in the work environment. Although mining-specific findings are currently lacking, studies from the construction industry show that working memory load significantly affects the detection of safety-relevant stimuli (Liko et al., 2020). Another key requirement is the ability to concentrate, as attention must be maintained over longer periods and omission errors in repetitive tasks must be avoided; here too, a relationship with safety-relevant criteria was found in the present sample ($\rho = .17$). These findings align with results from vigilance and fatigue research identifying attention and concentration performance as central mediators between workload and error proneness (Bauerle et al., 2018; Techera et al., 2016).

Personality traits may also provide additional indications of safety-relevant behavior: a meta-analysis on occupational safety found consistent relationships of conscientiousness ($\rho = .26$) and emotional stability ($\rho = .19$) with accident and injury rates, whereas extraversion showed clearly lower relevance (Christian et al., 2009).

Therefore, the Test Solution “Mining Machine Operators” consists of the following tests:

- Reactive stress tolerance (DT)
- Ability to react – motor time (RT)
- Obtaining an overview / Visual attention (ATAVT-2)
- Ability to concentrate (TACO)
- Optional: Big Five personality (FCB5): conscientiousness and emotional stability

The table below provides a complete overview of the specific weightings of the individual tests used to calculate the overall score for the Test Solution “Mining Machine Operators”.

> Please note that the dimension *reaction speed* is measured by the test RT and is displayed in the result table and profile but does not contribute to the overall score. Depending on the precise requirements of the job it can be considered as an additional information when interpreting the results.

Further information on the calculation and interpretation of testing results can be found on the page: Notes on evaluation and interpretation.

Mining Machine Operators	Weighting standard form	Weighting form with personality
Cognitive ability	**100**	**84**
Ability to react (motor speed)	25	21
Reactive stress tolerance	25	21
Ability to concentrate	25	21
Obtaining an overview	25	21
Personality	**0**	**16**
Conscientiousness	-	8
Emotional stability	-	6
Extraversion	-	2
Agreeableness	-	-
Openness	-	-

The Test Solution “Mining Machine Operators” has a total duration of approximately 40 minutes, or 28 minutes without personality assessment.

5.4.2.3 Mining Technicians

Mining Technicians frequently work in collaboration with engineers in the planning, monitoring, maintenance, and analysis of technical systems (cf. MQA, 2018). Their work is less characterized by continuous control or routine tasks and more by technical problem solving, diagnosis, and decision-making in electrical and mechanical domains, for example in the repair and maintenance of complex equipment and machinery. Errors often have indirect effects but may involve considerable hazard and damage potential for people, equipment, and the environment.

According to the findings discussed above, the basic cognitive prerequisites for operational safety are primarily reactive stress tolerance and ability to concentrate (cf. Vorster et al., 2011; Aguilera-Vanderheyden, 2013; Bauerle et al., 2018). Eye-hand coordination additionally reflects the technical dexterity described in the requirement profile, which is necessary for precise interventions, adjustments, and maintenance work. Furthermore, the literature shows that higher cognitive abilities are associated with occupational and training success, including mechanical-technical comprehension, spatial visualization ability, and logical reasoning (cf. Nye et al., 2022; Berkowitz & Stern, 2018). Personality traits can optionally provide additional indications of safety-relevant behavior, particularly emotional stability and conscientiousness (cf. Christian et al., 2009), which are also consistently linked to occupational success beyond accident prevention (He et al., 2019).

Therefore, the Test Solution “Mining Technicians” consists of the following tests:

- Reactive stress tolerance (DT)
- Eye-hand coordination (2HAND)
- Logical reasoning (INT)
- Spatial visualization ability (INT)
- Mechanical-technical comprehension (MECH)
- Ability to concentrate (TACO)

- Optional: Big Five personality (FCB5): Conscientiousness and Emotional stability

The table below provides a complete overview of the specific weightings of the individual tests used to calculate the overall score for the Test Solution “Mining Technicians”. Due to the lack of specific empirical validation data from the mining industry, the described cognitive performance measures are weighted equally in the calculation of the overall score. Further information on the calculation and interpretation of testing results can be found on the page: Notes on evaluation and interpretation.

Mining Technicians	Weighting standard form	Weighting form with personality
Cognitive ability	**100**	**84**
Reactive stress tolerance	17	14
Ability to concentrate	17	14
Eye-hand coordination	17	14
Logical reasoning	16	14
Spatial visualization ability	16	14
Mechanical-technical comprehension	17	14
Personality	**0**	**16**
Conscientiousness	-	8
Emotional stability	-	6
Extraversion	-	2
Agreeableness	-	-
Openness	-	-

Due to the extended cognitive requirements, the total test duration is approximately 69 minutes, reduced to 57 minutes without personality assessment.

5.4.3 Concept

With the aim of creating a platform that provides scientifically sound answers to as many different career and training-related questions as possible, the following approach was designed:

5.4.3.1 Requirements analysis

The data from SFS Test Solutions on over 1,700 job titles in German-speaking and American regions comes from two different sources. Based on the AMS job register (AMS Berufslexikon – Berufe von A-Z, n.d. (website in German only)), an attempt was made to approximate the occupations and job titles in the DACH region. The occupational register comprises a total of 1,733 occupations and is continuously maintained by the AMS. The AMS (Arbeitsmarktservice) is a service provider on the Austrian labor market. It fulfills the functions of a public employment service and places workers in vacant positions and supports the initiative of job seekers and companies as employers through advice, information, training, and financial support.

Data from the O*NET platform (O*NET OnLine, n.d.) was also used to represent US occupations and job titles. The O*NET program is the most important source of occupational information in the US. At its core is the O*NET database, which contains hundreds of standardized and occupation-specific descriptions for nearly 1,000 occupations across the US economy. The database, which is freely available to the public, is continuously updated based on a broad spectrum of employees in each occupation. The data is collected in a two-step process. In the first step, a random statistical sample of companies that are likely to employ people in the target occupations is determined. A random sample of employees within these companies is then selected. The information is then collected using standardized questionnaires.

The final data pool was supplemented with SCHUHFRIED's own validation studies. For example, one study has already shown that computer-based test batteries have high criterion validity when it comes to predicting safe driving behavior among professional bus drivers (Vetter et al., 2018). The analysis of data on aptitude testing for African mine workers also demonstrated criterion validity (SCHUHFRIED, 2013).

5.4.3.2 Comparison of requirements x tests

The data was prepared in a matrix (job titles x requirements). O*Net provides information on 231 different requirements. These include skills such as cognitive abilities (visual-spatial ability, selective attention, logical reasoning, etc.) or psychomotor skills (dexterity, eye-hand coordination, etc.), as well as social or technical competencies. Data on work values and work contexts is also available (e.g., how much time must be spent sitting/kneeling on average? Are you exposed to workplace hazards such as radiation or diseases?).

This extensive list was compared with the SCHUHFRIED Selection. Currently, 61 requirements can be covered with tests from the SCHUHFRIED Selection. In this table, the requirements are sorted alphabetically and paired with the appropriate SCHUHFRIED tests that measure the respective requirement. Due to the strong differentiation by O*Net, similar requirements are covered by the same (sub)test in SFS Test Solutions.

O*Net requirement	Description	SCHUHFRIED test
Analytical thinking	The activity requires the analysis of information and the application of logic to solve work-related issues and problems.	**INT – Logical reasoning**
Attention to Detail	The activity requires attention to detail and thoroughness in completing work tasks.	**FCB5 – Conscientiousness**
Categorical Flexibility	Describes the ability to create or use different sets of rules for combining or grouping things in different ways.	**INT – Logical reasoning**
Complex problem-solving ability	Describes the ability to identify complex problems and examine related information to develop and evaluate options and implement solutions.	**INT – Logical reasoning**
Concern for Others	The job requires being sensitive to the needs and feelings of others and being understanding and helpful in one's work.	**FCB5 – Agreeableness**
Cooperation	The activity requires pleasant interaction with others and a good-natured, cooperative attitude.	**FCB5 – Agreeableness**
Critical thinking	Describes the ability to apply logic and reasoning to determine the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.	**INT – Logical reasoning**

O*Net requirement	Description	SCHUHFRIED test
Deductive reasoning	Describes the ability to apply general rules to specific problems to find meaningful answers.	**INT – Logical reasoning**
Depth Perception	Describes the ability to judge which of several objects is closer or farther away, as well as being able to judge the distance between oneself and an object.	**INT – Visual-spatial ability**
Flexibility	The activity requires openness to change (positive and negative) and to great variety in the workplace.	**FCB5 – Openness**
Independence	The job requires developing your own methods, managing yourself with little or no supervision, and relying on yourself to get things done.	**FCB5 – Conscientiousness**
Inductive reasoning	Describes the ability to combine information and derive general rules or conclusions from it (for example, to establish a relationship between seemingly unrelated events)	**INT – Logical reasoning**
Initiative	The activity requires a willingness to take responsibility and accept challenges.	**FCB5 - Conscientiousness**
Innovation	The activity requires creativity and alternative thinking to develop new ideas and solutions to work-related problems.	**FCB5 – Openness**
Instructing	The activity requires teaching others how to do things.	**FCB5 – Conscientiousness**
Integrity	The job requires honesty and ethical behavior.	**FCB5 - Conscientiousness**
Judgment and decision-making ability	Describes the ability to weigh the relative costs and benefits of potential actions in order to choose the most appropriate one.	**FCB5 – Conscientiousness**
Leadership Ability	The activity requires a willingness to lead, take responsibility, and give opinion and direction.	**FCB5 – Extraversion**
Learning Strategies	Describes the selection and use of situationally appropriate teaching and learning methods and procedures when learning or learning new things.	**INT – Logical reasoning**
Management of Financial Resources	Includes determining how much money to spend to accomplish work and accounting for this spending.	**FCB5 – Conscientiousness**
Management of Human Resources	Includes motivating, developing, and directing employees on the job and identifying the best employees for the job.	**FCB5 – Conscientiousness**
Management of Material Resources	Includes the acquisition and proper use of equipment, facilities, and materials required to perform specific work.	**FCB5 – Conscientiousness**
Mathematical Reasoning Ability	Describes the ability to choose the correct mathematical methods or formulas to solve a problem	**INT – Numerical ability**

O*Net requirement	Description	SCHUHFRIED test
Mathematics	Describes the ability to use mathematics to solve problems.	**INT – Numerical ability**
Memorization	Describes the ability to memorize information such as words, numbers, pictures, and procedures.	**INT - Long-term memory**
Monitoring	Describes the ability to monitor/assess own performance, the performance of others, or organizations to make improvements or take corrective action.	**FCB5 – Conscientiousness**
Multi-unit Coordination	Describes the ability to coordinate two or more limbs (for example, two arms, two legs, or one leg and one arm) while sitting, standing, or lying down.	**2HAND**
Negotiating Skills	Describes the ability to bring others together and try to reconcile differences.	**FCB5 – Agreeableness**
Numerical ability	Describes the ability to add, subtract, multiply, or divide quickly and correctly.	**INT – Numerical ability**
Operation and Control	Describes controlling the operation of equipment or systems.	**DT**
Operational Analysis	Describes the analysis of needs and product requirements to produce a design.	**INT – Logical reasoning**
Operational Monitoring	Describes the observation of gauges, dials, or other indicators to ensure that a machine is operating properly.	**VIGIL**
Oral Language Comprehension	Describes the ability to hear and understand information and ideas presented in spoken words and sentences.	**INT – Verbal ability**
Organizing Information	Describes the ability to arrange things or actions in a specific order or pattern according to a specific rule or set of rules (for example, patterns of numbers, letters, words, pictures, mathematical operations).	**INT – Logical reasoning**
Originality	Describes the ability to come up with unusual or clever ideas about a particular topic or situation or to find creative ways to solve a problem.	**FCB5 – Openness**
Pattern Recognition	Describes the ability to identify or recognize a familiar pattern (a figure, object, word, or sound) hidden in other distracting material.	**TACO**
Perceptual Skills	Describes the ability to quickly grasp, combine, and organize information into meaningful patterns.	**INT – Logical reasoning**
Perceptual Speed	Describes the ability to quickly and accurately compare similarities and differences among groups of letters, numbers, objects, pictures, or patterns. The items being compared may be presented simultaneously or sequentially. This ability also includes comparing a presented object with a remembered object.	**TACO**

O*Net requirement	Description	SCHUHFRIED test
Performance Orientation	The activity requires setting and maintaining personally challenging performance goals and striving to accomplish tasks.	**FCB5 – Conscientiousness**
Persistence	The activity requires persistence in the face of obstacles.	**FCB5 – Conscientiousness**
Persuasion	Describes the ability to persuade others to change their mind or behavior.	**FCB5 – Extraversion**
Precision Control	Describes the ability to quickly and repeatedly move the controls of a machine or vehicle into precise positions.	**2HAND**
Problem-based Learning	Describes understanding the impact of new information on current and future problem-solving and decision-making.	**INT – Logical reasoning**
Quality Control Analysis	Activity requires performing tests and inspection of products, services, or processes to evaluate quality or performance.	**FCB5 – Conscientiousness**
Reaction Speed	Describes the ability to respond quickly (with hand, finger, or foot) to a signal (sound, light, image) when it appears.	**RT**
Reading Competency	Describes the ability to understand written sentences in work-related documents.	**INT – Verbal ability**
Reliability	The job requires reliability, a sense of responsibility and dependability, and the fulfillment of obligations.	**FCB5 – Conscientiousness**
Response Orientation	Describes the ability to quickly choose between two or more different movements in response to two or more different signals (lights, sounds, pictures). This includes the speed with which the correct response is initiated with the hand, foot, or other body part.	**DT**
Selective Attention	Describes the ability to concentrate on a task over a period of time without being distracted.	**TACO**
Self-control	The job requires one to maintain composure, keep emotions in check, control anger, and avoid aggressive behavior even in difficult situations.	**FCB5 – Conscientiousness**
Service Orientation	The activity requires actively looking for ways to help people.	**FCB5 – Agreeableness**
Social Orientation	The activity requires preferring to work with others rather than alone.	**FCB5 – Extraversion**
Social Perception	Describes the ability to be aware of the reaction of others and to understand why they react the way they do.	**FCB5 – Openness**
Spatial Orientation	Describes the ability to know one's location in relation to the environment or where other objects are in relation to oneself.	**INT – Visual-spatial ability**

O*Net requirement	Description	SCHUHFRIED test
Speed of Limb Movement	Describes the ability to move arms and legs quickly.	**RT**
Stress Tolerance	The activity requires accepting criticism and being able to handle stressful situations calmly and effectively.	**FCB5 – Emotional stability**
System Evaluation	The activity requires identifying measures or indicators of system performance and actions needed to improve or correct performance relative to system goals.	**FCB5 – Conscientiousness**
Troubleshooting	The activity requires identifying causes of operator errors and deciding what to do about them.	**INT - logical reasoning**
Time Sharing	The ability to shift back and forth between two or more activities or sources of information.	**M-TASK**
Visualization	Describes the ability to imagine how something will look after it is moved or its parts are moved or rearranged.	**INT – Visual-spatial ability**
Written Comprehension	Describes the ability to read and understand information and ideas presented in writing.	**INT – Verbal ability**

5.4.3.3 Creation of the test batteries

In the first step, the AMS and O*Net designations were paired with each other. The job descriptions and requirement profiles on the websites were used as a basis for this. From more than 1700 job titles, 631 clusters were then created. For example, 15 different designations for retail salespersons (retail salesperson – focus on interior design consulting, retail salesperson – focus on food retail, etc.) were combined into a cluster called *retail salesperson*. In principle, an effort was made to limit the clusters to those that were practically meaningful. Preliminary, data-based requirement profiles and, subsequently, test batteries were then created. O*Net assigns a value between 0 and 1 for all requirements per occupation. This value is intended to indicate how important this requirement is for the occupation. For the requirement profiles, all requirements with a value in the 60th percentile were taken into account.

