DEEPER
SIGNALS

The Core Drivers Diagnostic

Technical
Manual

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Executive Summary

Scientific research has consistently demonstrated personality, defined as stable dispositions in how one thinks, feels, and behaves, to be a significant predictor of work-related outcomes. It is now common practice for organizations to use personality assessment tools in their talent management strategies, using such insights to shape how they select, develop or promote employees, teams and leaders. In fact, such tools are found to have incremental validity in their prediction of job performance over widely used methods such as interviews, resumés, and education, while being free from adverse impact and group bias.

While many organizations use personality assessments in their talent management strategies, from individual contributor to leadership roles, the most popular tools are confounded by their length, poor use of technology, and inaccessible insights. Together, this creates a poor user experience where respondents do not enjoy taking the assessment nor can they fully understand the generated report feedback. Furthermore, these factors restrict an organization's ability to deploy personality assessments at scale. As a result, talent is often overlooked and undeveloped, while leaders make ill-informed human capital decisions. Overcoming these limitations was the motivation to develop the Core Drivers Diagnostic.

The Deeper Signals Core Drivers Diagnostic is a personality inventory based on the Five Factor Model — the most scientifically validated and defensible model of personality. The Core Drivers Diagnostic consists of 60 items, where respondents have to choose an adjective from a pair that best describes them. The diagnostic is administered on a modern, secure and regulation compliant technology platform ("The Deeper Signals Platform"[1]). Upon completion respondents are presented with an interactive and intuitive report that describes their results.

The Core Drivers Diagnostic was developed using over 35,000 working adults, psychometric techniques, and machine learning methods. This report describes the diagnostic's psychometric properties. Specifically, the scales' reliability, factor structure and intercorrelations, alongside construct (convergent & discriminant) and concurrent validity. Scores on the Core Drivers dialogistic correlate with many popular psychometric constructs and inventories, such as The Big Five, Dark Triad, and the Hogan Personality Inventory, in addition to employee engagement, counterproductive work behaviors and self-reported measures of job performance. The diagnostic was also tested for adverse impact, of which there is none. The diagnostic does not discriminate between protect groups.

The Core Drivers Diagnostic was designed for working adults, in individual contributor, management, and leadership roles. The tool can be used to inform talent management decisions, coaching, team development, training, and to support organizational change. If the diagnostic is to be used for selection purposes, a local validation study must be conducted first and should not be the sole data point used in a decision-making process.

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[1] A full technical paper that describes the platform's architecture and security is available upon request.

Assessment Characteristics

This chapter describes the key characteristics of the Core Drivers diagnostic, specifically how the diagnostic can be used, intended audiences and an overview of the report insights. This chapter has been created to help practitioners and stakeholders evaluate the Core Drivers diagnostic and assess it suitability within their organizations.

ASSESSMENT SCOPE

The Core Drivers diagnostic contains six scales that are based on the Five-Factor model of personality (Chamorro-Premuzic & Furnham, 2010), the most scientifically supported personality model. The next chapter describes the scales in more detail; however the six scales are:

- **Agreeableness** — The tendency to be candid or considerate.
- **Conscientious** — The tendency to be flexible or organized.
- **Drive** — The tendency to be laid back or driven.
- **Extraversion** — The tendency to be reserved or outgoing.
- **Openness** — The tendency to be pragmatic or curious.
- **Emotional Stability** — The tendency to be passionate or stable.

Featuring 60 force-choice items, participants have to choose which adjective from a pair best describes them. It takes between five to ten minutes to complete the diagnostic.

Participants complete the assessment on the Deeper Signals platform. This platform features a modern user interface and designed for mobile devices, while providing a safe, secure and private online experience that is GDPR compliant.

The Core Drivers diagnostic is quick to complete and engaging. Compared to other commercial assessment, the Core Drivers was designed to be deployed to large volumes and provide insight fast and effortless. That said, its validity ensures that the diagnostic is accurate and can be an important tool in "high touch" development engagements.

HOW CAN THE DRIVERS DIAGNOSTIC BE USED?