The automatically generated profiles and batteries were then reviewed and adjusted in several feedback rounds by DIN 33430-certified occupational, organizational, and business psychologists. In addition, the results were compared with empirical evidence and existing validation studies and adapted where necessary.

5.5 Education

The application area “Education” provides test solutions for use in career counselling.

5.5.1 Career Counseling

The Test Solution “Career Counseling” is designed to assess key psychological characteristics that are relevant for successful professional development and well-founded career decisions. The Test Solution is based on a broad empirical foundation of meta-analyses, longitudinal studies, and vocational psychological theories and includes the core areas of vocational interests, cognitive abilities, and personality traits.

Vocational interests represent a central pillar in career guidance. They are a significant predictor of occupational and academic satisfaction and performance. Sackett et al. (2021), in a revision of the findings by Schmidt and Hunter (1998), showed that the relative relevance of interests with regard to occupational success is higher than originally assumed compared with other procedures (see Evaluation). A well-known model regarding the importance of vocational interests is Holland's RIASEC model (1985). Meta-analyses have shown that small to moderate relationships exist between RIASEC interest congruence and academic and occupational performance (Nye et al., 2012; Nye et al., 2017) as well as job satisfaction (Hoff et al., 2020). Positive correlations between interest congruence and satisfaction with the chosen field of study have also already been demonstrated (Bai & Liao, 2019). In a recent meta-analysis, De Vries et al. (2024) found significant relationships between academic success, persistence and satisfaction and the congruence between person and field of study, whereby a number of additional personal characteristics as well as the type of measurement proved relevant, with the former showing significance only within the context of a sensitivity analysis. Differentiated relationships between individual RIASEC factors and job-related competencies have been demonstrated in the military context (Van Iddekinge et al., 2011). Assessing the individual interest profile therefore makes it possible to identify educational and career paths that match the personal interests of the counseled person as closely as possible, and to align career guidance accordingly.

To enable a differentiated consideration of individual learning prerequisites and occupational strengths, it is also informative to take a person's cognitive abilities into account. In the context of career and educational counseling, the assessment of cognitive abilities is not primarily intended to assign people to specific educational paths, but rather serves as an orientation aid that supports people in independently choosing career paths in which they can optimally use their cognitive resources. Numerous studies show that cognitive abilities are central predictors of performance and learning success in education and work (Roth et al., 2015; Deary et al., 2007; Peng & Kievit, 2019; Schmidt & Hunter, 1998; Sackett et al., 2021; Hambrick et al., 2024). Logical reasoning correlates particularly strongly with examination and graduation grades in these studies, while numerical ability reliably predicts academic success in STEM subjects, and verbal ability predicts grades in humanities and social sciences (Roth et al., 2015; Peng & Kievit, 2019). A meta-analysis by Diedrich et al. (2018) showed that verbal, numerical and spatial-figural intelligence together with conscientiousness explain up to 37% of the variance in vocational school graduation grades. In addition to general cognitive abilities, more specific performance areas such as ability to concentrate, long-term memory and, especially in technical and design contexts, spatial visualization ability play an important role. For technical and scientific performance and corresponding occupational success, spatial visualization ability is a central predictor and shows incremental validity beyond verbal and numerical abilities (Berkowitz & Stern, 2018; National Research Council [NRC], 2015; Lubinski, 2010; Uttal & Cohen, 2012; Shea et al., 2001; Webb et al., 2007). For success in mathematics and physics, general intelligence, numerical ability and verbal ability proved predictive (Berkowitz & Stern, 2018). For selection and training in mechanical occupations as well as success in practical-technical further training, mechanical-technical comprehension represents a central predictor (McDaniels & Reynolds, 1955; Mayberry & Carey, 1997).

Although the predictive validity of personality traits is lower than that of cognitive abilities (Zisman & Ganzach, 2022), they are nevertheless important for occupational fit, performance and satisfaction. A meta-analysis by Mammadov (2022) shows that conscientiousness in particular, controlled for intelligence, is a consistent predictor of academic performance, followed by openness to experience and agreeableness. Overall, conscientiousness emerges as a central driver of academic performance, openness is essential for intellectual curiosity and research success, and emotional stability, extraversion and agreeableness each make specific but smaller contributions (Mammadov, 2022; Wang et al., 2023). Meta-analyses and longitudinal studies on vocational training also confirm that conscientiousness is a significant personality predictor (Diedrich et al., 2018; Nießen et al., 2020; Schmidt & Hunter, 1998). The analysis of these characteristics can provide guidance toward career paths in which individuals can particularly develop their personality, while also making development potential visible.

Based on these findings, and to obtain the most comprehensive possible assessment of individual interests, strengths and personality structure, the Test Solution “Career Counseling” includes the following areas and dimensions:

- **Cognitive Abilities**: Logical reasoning (INT), Numerical ability (INT), Verbal ability (INT), Spatial visualization ability (INT), Long-term memory (INT), Ability to concentrate (TACO), Mechanical-technical comprehension (MECH)
- **Personality**: Openness, Conscientiousness, Extraversion, Agreeableness and Emotional stability (FCB5)
- **Interests**: Realistic interests, Investigative interests, Artistic interests, Social interests, Entrepreneurial interests and Conventional interests (PRIO)

The integration of these three areas enables a comprehensive assessment of individual potentials and interests. The report first presents the RIASEC interest type as well as an overview of the interest profile and its level of differentiation, enabling a quick assessment of potentially suitable occupational areas. In addition, a result table provides a systematic overview of strengths and development areas based on raw scores and percentile ranks, average to above-average performance is marked in green (≥ PR25), slightly below average in yellow (≥ PR16), and clearly below average in red (< PR16). For more detailed results, the individual test results can be consulted. In German-language reports, the PRIO results additionally provide concrete recommendations for suitable occupational areas and professional activities. The Test Solution “Career Counseling” therefore supports the identification of career perspectives that harmonize with individual interests, cognitive strengths and personality traits. It provides a well-founded basis for differentiated, practice-oriented career decisions aimed at long-term occupational satisfaction, sustainable development and realistic chances of success. In addition, the SFS Test Solutions offer a wide range of occupation-specific test combinations to assess the fit between a person and a specific occupational profile. The test duration is approximately 76 minutes.

5.5.2 Academic Aptitude

The Test Solutions “Academic Aptitude” and “Academic Aptitude - Form for technical studies” provide test batteries that can be used to examine a person's psychological prerequisites for academic success. The test battery for assessing academic aptitude is available in a standard form and in an extended form for technical fields of study and is based on a broad empirical basis for predicting academic success. The corresponding predictors include cognitive abilities as well as personality traits and professional interests, with the selection of specific dimensions based on robust empirical findings from large-scale meta-analyses and longitudinal studies on the prediction of school and academic performance. In general, cognitive abilities consistently prove to be the strongest single predictors of academic performance. A comprehensive meta-analysis by Roth et al. (2015), which evaluated 240 samples from 33 countries with a total sample size of $N = 105{,}158$, documents a corrected population correlation of $\rho = .54$ between performance on various standardized cognitive achievement tests and school grades. In a longitudinal study of over 70,000 English children, Deary et al. (2007) demonstrate a correlation of $r = .81$ between general intelligence (psychometric g) at age 11 and various academic achievements at age 16. Peng et al. (2019) confirm in their meta-analysis that general intelligence explains an average of $r^2 = .54$ of the variance in academic performance. In these studies, logical-deductive thinking correlates particularly strongly with exam and final grades, numerical abilities reliably predict academic success in STEM subjects, and verbal abilities influence grades in humanities and social science subjects (Roth et al., 2015; Peng et al., 2019). According to Gallen et al. (2023), the ability to concentrate is a significant predictor of academic and subject-specific performance, while long-term memory performance is linked to the ability to store and apply complex concepts in a sustainable manner (Zainuddin et al., 2024). For technical fields of study, spatial reasoning was also included, as this ability explains additional variance in engineering grades alongside verbal and numerical intelligence (Berkowitz & Stern, 2018). A number of research findings show that spatial reasoning is a key predictor of success in STEM careers and education (National Research Council [NRC], 2015; Lubinski, 2010; Uttal & Cohen, 2012), and even provides incremental predictive validity for professional and academic success beyond the assessment of quantitative and verbal abilities (Berkowitz & Stern, 2018; Shea et al., 2001; Webb et al., 2007).

For personality domains, Mammadov's (2022) meta-analysis of 67 samples ($N = 55{,}260$) confirms moderate incremental validity of the Big Five dimensions for college performance: Controlling for cognitive abilities, conscientiousness emerges as the strongest predictor of academic performance ($\rho = .27$), followed by openness to experience ($\rho = .16$) and agreeableness ($\rho = .09$), while emotional stability and extraversion show negligible effects (ρ between .01 and .02). Rani Bhattacharjee & Ramkumar (2025) also show in a single sample of 384 students that conscientiousness is the strongest personality predictor of grade point average ($\beta = .42$, $p < .001$), followed by openness ($\beta = .28$, $p < .01$) and emotional stability ($\beta = .19$, $p < .05$). Overall, conscientiousness emerges as a key driver of academic performance, openness is essential for intellectual curiosity and research success, and emotional stability, extraversion, and agreeableness each make specific but smaller contributions (Mammadov, 2022; Wang et al., 2023). Empirical evidence also shows that the predictive power of personality traits is significantly lower overall than that of cognitive abilities: while intelligence explains an average of 22.9% ($R^2 = .229$) of the variance in academic performance (GPA), personality traits only account for 2.4% ($R^2 = .024$) (Zisman & Ganzach, 2022).

Based on these results, the Test Solution “Academic Aptitude” covers the following dimensions:

- Cognitive abilities: Logical reasoning (INT), numerical ability (INT), verbal ability (INT), visual-spatial ability (INT; only for technical fields of study), long-term memory (INT), ability to concentrate (TACO), mechanical-technical comprehension (MECH; only for technical fields of study)
- Personality: Openness, Conscientiousness, Extraversion, Agreeableness, and Emotional Stability (FCB5)
- Interests: Practical-technical interests, intellectual-research interests, artistic-linguistic interests, social interests, entrepreneurial interests, and organizational-administrative interests (PRIO)

The dimensions for the Test Solution “Academic Aptitude” were selected on the basis of extensive research into predictors of school and academic success, which shows that the combination of cognitive abilities and Big Five personality traits has substantial predictive power. A standard form and a form for technical fields of study, with the additional dimensions of visual-spatial ability and mechanical-technical comprehension, are available for aptitude testing of students. The standard form takes about 82 minutes to complete, while the form for technical fields of study takes about 102 minutes.

5.5.3 Apprentices

The SFS Test Solutions “Apprentices” and “Apprentices - Form for technical Jobs” are test batteries that can be used to evaluate the psychological prerequisites of applicants in various skilled occupations. The test battery for trainees and apprentices is available in a standard form (“Apprentices”) and also as an extended form for technical professions

("Apprentices - Form for technical jobs") and is based on comprehensive empirical evidence on the predictive validity of cognitive abilities, professional interests, and personality traits for training success. The selection of specific dimensions is based on empirical findings that have specifically examined the prediction of training success. A meta-analysis by Diedrich, Neubauer, and Ortner (2018) with 648 trainees from five industries (including skilled trades, technology, and services) shows that verbal, numerical, and spatial-figurative intelligence, as well as conscientiousness, each contribute significantly to predicting grade point averages in vocational schools and together explain up to 37% of the variance in final grades. General cognitive ability and conscientiousness in particular prove to be strong predictors (Diedrich et al., 2018). A longitudinal study in the German National Education Panel (NEPS; n = 4,137) confirms that conscientiousness, beyond cognitive abilities, plays a consistent role in the successful transition to dual training and predicts all seven transition indicators examined (including start of training, dropout, final grade, satisfaction) (Nießen et a., 2020). Similar robust effects are shown in the meta-analysis by Schmidt and Hunter (1998), which documents a mean adjusted validity of .54 for cognitive tests and .31 for conscientiousness in vocational training. Furthermore, recent findings by Hambrick, Burgoyne, and Oswald (2024) suggest that cognitive abilities remain stable predictors of performance indicators throughout practical training, regardless of experience. For technical apprenticeships, the cognitive requirements profile is expanded to include visual-spatial ability and mechanical-technical comprehension. Spatial awareness proves to be a significant predictor of success in technical courses of study and professions, as it enables mental manipulation of three-dimensional objects and understanding of technical drawings. Mechanical-technical understanding is fundamental to understanding functional principles, laws, and technical relationships and proves to be a relevant predictor for the selection and training of individuals in mechanical professions, as well as for the successful completion of practical-technical further training (McDaniels & Reynold, 1955; Mayberry & Carey, 1997; SCHUHFRIED, 2019). Practical-technical interests (RIASEC dimension R) also increase the fit with the , especially in manual and technical occupations (Diedrich et al., 2018), while other interest dimensions complement the range of occupational aptitudes.

Based on these findings, the SFS Test Solution Apprentice Test measures the following dimensions:

- Cognitive abilities: Logical reasoning (INT), numerical ability (INT), verbal ability (INT), visual-spatial ability (INT; only for technical occupations), long-term memory (INT), ability to concentrate (TACO), mechanical-technical comprehension (MECH; only for technical occupations)
- Personality: Openness, Conscientiousness, Extraversion, Agreeableness, and Emotional Stability (FCB5)
- Interests: Practical-technical interests, intellectual-research interests, artistic-linguistic interests, social interests, entrepreneurial interests, and organizational-administrative interests (PRIO)

These domains were selected on the basis of meta-analytical findings showing that the combination of cognitive abilities, professional interests, and personality traits achieves the highest predictive validity for job-related training success. A standard form and a form for technical professions, with the additional dimensions of visual-spatial ability and mechanical-technical comprehension, are available for aptitude testing of apprentices and trainees. The standard form takes about 62 minutes to complete, while the form for technical professions takes about 76 minutes.

5.6 Security

The application area “Security” provides test solutions for use in aptitude assessment and personnel selection for security forces (police and military).

5.6.1 Police

5.6.1.1 Police Officers

The police play a central societal role, which makes the selection of suitable candidates particularly important. Incorrect decisions in the selection process are associated with high individual, organizational, and societal costs. Accordingly, the assessment of physical and psychological aptitude is common internationally and legally required in many countries. In particular, the use of psychometric testing procedures in addition to interviews has a long tradition, especially in the USA.

As early as 2004, an influential US meta-analysis was published that examined the extent to which cognitive abilities and personality traits predict training performance, job performance, and duty-related problems in the police context (Aamodt, 2004). This meta-analysis was updated several times in subsequent years and is now part of the standard reference work *Police Psychology* (Aamodt & Brewster, 2022). The authors summarize the findings by stating that police officers with higher cognitive ability show better performance in training (r = ,34), receive higher supervisor performance ratings on duty (r = ,15), show higher activity levels, for example measured by arrests or reports (r = ,19), and are less likely to leave service (r = −,09). Formal education level also predicts job performance, but is generally not considered in police assessment for legal and ethical reasons. In contrast, interviews show comparatively low validity and only weak relationships with both training performance and duty-related performance ratings (Aamodt & Brewster, 2022).

Which specific intelligence dimensions are particularly relevant in the police context has not yet been investigated by meta-analyses or individual studies with sufficiently large samples. In line with the broad requirements profile of police work, the test batteries used by police organizations in the DACH region (Austria, Germany, Switzerland) and internationally include a wide spectrum of cognitive ability areas. In addition to general cognitive ability, logical reasoning, memory performance, verbal and numerical abilities, spatial visualization ability, as well as reading and spelling skills are typically assessed.

With regard to personality traits, overall small but consistent relationships with police performance are found. The uncorrected correlations between the Big Five dimensions and police performance reported in the standard reference work *Police Psychology* showed that openness is mainly relevant for training success, and agreeableness has small effects on job performance after training, while conscientiousness and emotional stability are consistently associated with success criteria in police work (Aamodt & Brewster, 2022); this is also confirmed in a further meta-analysis by Wilmot and Ones (2021).

	Training performance	**Job performance**	**Job performance**	**Duty-related problems**
Source	Aamodt & Brewster, 2022	Aamodt & Brewster, 2022	Wilmot & Ones, 2021	Aamodt & Brewster, 2022
Openness	,09*	,04*	,04*	−,03
Conscientiousness	,09*	,09*	,15*	−,06*
Extraversion	,08*	,05*	,07*	,00

	Training performance	Job performance	Job performance	Duty-related problems
Agreeableness	,02	,05*	,06*	−,04*
Emotional stability	,04*	,07*	,09*	−,08*

*Note: $p < ,05$

In addition to these classic cognitive and personality-related requirements, the safe handling of complex dynamic situations is of particular importance in police work. A study on (simulated) emergency driving showed that the ability to direct attention to currently relevant aspects of a situation and to ignore irrelevant aspects is crucial for lane keeping and accident prevention during emergency driving (Zahabi et al., 2021). This ability corresponds to attentional control within the CHC model (Schneider & McGrew, 2018), which is considered a central predictor of driving safety within the framework of working memory (cf. Zhang et al., 2023). Obtaining an overview - traffic is a special case of this attentional control and describes the ability to quickly identify relevant stimuli in a situation. Obtaining an overview - traffic predicted performance in a hazard course in a group of N = 161 professional drivers (r = ,25; Vetter et al., 2018).

In summary, cognitive ability, selected personality traits, and obtaining an overview - traffic represent central abilities for police training and occupational success.

The Test Solution “Police Officers” therefore includes the following dimensions:

- Logical reasoning (INT)
- Long-term memory (INT)
- Spatial visualization ability (INT)
- Verbal ability (INT)
- Numerical ability (INT)
- Obtaining an overview - traffic (ATAVT-2)
- Personality: Emotional stability, Conscientiousness, Openness, Agreeableness, Extraversion (FCB5)

The table below provides a complete overview of the specific weightings of the individual tests used to calculate the overall score for the Test Solution “Police Officers”. The relative weighting of specific cognitive abilities in this Test Solution was determined on the basis of their respective loading on g (SCHUHFRIED, 2025b). Further information on the calculation and interpretation of the result of a testing can be found on the page: Notes on evaluation and interpretation.

Police Officers	Weighting
Cognitive abilities	**85**
Logical reasoning	17
Long-term memory	11
Spatial visualization ability	12
Numerical ability	15
Verbal ability	14
Obtaining an overview (left-hand / right-hand traffic)	16

Police Officers	Weighting
Personality	**15**
Conscientiousness	4
Emotional stability	4
Extraversion	2
Agreeableness	2
Openness	3

If additional country-specific requirements for reading or spelling skills exist, tests such as the ELST (English Language Skills Test) or the WRST (Vienna Spelling Test) can additionally be used. Finally, it should be noted that the Test Solution "Police Officers" is available for both right-hand and left-hand traffic. The total duration of the Test Solution "Police Officers" is 84 minutes.

5.6.1.2 Police Special Forces

Beyond regular police service, special forces exist in many countries, such as SWAT (USA), SEK (Germany), EKO Cobra (Austria), or cantonal special forces in Switzerland. These are generally recruited from existing police personnel, although the requirements of their activities go beyond normal police work. However, a requirements analysis of different police occupational roles, including patrol police and special forces (SWAT), showed that the cognitive basic requirements in Swedish and US patrol and special police units are assessed as largely similar by a representative sample of active police officers (Tedeholm & Bäckström, 2025). In the personality domain, emotional stability in particular gains importance in special operations compared to regular police service (Garbarino et al., 2012).

Due to the deployment of special forces in highly demanding scenarios such as anti-terror operations or hostage situations, the ability to react quickly and correctly under stress appears to be particularly important (Dominski et al., 2018). This is also reflected in a requirements analysis of Swiss police special forces, which identified decision-making competence under time pressure and stress tolerance as central competencies (Muhly & Dössegger, 2025). The literature describes close relationships between shoot/don't-shoot paradigms and executive control processes, especially inhibitory control. A systematic review showed that executive function training programs, for example for controlling gaze behavior, attention, and decision-making under time and stress pressure, can be transferred to police-relevant action situations (cf. Spiegel & Sutter, 2025).

The Test Solution "Police Special Forces" therefore additionally assesses the following dimensions:

- Reactive stress tolerance, incorrect reactions (DT)
- Reaction speed, motor speed (RT)

The table below provides a complete overview of the specific weightings of the individual tests used to calculate the overall score for the Test Solution "Police Special Forces". The additional tests in the Test Solution "Police Special Forces" were aligned as far as possible with the cited literature findings and otherwise weighted equally due to the lack of solid empirical evidence. Further information on the calculation and interpretation of the result of a testing can be found on the page: Notes on evaluation and interpretation.

Police Special Forces	Weighting
Cognitive abilities	**85**
Logical reasoning	13
Long-term memory	8
Spatial visualization ability	9
Numerical ability	12
Verbal ability	11
Obtaining an overview - traffic (left-hand / right-hand traffic)	11
Ability to react	10
Reactive stress tolerance	11
Personality	**15**
Conscientiousness	5
Emotional stability	6
Extraversion	2
Agreeableness	1
Openness	1

In addition, it should be considered that obtaining an overview in the context of special forces is assessed not as traffic-specific but as general / abstract (test form S3), in order to reflect the diverse activity field. The total duration of the Test Solution “Police Special Forces” is 96 minutes.

5.6.2 Military

5.6.2.1 Military Aptitude

Military activities place high demands on cognitive ability, learning ability, as well as on the safe handling of complex, often safety-critical situations. Incorrect decisions in the selection and assignment process are associated with substantial individual, organizational, and societal costs. Accordingly, psychological aptitude testing plays a central role internationally in the military context.

Most central meta-analyses and large-scale individual studies on the validity of cognitive and personality-related predictors in the military context largely refer to the US selection model. This model is based on the *Armed Services Vocational Aptitude Battery* (ASVAB), a standardized test battery for the assessment of cognitive abilities. From the ASVAB subtests, a general ability index, the *Armed Forces Qualification Test* (AFQT), is calculated, which consists of verbal ability and numerical ability and correlates highly with fluid intelligence (r = ,54; Hambrick et al., 2023). The AFQT can therefore serve as an indicator of general mental ability (GMA). In addition, job-specific *Aptitude Area Scores* are derived within the ASVAB, representing different combinations of specific cognitive abilities for individual military occupational areas.

Meta-analytic findings confirm the high validity of the AFQT for military performance criteria: a recent meta-analysis by Cucina et al. (2024), which exclusively considered performance-near criteria in the form of *Hands-on Performance Tests* (HOPT), reports corrected variance explanations of approximately 20–25 % for AFQT-based predictions. The authors also showed that job-specific Aptitude Scores can explain additional variance beyond the pure AFQT (ρ = ,55; corrected for correlation with range restriction and criterion validity (cf. Schmidt & Hunter, 1998)), while general cognitive ability continued to have the greatest predictive power (ρ = ,44). In addition, findings by Hambrick et al. (2024) show that the validity of general cognitive ability remains stable even after several years of professional experience and is not replaced by increasing experience. GMA therefore remains a central predictor of professional performance even among more experienced military personnel.

Besides general cognitive ability, specific cognitive performance dimensions also provide incremental contributions to the prediction of military performance. This relevance of specific abilities is directly reflected in the structure and weighting of the US Aptitude Area Scores, which intentionally combine verbal, numerical, logical reasoning, and spatial visualization ability with knowledge tests. Evidence for the relevance of specific cognitive abilities can also be found outside the military context: Nye et al. (2022) report in a meta-analytic relative weighting analysis on general occupational success that specific cognitive abilities account for a larger proportion of explained variance than the g-factor alone. However, these findings cannot be directly transferred to military activities due to the lack of military-specific criteria. For certain military occupational groups, for example in military aviation, studies additionally show that GMA is a very good predictor but is not sufficient to fully capture performance requirements (Al Mamari & Traynor, 2021). In combat situations in particular, the ability to react quickly and correctly under strain is additionally required (Dominski et al., 2018). While resilience is often operationalized as a personality trait (e.g., Maddi et al., 2017), initial empirical individual studies show that reactive stress tolerance in cognitive ability tests is related both to resilience as a personality trait (Volgemute et al., 2023) and to close-combat performance (Maddi et al., 2017).

Compared to cognitive performance characteristics, personality traits show lower but consistent incremental validity. Dominance analyses in the military context show that personality traits contribute considerably less to explained variance than cognitive abilities (Darr & Catano, 2016). A second-order meta-analysis by Wilmot and Ones (2021) reports a corrected meta-analytic variance explanation of approximately 13% for personality traits in military occupational success, with a relative importance analysis showing that conscientiousness (53%), emotional stability (30%), and openness (11%) contributed the most. Nye et al. (2020) point out that forced-choice personality tests are particularly suitable for military selection procedures due to their high resistance to faking and could in the future enable a more differentiated assignment of personality profiles to military occupational areas.

In summary, the available findings show that general cognitive ability represents the central predictor of military training and occupational success, complemented by specific cognitive abilities and, to a lesser extent, personality traits.

The Test Solution “Military Aptitude” therefore includes the following dimensions:

- Logical Reasoning (INT)
- Numerical Ability (INT)
- Verbal Ability (INT)
- Reactive Stress Tolerance (DT)
- Personality: Conscientiousness, Emotional Stability, Openness, Extraversion, Agreeableness (FCB5)

The table below provides a complete overview of the specific weightings of the individual tests used to calculate the overall score for the Test Solution “Military Aptitude”. The weighting of the dimensions in the Test Solution “Military Aptitude” is derived from the presented meta-analyses, relative weighting studies, and dominance analyses. The relative weighting of specific cognitive abilities in this Test Solution was determined on the basis of their respective loading on g (SCHUHFRIED, 2025b). The weighting of reactive stress tolerance is implemented as the mean value of the weights of the other cognitive performance characteristics due to a lack of robust empirical findings. Further information on the calculation and interpretation of the result of a testing can be found on the page: Notes on evaluation and interpretation.

Military Aptitude	Weighting standard form	Weighting screening form
Cognitive abilities	**84**	**100**
Logical reasoning	23	37
Numerical ability	21	33
Verbal ability	19	30
Reactive stress tolerance	21	-
Personality	**16**	**0**
Conscientiousness	5	-
Emotional stability	4	-
Extraversion	2	-
Agreeableness	2	-
Openness	3	-

For all military occupational areas, a uniform screening is used. Based on the strongest and most consistent empirical evidence, this screening is based exclusively on general cognitive ability. The same test principles are applied as those underlying the calculation of the AFQT, as these show consistently high validity across all military occupational groups. Personality traits are not considered in the screening, as their relative dominance compared to cognitive abilities is clearly lower. The total duration of the screening form is 20 minutes. The total duration of the Test Solution “Military Aptitude” is 55 minutes.

5.6.2.2 Military Aptitude - Technical Occupations

Technically oriented military activities, for example in maintenance, servicing, system operation, or technical specializations, place additional specific cognitive demands beyond general military requirements. Besides high general cognitive ability, spatial visualization ability and mechanical-technical comprehension are particularly required for job-specific demands.

General cognitive ability also remains a central predictor of training and occupational performance for technical military activities, as shown by findings on the validity of the AFQT. In addition, many requirement profiles of technical occupations in the US Army, Navy, and Air Force include ASVAB subtests on spatial ability and mechanical-technical comprehension (cf. http://www.military.com , accessed 22.12.2025; Hambrick et al., 2023), which, according to the above-mentioned meta-analysis on job-specific ASVAB scores, suggest incremental validity for military occupational success (cf. Cucina et al., 2024).

The Test Solution “Military Aptitude - Technical Occupations” therefore extends the base model by the following dimensions:

- Spatial Visualization Ability (INT)
- Mechanical-Technical Comprehension (MECH)

The table below provides a complete overview of the specific weightings of the individual tests used to calculate the overall score for the Test Solution “Military Aptitude - Technical Occupations”. The weighting of these additional dimensions was based on meta-analyses on general occupational success (Nye et al., 2022), due to a lack of robust empirical findings in the military context. Further information on the calculation and interpretation of the result of a testing can be found on the page: Notes on evaluation and interpretation.

Military Aptitude - Technical Occupations	Weighting standard form	Weighting screening form
Cognitive abilities	**84**	**100**
Logical reasoning	16	37
Numerical ability	14	33
Verbal ability	13	30
Spatial visualization ability	12	-
Reactive stress tolerance	14	-
Mechanical-technical comprehension	15	-
Personality	**16**	**0**
Conscientiousness	5	-
Emotional stability	4	-
Extraversion	2	-
Agreeableness	2	-
Openness	3	-

The total duration of the Test Solution “Military Aptitude - Technical Occupations” is 75 minutes.

5.6.2.3 Military Special Forces

Special forces are characterized by particularly high physical, psychological, and cognitive demands. General cognitive ability and resilience remain central predictors in this area as well, as shown by studies on the selection of special forces (Beal, 2010). At the same time, requirements analyses show that in highly demanding scenarios such as anti-terror operations or hostage situations, the ability to quickly obtain an overview in order to react quickly and correctly is particularly important (Dominski et al., 2018; Muhly & Dössegger, 2025). Empirical individual studies additionally show clear performance differences in reaction-related and motor-related abilities. Paśko et al. (2022) report that members of special forces show significantly better motor times as well as faster reaction times compared to civilian comparison groups, with motor time showing higher validity. These differences appear in simple reaction tasks as well as in choice reaction and complex reaction tasks.

The Test Solution “Military Special Forces” therefore additionally includes the following dimensions:

- Obtaining an Overview (ATAVT-2)
- Motor Time (RT)
- Ability to React (RT)

The table below provides a complete overview of the specific weightings of the individual tests used to calculate the overall score for the Test Solution “Military Special Forces”. The weighting of these dimensions is based on available empirical findings, meta-analyses on cognitive ability, and consideration of the specific requirements profile of special forces. Where empirically robust literature is insufficient, the weights of requirement-related dimensions correspond to the average of the other weights. Further information on the calculation and interpretation of the result of a testing can be found on the page: Notes on evaluation and interpretation.

Military Special Forces	Weighting standard form	Weighting screening form
Cognitive abilities	**84**	**100**
Logical reasoning	15	37
Spatial visualization ability	12	-
Numerical ability	14	33
Verbal ability	13	30
Reactive stress tolerance	11	-
Ability to teact (teaction speed)	1	-
Ability to react (motor speed)	7	-
Obtaining an overview	11	-
Personality	**16**	**0**
Conscientiousness	5	-
Emotional Stability	4	-
Extraversion	2	-
Agreeableness	2	-
Openness	3	-

The total duration of the Test Solution “Military Special Forces” is 80 minutes.

5.7 Sports

The application area “Sports” provides test solutions for use in sports psychology and for personnel selection or aptitude assessment for professions in sport.

5.7.1 (Team) Athletes

The Test Solutions “Athletes” and “Team Athletes” are suitable for sports psychology talent assessment in adult athletes. The selection and weighting of the test dimensions are based on current meta-analytic findings on the relationship between cognitive, and sensorimotor abilities and personality traits with athletic performance, whereby the weighting and selection of the dimensions were optimized for team and individual sports respectively.

Scharfen and Memmert (2019) were able to show in their meta-analysis that athletes with a high performance level achieve significantly better results in general cognitive ability tests than those with a lower performance level, across various sports. All three examined dimensions, executive functions (such as working memory or cognitive flexibility), visual-perceptual functions (such as visual orientation and attention), and further cognitive functions (for example processing speed and mental rotation), showed higher levels in elite athletes. Another meta-analysis (Kalén et al., 2021) also demonstrated significantly better performance of highly qualified athletes in general ability tests, both in basic and higher cognitive functions. Although Kalén et al. (2021) emphasize that sport-specific cognitive tests in particular have high predictive power for athletic performance, their detailed results as well as the meta-analysis by Scharfen and Memmert (2019) confirm the validity of general cognitive function measures. In team sports, divided attention is particularly relevant within the domain of attention, for example in rugby (Gabbett & Abernethy, 2012) or soccer (Vestberg et al., 2012), where parallel stimulus processing and rapid orientation in dynamic game situations appear central for successful decisions. In individual sports, by contrast, selective attention has been shown in the literature to be of greater importance, for example in archery (Sterkowicz-Przybycien et al., 2015) or combat sports (Lu et al., 2021).

A recent meta-analysis by Yang et al. (2024) further showed that, in addition to cognitive abilities, personality traits are also relevant for athletic performance. In particular, conscientiousness and extraversion proved to be important predictors across sports, both in team and individual sports, whereas openness and emotional stability played a smaller role. Moderator analyses from the same work show that agreeableness has increased relevance in team sports, while conversely in individual sports agreeableness is only weakly associated with athletic performance and expertise.

The Test Solutions “Athletes” and “Team Athletes” therefore include the following dimensions:

- Logical reasoning and spatial visualization ability (INT)
- Processing speed (TMT-S)
- Selective attention: “Athletes”; divided attention: “Team athletes” (TACO)
- Working memory (SPAN)
- Cognitive flexibility (TMT-S)
- Interference (STROOP)
- Reactive stress tolerance (DT)
- Ability to react (RT)
- Obtaining an overview (ATAVT-2)
- Personality: Openness, Conscientiousness, Extraversion, Agreeableness and Emotional stability (FCB5)

The table below provides a complete overview of the specific weightings of the individual tests for calculating the overall score for the Test Solutions “Athletes” and “Team Athletes”. For the weighting of the cognitive ability tests, the findings from the meta-analyses by Scharfen and Memmert (2019) as well as Kalén and colleagues (2021) were combined and recalculated with a higher level of detail and completeness using the R software package (R Core Team, 2025; metafor package: Viechtbauer, 2010), while the weighting of personality could be directly adopted from a recent meta-analysis (Yang et al., 2024). Further information on the calculation and interpretation of the result of a testing can be found on the page: Notes on evaluation and interpretation.

Dimension	Weighting athletes standard form	Weighting athletes screening form	Weighting team athletes standard form	Weighting team athletes screening form
Cognitive abilities	**75**	**75**	**75**	**75**
Logical reasoning	6	11	6	11

Dimension	Weighting athletes standard form	Weighting athletes screening form	Weighting team athletes standard form	Weighting team athletes screening form
Spatial visualization ability	9	16	9	16
Processing speed	8	15	8	15
Ability to concentrate (selective attention)	12	22	-	-
Divided attention	-	-	12	22
Working memory	5	-	5	-
Cognitive flexibility	6	-	6	-
Interference	10	-	10	-
Reactive stress tolerance	5	-	5	-
Ability to react (reaction speed)	2	-	2	-
Ability to react (motor speed)	2	-	2	-
Obtaining an overview	10	-	10	-
Personality	**25**	**25**	**25**	**25**
Conscientiousness	10	10	8	8
Emotional stability	5	5	4	4
Extraversion	8	8	6	6
Agreeableness	-	-	6	6
Openness	2	2	1	1

For testing, a standard form is available in each case, which assesses all mentioned cognitive dimensions as well as the five personality traits. In addition, a screening form is available in each case, which is limited to central cognitive areas and personality (INT, TMT-S, TACO, FCB5) and does not require additional hardware. The test duration of the standard form for athletes is approximately 77 minutes, and approximately 39 minutes for the screening form. The test duration of the standard form for (Team) Athletes is approximately 79 minutes, and approximately 41 minutes for the screening form.

5.7.2 Young Athletes

The Test Solution “Young Athletes” is based on the meta-analytic foundations of general sport psychology performance research (see also (8.30-de) (Team) Athletes; Scharfen & Memmert, 2019; Kalén et al., 2021), supplemented by systematic reviews and studies on cognitive development in childhood and adolescence. Review papers show that there is less evidence for the relationship between higher cognitive abilities and athletic performance, while group-differentiating effects have frequently been described for executive functions in youth samples (cf. Singh et al., 2018).

Individual studies in youth samples particularly emphasize the relevance of inhibition, divided attention and working memory: Giordano and colleagues (2021) showed that these three executive functions in particular display the largest group differences between children and adolescents involved in combat sports, team sports and no sporting activity, while verbal fluency showed no differential contribution and decision-related performance in gambling tasks was less strongly associated with sporting activity. In young soccer players, inhibitory control and cognitive flexibility in particular proved to be performance-relevant characteristics, while visual working memory, reaction time and basic processing speed (TMT-A) showed no meaningful differences between elite and sub-elite athletes (Huijgen et al., 2015). Selection for early elite soccer could also be partially predicted by inhibitory control (Sakamoto et al., 2018). Overall, findings indicate that in adolescence, components of executive functions, particularly inhibition, cognitive flexibility, processing speed, working memory and divided attention, are considered robust predictors of athletic performance and developmental differences, although findings differ in their level of differentiation across studies. Higher cognitive functions and metacognitive planning performance, however, are less consistently researched in child and youth sport psychology.

Due to the lack of meta-analytic findings on the relationship between personality and athletic success in young athletes, the selection and weighting of personality traits are based on the findings of Yang et al. (2024), who identified the largest and most consistent relationships between personality and athletic performance in conscientiousness and extraversion, while agreeableness showed differential effects depending on the type of sport.

The Test Solution “Young Athletes” therefore includes the following dimensions:

- Processing speed (TMT-S)
- Divided attention (TACO)
- Working memory (SPAN)
- Cognitive flexibility (TMT-S)
- Interference (STROOP)
- Reactive stress tolerance (DT)
- Logical reasoning (INT)
- Obtaining an overview (ATAVT-2)
- Personality: Openness, Conscientiousness, Extraversion, and Emotional stability (FCB5)

The table below provides a complete overview of the specific weightings of the individual tests used to calculate the overall score for the Test Solution “Young Athletes”. No differentiated meta-analytic effects are available for this age group, therefore the weighting follows the adult meta-analyses (see also (8.30-de) (Team) Athletes; Yang et al., 2024). Further information on the calculation and interpretation of the result of a testing can be found on the page: Notes on evaluation and interpretation.

Dimension	Weighting standard form	Weighting screening form
Cognitive abilities	**75**	**75**
Logical reasoning	7	-
Processing speed	9	19
Divided attention	14	28
Working memory	6	14

Dimension	Weighting standard form	Weighting screening form
Cognitive flexibility	7	14
Interference	12	-
Reactive stress tolerance	10	-
Obtaining an overview	10	-
Personality	**25**	**25**
Conscientiousness	10	10
Emotional stability	5	5
Extraversion	8	8
Agreeableness	-	-
Openness	2	2

A standard form is available that fully assesses the performance dimensions and personality traits listed above. In addition, a screening form is available that focuses on the central executive functions as well as personality (SPAN, TMT-S, TACO, FCB5). The test duration of the standard form is approximately 73 minutes, and the screening form approximately 29 minutes.

5.8 Dimensions

In addition to the application-specific selection of predefined solutions, **SFS Test Solutions** offers a comprehensive selection of dimensions for assessing specific cognitive abilities, personality traits, and professional interests.

5.8.1 Concept

The dimensions of the Vienna Test System (VTS) are divided into the broad areas performance, personality, and interests. Each area contains several dimensions, which in turn can be subdivided into subdimensions. A detailed description of the quality criteria and theoretical background of the tests can be found in the respective test manual. All manuals are available in the VTS. For more detailed information on how to view the individual test manuals in the VTS, please visit Implementation. An overview of all dimensions and tests can be found here:

Dimension	Tests	Test form	Duration
Performance			
Alertness	RT	S6	9
Working memory	SPAN	S2	5
Eye-hand coordination	2HAND	S1	4
Selective sustained attention	TACO	S3	32
Focused attention	SIGNAL	S1	15
Divided attention	TACO	S5	10
Interference	STROOP	S7	15
Cognitive flexibility	TMT-S	S	2

Dimension	Tests	Test form	Duration
Ability to concentrate	TACO	S1	8
Long-term memory	INT	S2	15
Logical reasoning	INT	S2	8
	BMT	S1	8
Mechanical and technical comprehension	MECH	S1	7
Motor speed	RT	S3	5
Multitasking ability	M-TASK	S1	18
Numerical ability	INT	S2	9
Visual-spatial ability	INT	S2	7
Reaction speed	RT	S3	5
Reactive stress tolerance	DT	S1	10
Obtaining an overview	ATAVT-2	S1 & S2	5
	ATAVT-2	S3	6
Processing speed	TMT-S	S1	2
Verbal ability	INT	S2	4
Vigilance	VIGIL	S1	28
Visual orientation ability	LAT	S1	5
Personality			
Openness	FCB5	S1	7
Conscientiousness	FCB5	S1	7
Extraversion	FCB5	S1	7
Agreeableness	FCB5	S1	7
Emotional stability	FCB5	S1	7
Mental stability	IVPE-R	S1	12
Sense of responsibility	IVPE-R	S1	12
Self-control	IVPE-R	S1	12
Risk avoidance	IVPE-R	S1	12
Interests			
Realistic interests	PRIO	S	1
Investigative interests	PRIO	S1	1
Artistic interests	PRIO	S	1
Social interests	PRIO	S1	1

Dimension	Tests	Test form	Duration
Enterpreneurial interests	PRIO	S1	1
Conventional interests	PRIO	S1	1

5.8.2 Performance

5.8.2.1 Alertness

Alertness is measured using the **RT** test. This variable describes the ability to maintain a high reaction speed over a longer period of time under monotonous stimulus conditions. For more detailed information, please refer to the RT test manual.

5.8.2.2 Working memory

Working memory is measured using the **SPAN** test. This variable describes the ability to retain, process, and retrieve a limited amount of information for a short period of time. For more detailed information, please refer to the SPAN test manual.

5.8.2.3 Eye-hand coordination

Eye-hand coordination is measured using the **2HAND** test. The variable is a measure of the ability to coordinate the eyes and hands in fine, small-scale movements. A high percentile rank corresponds to good eye-hand coordination (or hand-hand coordination). For more detailed information, please refer to the 2HAND test manual.

5.8.2.4 Focused attention

Focused attention is measured using the **SIGNAL** test. The variable describes long-term focused attention and the visual differentiation performance of a relevant signal in the presence of interfering signals. For more detailed information, please refer to the SIGNAL test manual.

5.8.2.5 Divided attention

Divided attention is measured using the **TACO** test. The variable can be defined as the ability to effectively divide attention between multiple sources of information and thus perform multiple tasks at the same time. For more detailed information, please refer to the TACO test manual.

5.8.2.6 Interference

Interference is measured using the **STROOP** test. The interference tendency measures the extent to which individuals are susceptible to irrelevant stimuli. For more detailed information, please refer to the STROOP test manual.

5.8.2.7 Cognitive flexibility

Cognitive flexibility is measured using the **TMT-S** test. This variable refers to the ability to adapt behavior and thoughts to new, changing, or unexpected events. It describes the ability to recognize that a strategy is not working and to make appropriate changes in order to adapt to the situation. For more detailed information, please refer to the TMT-S test manual.

5.8.2.8 Ability to concentrate

Concentration is measured using the **COG** or **TACO** test. This variable measures the ability to work in a focused and attentive manner. A person with a high score in this variable finds it easy to quickly recognize details in a distracting environment under time pressure and to distinguish them from irrelevant material. For more detailed information, please refer to the COG and TACO test manuals.

5.8.2.9 Long-term memory

Long-term memory is measured by a subtest of the INT test. This variable measures the ability to memorize information over the long term, integrate it into one's own knowledge base, and retrieve and reconnect it when needed. Individuals with a high score have a high long-term memory capacity.

For more detailed information, please refer to the INT test manual.

5.8.2.10 Logical reasoning

Logical reasoning is measured by a subtest of the **INT** test. This variable measures the ability to solve novel problems through inductive thinking processes. A person with a high score on this variable has a particular ability to recognize patterns and regularities and to apply the rules derived from them.

For more detailed information, please refer to the INT test manual.

The **BMT** is particularly recommended for use in the lower performance range. For more detailed information, please refer to the BMT test manual.

5.8.2.11 Mechanical-technical understanding

Mechanical-technical understanding is assessed using the **MECH** test. This variable measures the ability to understand mechanical principles and successfully solve mechanical-technical problems. A person with a high score in this variable can efficiently comprehend mechanical-technical processes and draw well-founded conclusions or inferences from them.

For more detailed information, please refer to the MECH test manual.

5.8.2.12 Motor speed

Motor speed is measured using the **RT** test. This variable provides information about a person's movement speed and is defined as the second part of reaction ability. One hand must be placed on a rest button and moved as quickly as possible to another button (reaction button) when a stimulus is presented. The time between leaving the rest button and pressing the reaction button is used as a measure of motor speed.

For more detailed information, please refer to the RT test manual.

5.8.2.13 Multitasking ability

Multitasking ability is measured using the M-TASK test. The variable measures a person's ability to coordinate multiple simultaneous tasks and allocate cognitive resources efficiently while maintaining adequate performance levels across all tasks.

For more detailed information, please refer to the M-TASK test manual.

5.8.2.14 Numerical ability

Numerical ability is assessed by a subtest of the **INT** test. The variable assesses knowledge of basic arithmetic operations and the ability to derive mathematical solutions from them. A person with a high score in this variable finds it easy to recall basic arithmetic operations and use them flexibly.

For more detailed information, please refer to the INT test manual.

5.8.2.15 Visual-spatial ability

Visual-spatial ability is measured by a subtest of the **INT** test. The variable measures the ability to visualize objects spatially and rotate them mentally. Individuals with a high score have the ability to easily visualize three-dimensional objects from different perspectives.

For more detailed information, please refer to the INT test manual.

5.8.2.16 Reaction speed

The variable reaction speed is measured by the **RT** test.

The variable reaction speed is measured by the time that elapses between the start of the stimulus presentation and the release of a rest key and is defined as a sub-aspect of reaction ability alongside motor speed.

For more detailed information, please refer to the RT test manual.

5.8.2.17 Reactive stress tolerance

Reactive stress tolerance is measured using the **DT** test. The number of correct reactions is a measure of the test taker's reactive stress tolerance and provides information about their responsiveness under stressful conditions. The higher the percentile rank, the higher the reactive stress tolerance.

For more detailed information, please refer to the DT test manual.

5.8.2.18 Selective sustained attention

Selective sustained attention is measured using the **TACO** test. This variable describes the ability to maintain attention at a moderate level over a period of approximately 30 minutes. For more detailed information, please refer to the TACO test manual.

5.8.2.19 Obtaining an overview

Obtaining an overview is measured using the **ATAVT-2** test. The person parameter, i.e., a person's score on an ability dimension, represents a measure of their overview acquisition performance in the context of attention control. The higher the percentile rank, the better the ability to control the focus of attention for overview acquisition.

For more detailed information, please refer to the ATAVT-2 test manual.

5.8.2.20 Processing speed

Processing speed is measured using the **TMT-S** test. Processing speed is a cognitive ability that can be defined as the time it takes a person to perform a mental task. It is related to the speed at which a person can understand and respond to information received. For more detailed information, please refer to the TMT-S test manual.

5.8.2.21 Verbal ability

Verbal ability is measured by a subtest of the **INT** test. The verbal ability variable measures the ability to understand the meaning of words and their underlying concepts, to relate them to each other, and to draw conclusions from them. A person with a high score on this variable finds it easy to understand verbal information and apply this knowledge.

For more detailed information, please refer to the INT test manual.

5.8.2.22 Vigilance

Vigilance is measured using the **VIGIL** test. This variable indicates the average time between the presentation of critical stimuli and the pressing of a button. This variable provides information about attention performance when sustained vigilance is required in a low-stimulus observation situation and also includes aspects of the test taker's motor responsiveness. For more detailed information, please refer to the VIGIL test manual.

5.8.2.23 Visual orientation ability

Visual orientation ability is assessed using the **LAT** test. This variable is a very basic ability that primarily involves areas in the primary visual cortex and other areas of the brain. Impairments in this ability can be detected particularly in patients with brain damage, such as after traumatic brain injury, stroke, or neurodegenerative diseases. For more detailed information, please refer to the LAT test manual.

5.8.3 Personality

SFS Test Solutions assess different facets of personality that are relevant to varying degrees depending on the job requirements. The Big Five model is primarily used to define personality dimensions. This is a model of personality psychology that postulates five main dimensions of personality.

The following five variables are assessed by the **FCB5** test. For more detailed information, please refer to the FCB5 test manual.

5.8.3.1 Emotional stability

The variable emotional stability measures how resilient and emotionally controlled a person describes themselves to be. A high percentile rank in this variable corresponds to a high level of emotional stability. People who achieve a high percentile rank describe themselves as balanced individuals who can cope well with emotional stress. They describe themselves as people who are resistant to stress and difficult to ruffle. In contrast, individuals with low scores report that they are not very balanced and are irritable, and that they do not have a very positive outlook on the future. Individuals who score high on the Emotional Stability dimension report being more satisfied with their work. Studies have shown this factor to be a key predictor of professional success. A person's self-reported overall life satisfaction is also positively correlated with emotional stability.

5.8.3.2 Extraversion

The variable Extraversion measures how sociable, assertive, and dynamic a person describes themselves to be. A high percentile rank in this variable corresponds to a high level of extraversion. People who score high on this variable describe themselves as sociable individuals who actively engage in social interactions. They describe themselves as enterprising and cheerful and willing to take risks. In contrast, individuals with low scores indicate that they are aloof and cautious, tend to be less sociable, and often leave decisions to others. Studies have shown that the factor of extraversion is a relevant predictor of professional success and leadership success.

5.8.3.3 Conscientiousness

The variable conscientiousness measures how much a person describes themselves as dutiful, orderly, and careful. A high percentile rank in this variable corresponds to a high level of conscientiousness. People who achieve a high percentile rank describe themselves as ambitious, responsible individuals who work in a precise and careful manner. They describe themselves as well-organized and self-disciplined individuals who adhere to rules and plans. In contrast, people with low scores say that they are disorganized, reckless, and not very determined, and describe themselves as unreliable. Studies have shown that of all the Big Five factors, conscientiousness is the most relevant predictor of professional success, educational success, and leadership success.

5.8.3.4 Agreeableness

The variable agreeableness measures how helpful, accommodating, and trusting a person describes themselves to be. A high percentile rank in this variable corresponds to a high level of agreeableness. People who score high on this variable describe themselves as good-natured, considerate, and compassionate. They describe themselves as altruistic and quick to forgive others. In contrast, people with low scores say that they tend to be resentful, unhelpful, and distrustful, and show little willingness to accommodate others. Studies have shown that the Big Five factor of agreeableness is a relevant predictor of safety-related behavior and is also associated with professional success in certain occupations (e.g., customer service).

5.8.3.5 Openness

The variable openness measures how creative and intellectually open a person describes themselves to be. A high percentile rank in this variable corresponds to a high level of openness. People who score high on this variable describe themselves as curious, imaginative individuals who seek new experiences. They describe themselves as inquisitive, preferring varied tasks and being open to other points of view. In contrast, individuals with low scores indicate that they are not very imaginative and prefer to deal with concrete rather than abstract topics. They describe themselves as less open-minded and prefer the familiar. Studies have shown that the openness factor is a relevant predictor of educational success and that an individual's level of education correlates with the degree of this factor.

5.8.4 Traffic-related personality

The following four variables relating to traffic-related personality are assessed using the **IVPE-R** test. For more detailed information, please refer to the IVPE-R test manual.

5.8.4.1 Mental stability

An above-average percentile rank on this scale means that the test taker gives answers that indicate high psychological stability. The person thus describes themselves as resilient, emotionally robust, and capable of reacting calmly even in demanding traffic situations. A below-average percentile rank means that the test taker gives answers that indicate low psychological stability. The person thus describes themselves as less resilient and states that they tend to react emotionally, i.e., nervously or aggressively, to demanding situations in road traffic.

5.8.4.2 Self-control

An above-average percentile rank on this scale means that the person describes themselves as having above-average self-control. They see themselves as rather conscientious, disciplined, and skilled at delaying gratification, rather reflective, and not very impulsive. A below-average percentile rank corresponds to responses indicating low self-control. The person describes themselves as less conscientious and disciplined, more impulsive, and less skilled at delaying gratification.

5.8.4.3 Sense of responsibility

An above-average percentile rank on this scale means that a person considers themselves to be above average in terms of social responsibility. The person states that social and societal norms are very important in their life and that they strive to behave in accordance with these norms. A below-average percentile rank indicates a below-average sense of social responsibility. The person states that social and societal norms are of little importance in their life and that they behave contrary to known norms.

5.8.4.4 Risk avoidance

An above-average percentile rank on this scale means that the test taker describes themselves as particularly risk-averse. They state that they avoid risks in road traffic and instead exhibit behaviors that prevent risks. A low percentile rank means that the person describes themselves as more risk-seeking. They state that they seek out risky situations in traffic and engage in potentially dangerous situations to satisfy a need for excitement.

5.8.5 Professional interests

5.8.5.1 Realistic interests

An above-average percentile rank on this scale means that the test taker is more interested in manual activities or working with and manufacturing objects. The activities surveyed are aimed at tangible results and require mechanical or technical skills.

5.8.5.2 Investigative interests

An above-average percentile rank on this scale means that the test taker is more interested in observing, understanding, and controlling phenomena. The activities surveyed require skills in mathematics or science.

5.8.5.3 Artistic interests

An above-average percentile rank on this scale means that the test taker is more interested in open-ended and unstructured activities. The activities inquired about require linguistic, artistic, musical, or writing skills.

5.8.5.4 Social interests

An above-average percentile rank on this scale means that the test taker is more interested in activities or working with other people. The activities inquired about require interpersonal skills.

5.8.5.5 Entrepreneurial interests

An above-average percentile rank on this scale indicates that the test taker is more interested in activities in which others are to be instructed or persuaded to perform a task. The activities inquired about require leadership and persuasion skills.

5.8.5.6 Conventional interests

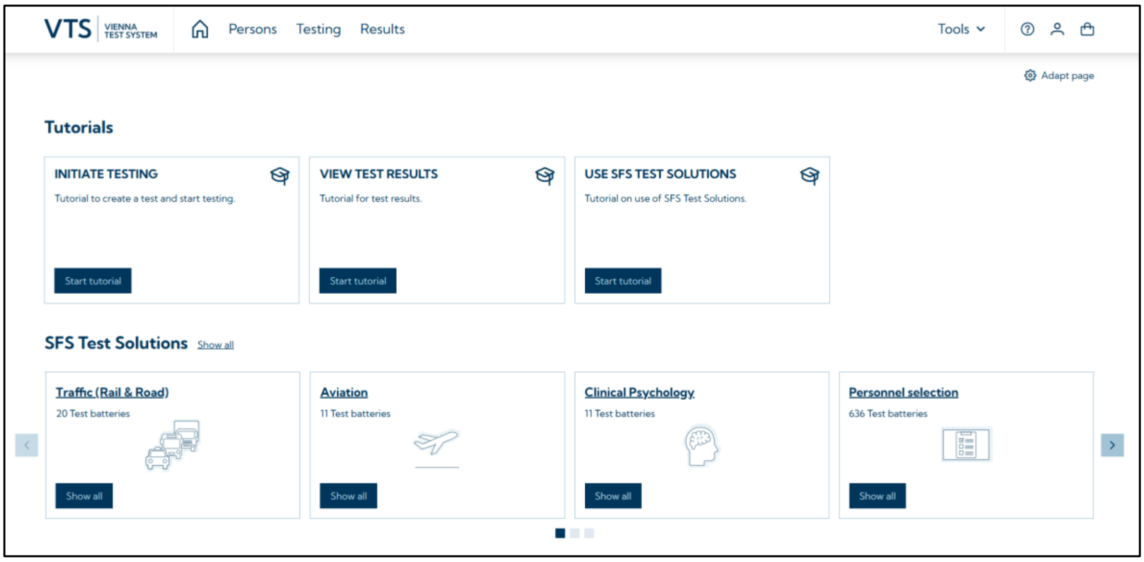
An above-average percentile rank on this scale means that the test taker is increasingly interested in clearly structured activities with regular processes. The activities inquired about require mathematical or business skills and are found in administrative or organizational areas of responsibility.

6 NOTES ON ADMINISTRATION

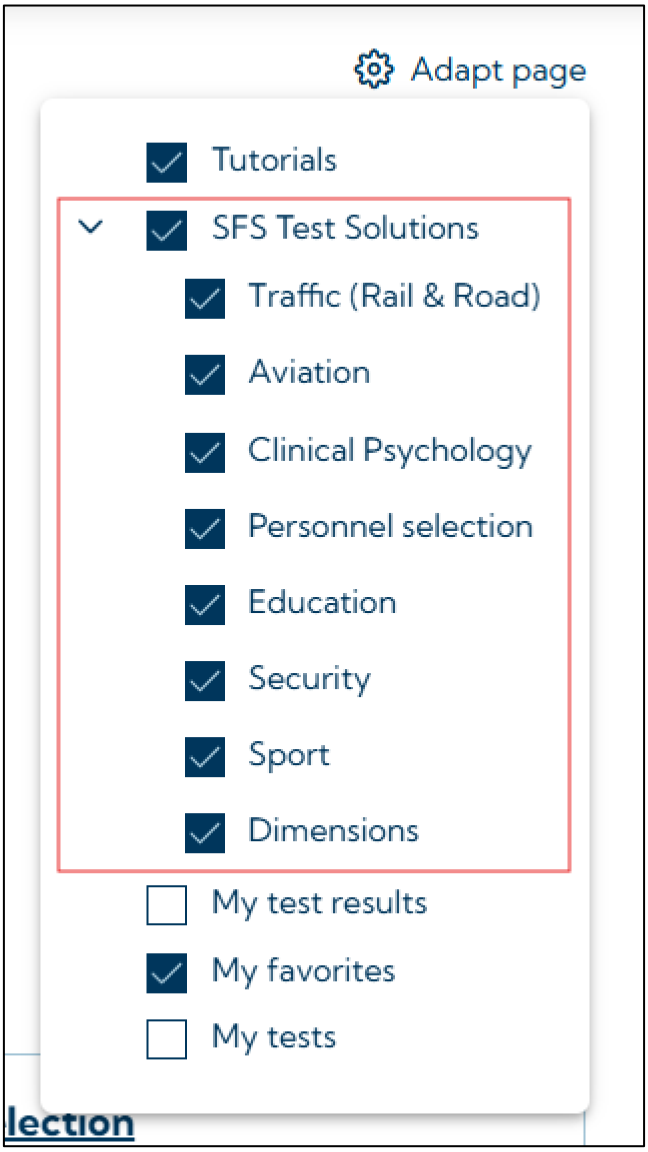
This chapter provides practical information that should be taken into account before and during testing.

6.1 Where to find SFS Test Solutions

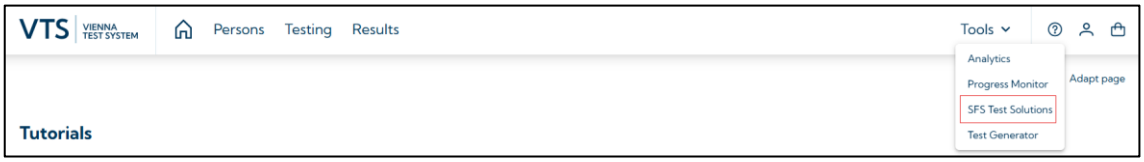
You can find SFS Test Solutions on the VTS homepage.



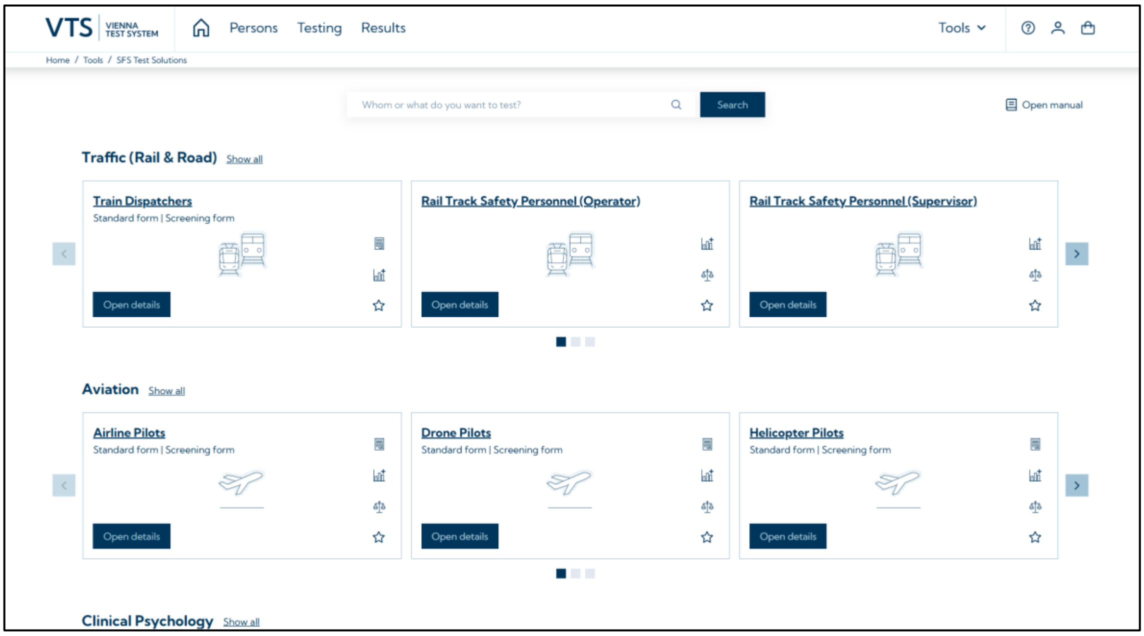
You can freely configure which **application areas** are to be displayed by clicking on *adapt page*. Similarly, the entire SFS Test Solutions area can be hidden or displayed.



You can access the SFS Test Solutions page in VTS via *Tools → SFS Test Solutions*.

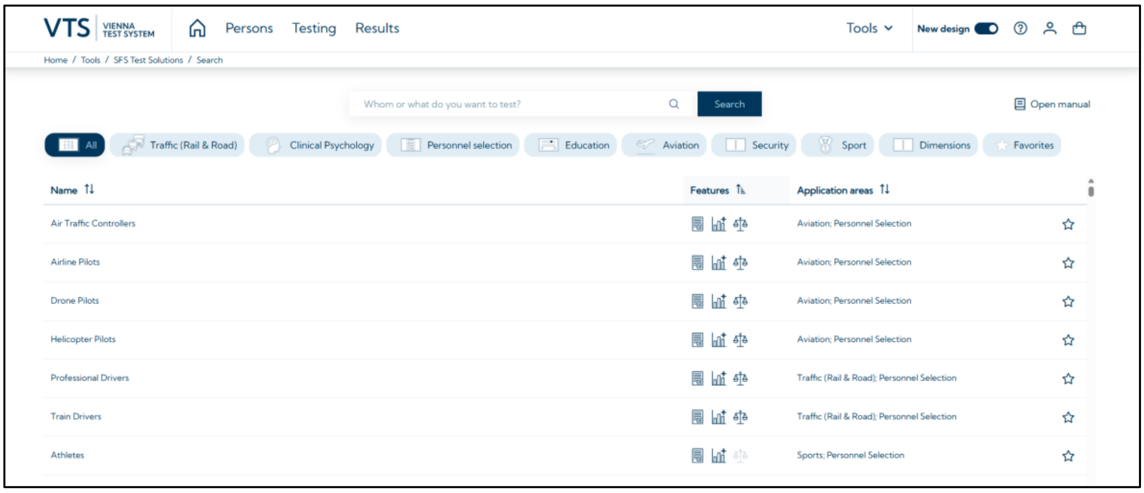


The SFS Test Solutions page is shown below.



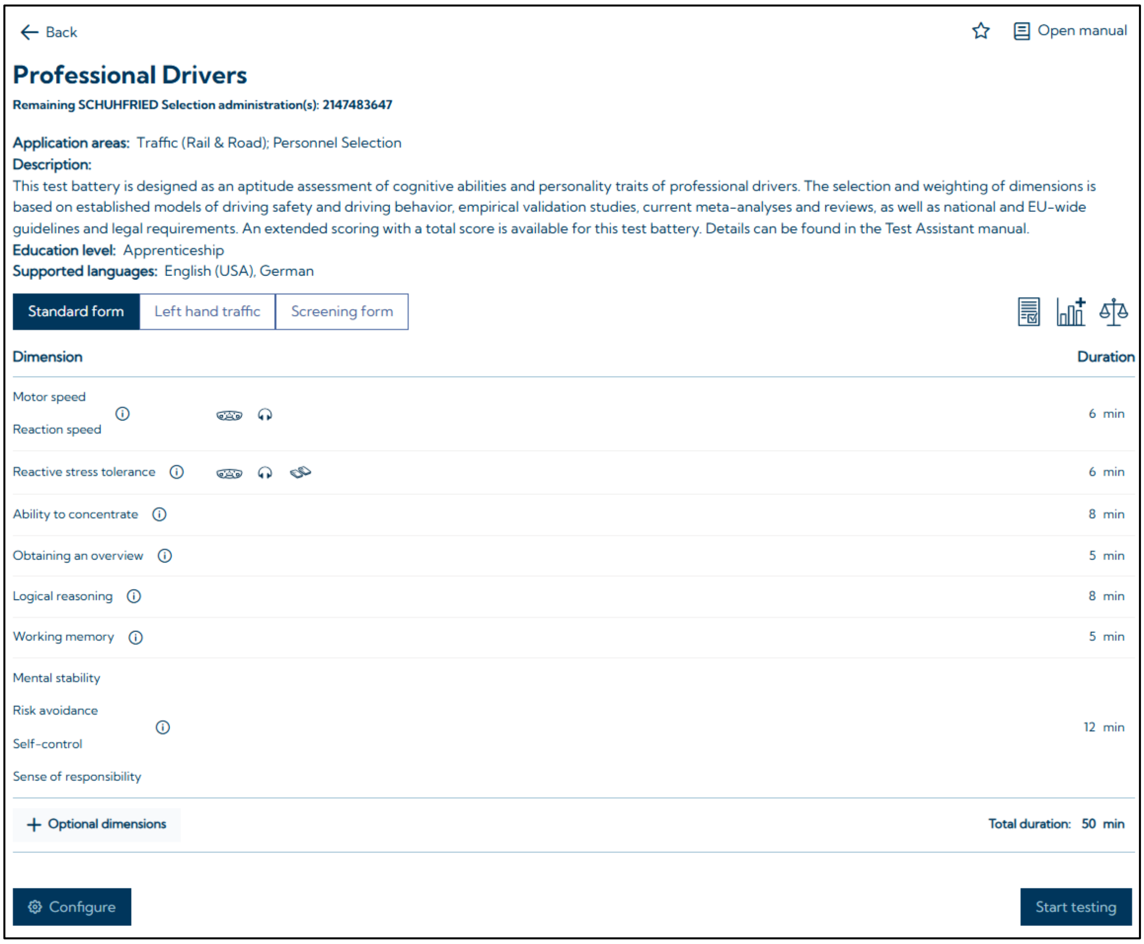
6.2 How to select a test solution?

At the top of the page, you will find the **search function**, which you can use to search for job titles, questions or dimensions. If you click on *Search* without entering a search term, or if you click on *Show all* for an application area, e.g. next to traffic (rail & road), you will be taken to an overview of all available content. You can **filter this content by application area** (the filters are located at the top; in the example, the filter *All* is selected).



Once you have found a test solution, you can view further information by opening it (via *Open details* or by clicking on the respective entry in the list). The detailed view provides further information, such as a **description** and the **supported languages.**

The example below shows a detailed view of the test solution for professional drivers. You can see all the dimensions that are measured, how long the testing takes approximately, and whether additional hardware is required to perform the testing. Some test solutions offer alternative forms or variants. In the example of the Test Solution for Professional Drivers, these are a form for left-hand traffic and a screening form. Further information can be found in the section application.



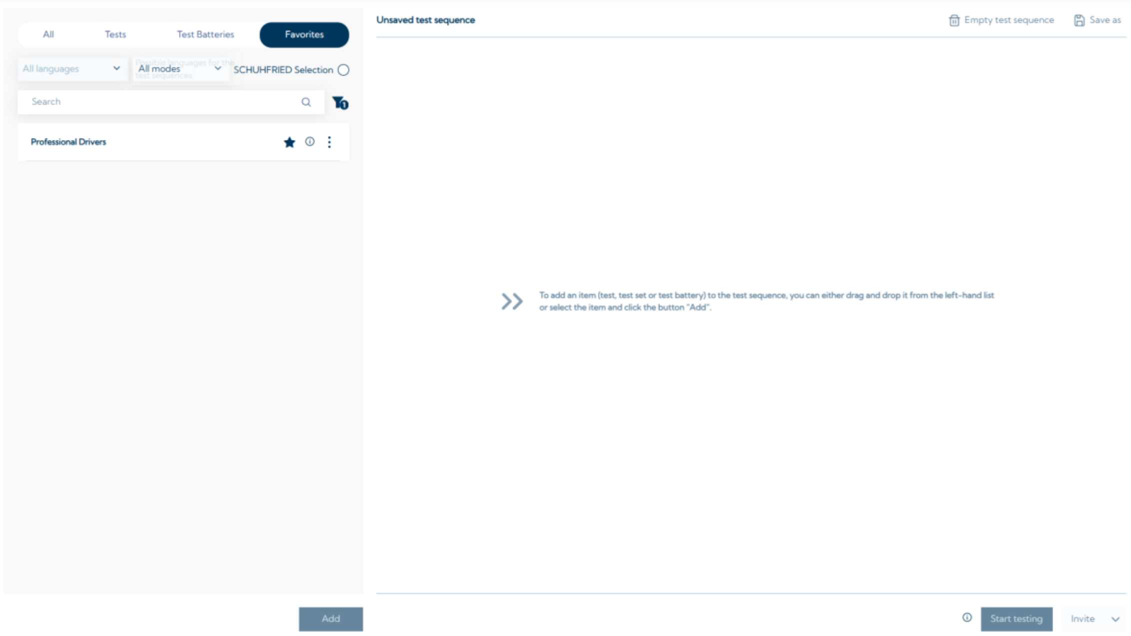
Each SFS Test Solution is also marked with three icons that indicate whether the test solution has additional features. These can include in-depth scientific research or empirical analyses for the selection and weighting of the dimensions included, the consideration of legal or professional regulations, or an extended scoring. The table below shows what the icons mean. These icons assist users in selecting the appropriate test solution.

ICON	Description
	Test solutions marked with this icon take application-specific legal or professional regulations into account when selecting dimensions.
	Test solutions marked with this icon take empirical analyses and/or scientific studies into account when selecting and weighting the dimensions.
	Test solutions marked with this icon include extended scoring in the form of an overall score, which represents the test taker's fit to an ideal profile.

If a test solution does not have an icon, it is based solely on a requirements analysis.

6.3 Mark test solutions as favorites

Test solutions can be marked as favorites by clicking on the star icon (☆). This allows the most frequently used or relevant test solutions to be made available for direct access from the *Testing* area in VTS (shown below).



6.4 Before testing

When **inviting test takers**, it should be announced that standardized tests are part of the process. The objectives of the testing should be briefly explained, e.g., that testing is a way to objectively assess important skills for the respective profession. Furthermore, the invitation should briefly mention what content the candidates can expect and that the data will be treated confidentially.

A **test solution**, i.e. the specific **test sequence**, has already been optimised in terms of the variation of the test content and a meaningful sequence of the individual tests. This is to ensure that the test taker switches between different types of tasks. This reduces fatigue and promotes motivation. If the pre-configured test battery of the SFS Test Solution is modified (parts of the battery are shortened or replaced by other tests), the user should independently ensure a meaningful test sequence. For example, it is advisable not to administer attention tests at the end of a long test battery unless the question is specifically aimed at this (e.g. to check whether someone still has a high level of attention performance after several hours of testing). When using test batteries, care should also be taken to ensure that sufficient breaks are scheduled. For performance tests, it is recommended to schedule a break of at least 10 minutes after approximately two hours. All test batteries from SFS Test Solutions have a test duration of less than or just over two hours and can therefore be administered without additional breaks.

Before the actual testing is carried out, optimal **conditions** for testing should be created, such as a comfortable seating position, adequate lighting, and a quiet test setting. The objectives, content, and duration of the testing should be explained to the test taker once again. Test takers should be instructed to read the instructions carefully, work independently, and refrain from asking the test administrator any questions during the test. It should also be pointed out that all necessary instructions will be provided on the screen. Finally, candidates should be informed about data security. Please also consider the information given in the section (8.30-en) Testing.

6.5 Application

The tests are designed so that they can be completed independently by the test taker. The language in which the test is presented can be set before the session begins.

6.5.1 Hardware

Some test batteries require SCHUHFRIED in- and output devices in order to assess all relevant dimensions (see: (8.30-en) Peripheral devices for more information). These include, for example, the SCHUHFRIED Response Panel or foot-operated keys (illustrations of these devices can be found in the table below). These are necessary for millisecond-accurate measurement, as required for assessing reaction times. Ifyou are unable or unwilling to use these devices, many test solutions offer the option of switching to a form without input devices.

In- and output devices	Icon	In- and output devices	Test
		Universal Response Panel	2HAND, RT, DT, COG, VIGIL, STROOP, SIGNAL
		Standard Response Panel	RT, DT, COG, VIGIL, STROOP, SIGNAL
		Foot-operated keys	DT
		Headphones	RT, DT

6.5.2 Screening Forms

Some test solutions include a screening form that also does not require any input devices. The screening forms have been compiled in such a way that the dimensions contained in the standard forms are covered as comprehensively as possible. To keep the duration of the test to a minimum, only the most relevant dimensions are taken into account.

The screening forms should meet the requirements for multi-stage selection processes (e.g., IATA, 2019) in accordance with recommendations for personnel selection (DIN 33430 and ÖNORM D 4000). It is recommended that time-saving and resource-efficient methods be used for all applicants in the early stages of a selection process so that time-consuming and resource-intensive methods can be applied exclusively to a selected talent pool at a later stage (Martinussen, 2017) .

While the first step in such a selection process often involves clarifying the formal requirements for the profession with the help of questionnaires or resumes (CVs), relevant performance and personality dimensions can also be recorded at this stage in order to make pre-selection more efficient within the framework of a screening process (see, for example, IATA, 2019).

This is precisely the goal to be achieved with the use of screening forms, by excluding unsuitable applicants at an early stage of the selection process. This saves the user the often time-consuming psychometric testing with extensive test batteries, comprehensive interviews, assessment centers (AC), or simulator testing with all persons in the recruitment pool.

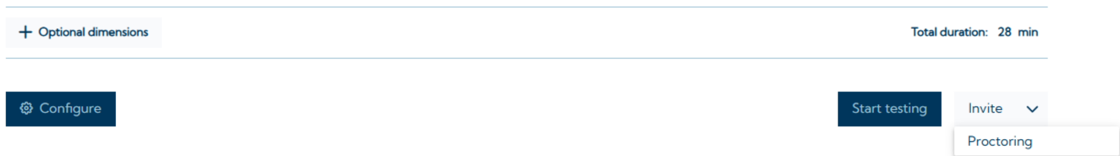
> For this purpose, all screening forms can be used for open mode testing. This means that invitation links can be created and the test takers can do the tests unsupervised, for example at home and on their own devices (smartphones, tablets, pcs). See the section start testing.

Individuals who meet the relevant formal criteria and achieve suitable results in the screening process can then undergo a more detailed psychometric examination with further tests. However, screening does not replace this detailed examination using an extensive standardized test battery but is intended to serve as an economical and valid decision-making aid for the preselection of applicants.

For the following test solutions screening forms are available: Air Traffic Controllers; Airline Pilots; Athletes; Captains, Mates, and Pilots of Water Vessels; Drone Pilots; Forklift Drivers; Helicopter Pilots; Military Aptitude; Military Aptitude - Technical Occupations; Military Special Forces; Professional Drivers; Team Athletes; Train Dispatchers; Train Drivers; Young Athletes

6.5.3 Start testing

There are various ways to start testing. Depending on which test is included in the Test Solution, the test administrator has various options to choose from:



Start testing
Start testing directly on the computer. The settings specified in the VTS for performing the tests will be applied (see also (8.30-en) VTS - First Steps).

Invite
Allows you to send test takers **a link via email** ((8.30-en) Invitation links), which they can use to start testing on their device. Once the testing is complete, the test results can be accessed in the VTS. This allows testing to be carried out independently of time and location, offering maximum flexibility. This is only possible if all tests in the test solution can be *run in open mode (see* (8.30-en) Testing modes#Open-mode).

Proctoring
During proctoring, the test supervisor has the option of supervising the testing using appropriate technical measures (e.g. video monitoring). The necessary conditions and technical requirements must be *created by the test administrator.* This test format also enables location-independent testing in a responsible, secure environment in accordance with legal requirements. According to DIN 33430, unsupervised testing should only be used for screening purposes – i.e. solely to eliminate candidates who do not meet the requirements. The proctoring testing mode offers a DIN 33430-compliant alternative for decisions in aptitude testing, allowing tests to still be used online (see also (8.30-en) Testing modes#Proctored-mode).

Configure
If you want to make adjustments to the test solution, the **configure** button (see figure above) takes you directly to the testing tab in the VTS. Here you will find detailed information about which (sub)tests are used and which specific settings have been set. In this view, you can remove (sub)tests from the battery or add them to other tests. Please note that once changes have been made to the test battery, you will no longer be able to generate a joint evaluation. In this case, the results will be output as individual test evaluations (one page per test).

Viewing the test manuals
After clicking on configure, you also have the option of viewing the manuals for the individual tests included in the test solution. To do this, click on the 3 dots to the right of the test duration and then on *Open Manual* (see figure below).

Figure 3 Opening test manuals.

6.5.3.1 Add dimensions

For all predefined test solutions, it is possible to add further dimensions to the test sequence.

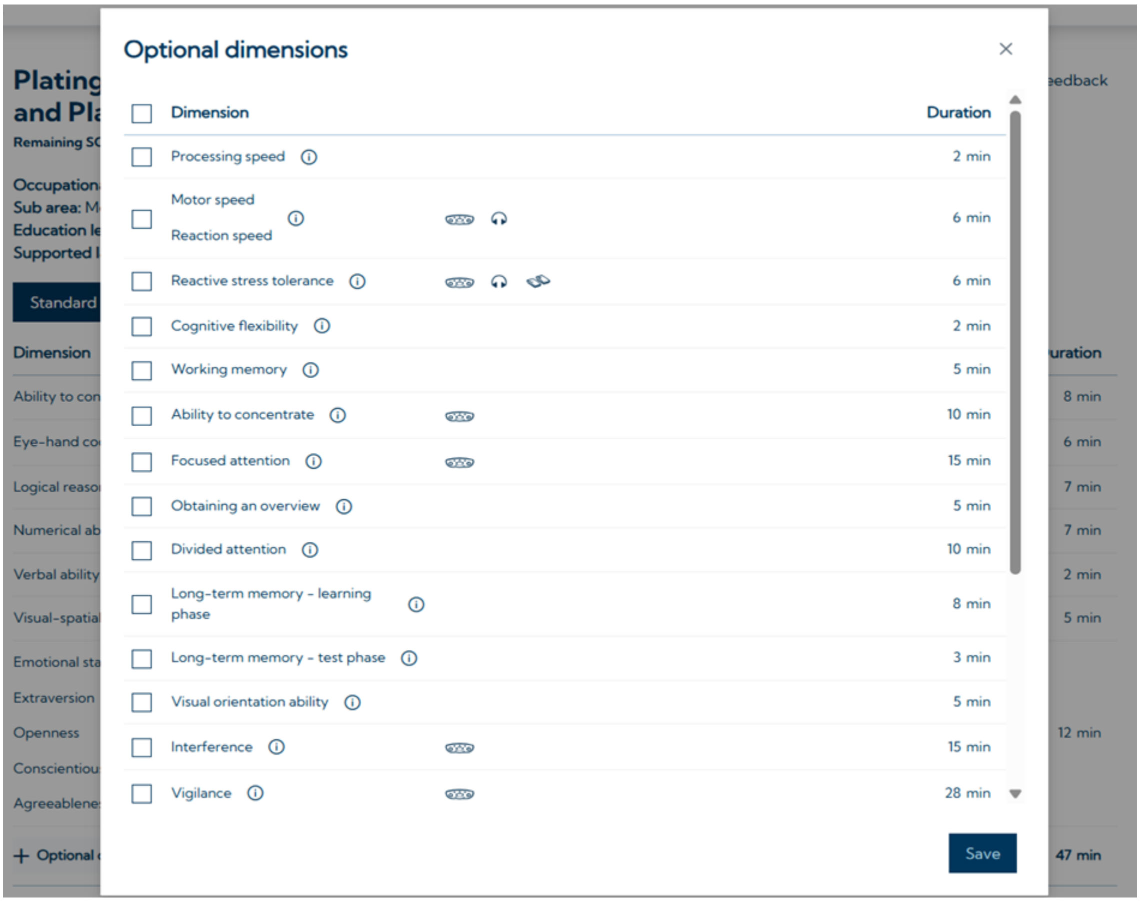


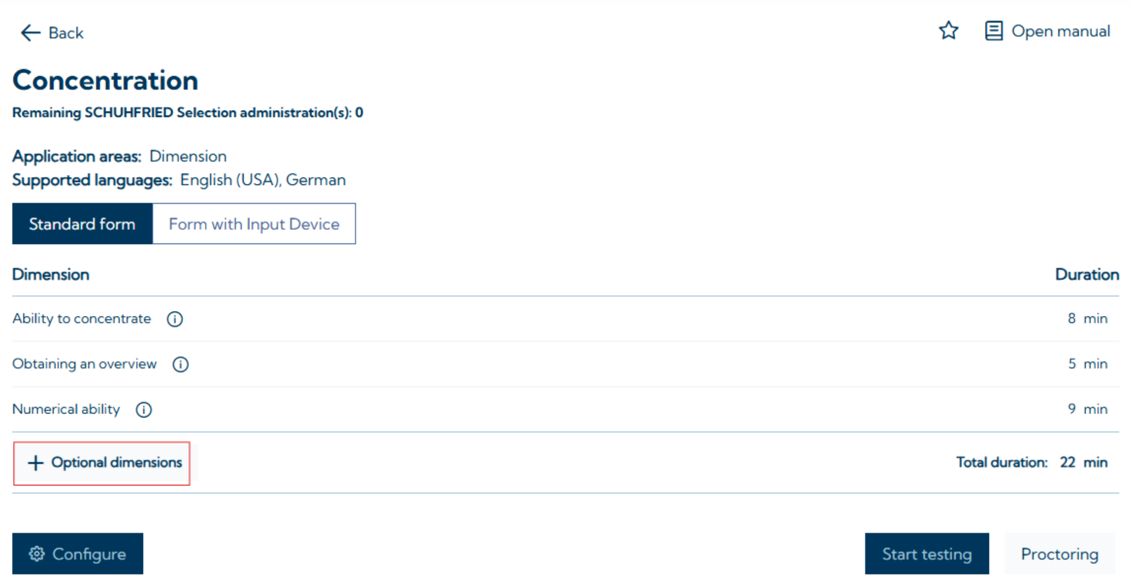
Figure 4 Optional dimensions

You can choose from all tests in the SCHUHFRIED Selection that are not already included in the original test solution. Please note that the drop-down list adapts to your initial settings. If you have selected a test solution **without input devices**, only tests that do not require input devices will be displayed in the drop-down list. Switch to the standard form first, if you want to see all available additional dimensions.

6.5.3.2 Testing individual dimensions

Mit den SFS Test Solutions ist es möglich, nach Einzeldimensionen zu suchen bzw. diese einzeln vorzugeben. This means that users can search specifically for skills such as *logical reasoning*, *working memory*, or *reaction speed* using the search bar on the home page. All performance dimensions can be added to the test sequence as individual dimensions. For personality, it is possible to record either the personality structures according to the Big Five (*emotional stability, extraversion, conscientiousness, agreeableness*, and *openness)* or traffic-related personality (*psychological stability, self-control, sense of responsibility*, and *risk avoidance)*. However, the test paradigm only allows for specifications at the test level. If *emotional stability* is to be tested, all other personality factors of the Big Five are also output. The same applies to traffic-related personality.

Aus mehreren Einzeldimensionen können zudem individuelle Testabfolgen erstellt werden. Wählen Sie dafür eine Dimension aus und fügen über *Optionale Dimensionen* weitere relevante Dimensionen der Testabfolge hinzu:

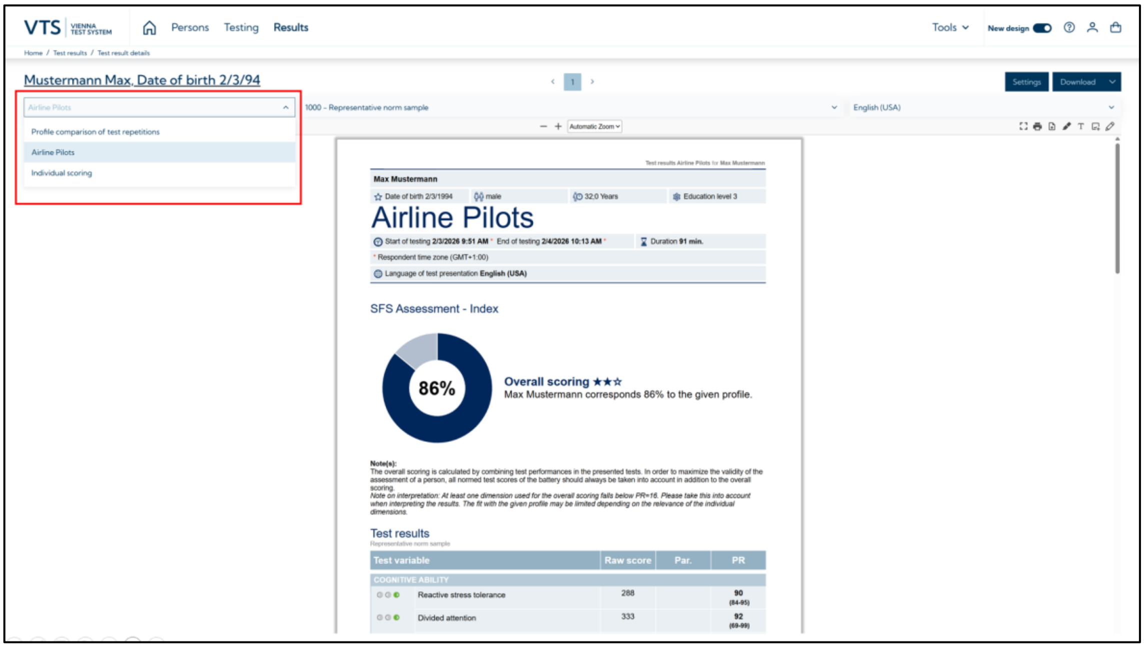


7 NOTES ON EVALUATION AND INTERPRETATION

7.1 General notes on evaluation

By using SFS Test Solutions, users benefit from a **joint results report** that summarizes the test results of all tests included in the test sequence in a single result. This integrated scoring enables efficient and transparent interpretation, as all test results are accessible at a glance.

However, users should inspect the results of the individual tests and take them into account when interpreting the results, as they may contain additional information that influences the interpretation (e.g. relevant subsidiary variables that provide information about the number of errors made when working the test). In VTS, you can easily switch between the different types of result display (see the following screenshot).



Please note that if the predefined test sequence is changed or tests that are not part of the SCHUHFRIED Selection are added, this joint results report will no longer be available automatically. The figure below shows a warning message that is displayed if the configuration of a test solution is changed.

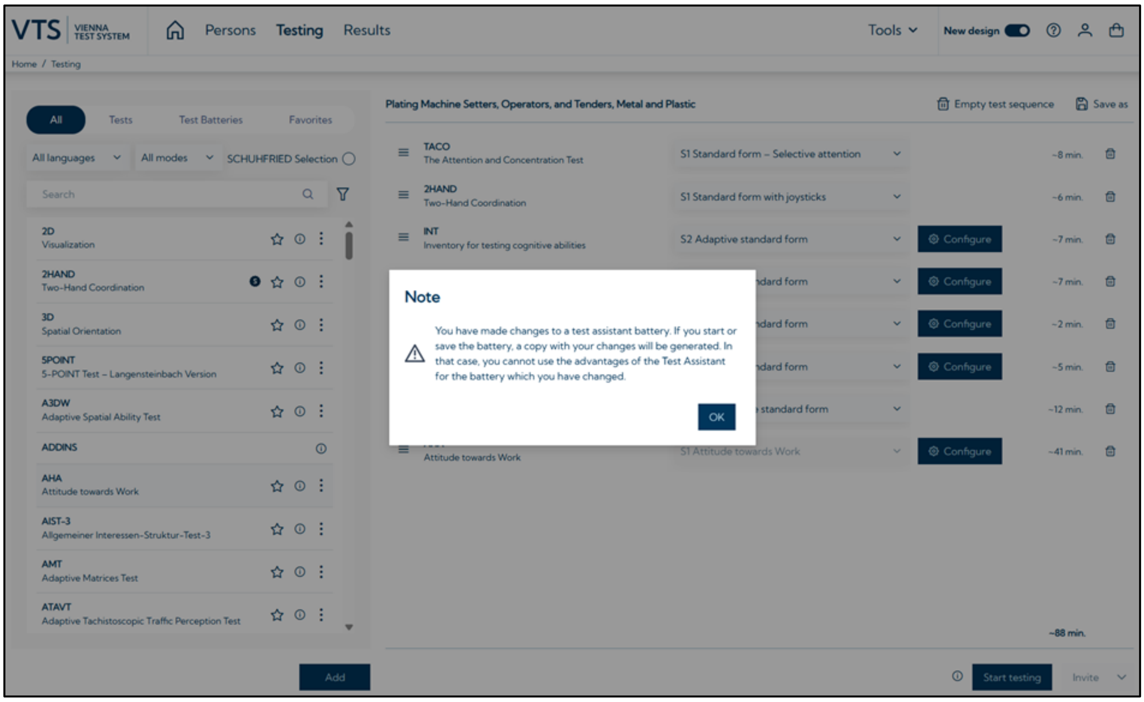


Figure 5 Warning message regarding the joint results report when changing the configuration of a test solution.

7.2 Extended scoring with overall scoring

For certain test solutions, a supplementary **overall scoring** is available in the joint results report. The overall scoring indicates how well the respondent matches an ideal profile. Test solutions that have such an overall scoring are marked with this icon: (for further information, see: Notes on administration).

The overall scoring represents a general, cross-dimensional evaluation calculated from the results of the presented individual tests. To this end, the results in the main variables are z-standardized, weighted, and aggregated into an overall score. Higher percentile ranks in the individual tests always lead to a better fit with the ideal profile.

The weightings of the individual tests are based on empirical studies or scientific findings on the relevance of the tested dimensions for the respective application (the diagnostic question to be answered). In addition, international or professional guidelines are taken into account when determining the relevance of the individual dimensions for certain applications. The weightings for the individual dimensions differ depending on the use case. Which weightings are used and how they were determined is described in the documentation for the individual test solutions (see: Test Solutions).

The overall rating is illustrated in the form of a graph for a quick overview. The center of the graph shows the match to the ideal profile (expressed as a percentage), with higher values indicating a better match. The extent of the match is shown in the graph.

Test results Professional Drivers for Maria Muster

Maria Muster

Date of birth 3/14/1978 | female | 47;5 Years | Education level 4

Professional Drivers

Start of testing **9/2/2025 11:38 AM** * End of testing **9/2/2025 12:05 PM** * | Duration **27 min.**

* Respondent time zone (GMT+2:00)

Language of test presentation **German**

SFS Assessment - Index

76%

Overall scoring ★★☆
Maria Muster corresponds 76% to the given profile.

Note(s):
The overall scoring is calculated by combining test performances in the presented tests. In order to maximize the validity of the assessment of a person, all normed test scores of the battery should always be taken into account in addition to the overall scoring.

Figure 6 Results output for test solutions with an overall scoring.

In addition, for ease of interpretation, the overall scoring, i.e., the fit to the ideal profile, is displayed using a categorization ("star rating"). There are three possible categories (1, 2, or 3 stars). The criteria for each category are listed in the table below. To achieve 3 stars, for example, the respondent's overall score must be above 89 (i.e., 90% or more).

Number of stars	Interpretation	Overall score
3 stars	The test taker's result represents an excellent match to the ideal profile.	> 89
2 stars	The test taker's result represents a solid match to the ideal profile.	45-89
1 star	The test taker's result represents a moderate match to the ideal profile.	< 45

The selected cutoffs for the three categories are based on the established average ranges used for interpreting individual test results in the field of aptitude testing. The cutoff for 3 stars correspond to an overall rating of 90. This value was chosen so that it corresponds approximately to an average percentile rank of 75 in all dimensions included in the overall rating. Accordingly, the cutoff value for 1 star was chosen to correspond to an average percentile rank of 25 in all dimensions included in the overall rating.

> One characteristic of this overall assessment is that a single dimension may be well below average, but still result in a high overall assessment. This may influence the

interpretation (e.g., whether a person is suitable for a particular profession) if the dimension is highly relevant. If this is the case, a corresponding **note** will be included in the results report.
In order to form as valid a judgment as possible based on the test results, all individual test results should always be taken into account in addition to the overall assessment. To make this easier, the performance in the individual tests is indicated at the dimension level for all test solutions that issue an overall rating, using a simple color scheme (**traffic light system**: red-yellow-green). Details can be found in the following section.

7.3 General notes on interpretation

Test results are usually interpreted using percentile ranks. The **percentile rank** indicates what percentage of a specific comparison group has a lower or equal score in this performance or personality trait. A representative sample from the total population is generally used as the comparison group. If this is not the case, this is explicitly stated in the evaluation. For example, a percentile rank of PR = 76 means that 76% of the test takers from the representative standard sample have a lower or equal score and 24% have a higher score in this performance or personality trait.

- A percentile rank of up to 24 indicates a below-average score for the relevant performance or personality trait compared to the representative norm sample.
- A percentile rank of 25 to 75 indicates that the performance or personality trait in question is average compared to the representative norm sample.
- A percentile rank of 76 or above indicates an above-average level of the relevant performance or personality trait compared to the representative standard sample.

In the SFS Test Solutions, that include an overall scoring, a simple color scheme (**traffic light system**: red-yellow-green) is used to indicate performance in the individual tests.

- A *red* mark on a test result indicates that a test taker has performed significantly below average. The threshold value corresponds to a percentile rank of 15.

- A *yellow* marking on a dimension indicates a slightly below-average performance by a test taker. The threshold value corresponds to a percentile rank of 25.

- Dimensions marked *in green* indicate an average performance by the test taker. Here, the test taker achieved a percentile rank in the range of 25 to 100.

In addition to comparing the test results with the norm sample, the individual **profile** should be taken into account when interpreting all test batteries in order to identify individual strengths and areas for development.

In addition, **confidence intervals** can be taken into account in the interpretation. The confidence interval takes into account the measurement accuracy (reliability) of a test and is a defined range (around the measured test score) within which the true value of the performance or personality trait lies with a certain probability (usually 95%). The confidence intervals are included in the results report by default.

The standard scoring provided by SFS Test Solutions offers a **joint result report.** However, this does not show all the details that are available in the individual test results. **Warnings** and detailed information that are output in the **test protocols** are **not displayed** in the joint result report, for example. Therefore, the individual test results and the corresponding test protocol should always be taken into account when interpreting the results.

At the level of individual test results, it is possible to check whether the testing was conducted as expected or whether, for example, **any anomalies occured during testing**. These could include, for example, an above average number of errors, which could indicate comprehension difficulties in completing the tasks, very short or long working times or conspicuous response patterns.

To verify this, the **test protocol** of individual test results provides information at the item level. This allows you to track which answer options were selected, how they were evaluated (e.g., correct or incorrect), and the working times.

The joint results report and, if applicable, the overall scoring should only be used to form an opinion after the individual test results and test protocols have been checked to ensure that the testing was carried out correctly.

7.4 Feedback to the test taker

The aim of the feedback talk is to provide those affected with appropriate information about the results of the diagnostic process in a transparent, respectful, and objective manner. The feedback should therefore provide information about the objectives of the testing, the assessment procedures used, and, if applicable, additional information that was taken into account in the final assessment. The methodology of the procedures used should be explained in a comprehensible manner and the content collected and, if applicable, the relevant theories should be explained in a way that is understandable to laypersons. The results of the assessment should be explained objectively and without bias. All questions and follow-up questions from the candidates should be answered adequately. In addition, the respondent's feedback on the testing should be taken into account (e.g., whether all tasks were understandable).

For this reason, sufficient time should be allowed for the feedback discussion. In practice, it is advisable to ensure an open and trusting atmosphere for the feedback discussion by introducing a few words. Even below-average test results should be communicated openly, but with the necessary sensitivity, so that intra-individual strengths as well as areas for development can be highlighted. In addition, test takers should be informed about possible influencing factors that may affect the test results, such as their condition on the day (tiredness), nervousness during testing, or similar.

In personnel selection, it is not always advisable to pass on the results to the test takers in written form without comment, as the results could be misinterpreted. Even if the results reports contain extensive information and explanations for the candidate, questions may still arise. The candidate should be informed that they are welcome to take notes during the feedback meeting. In the case of potential analyses, however, it may be useful to provide the candidate with a written, verbalized summary of the results.

The test results constitute sensitive personal data and should be treated in accordance with applicable data protection guidelines (e.g., GDPR).

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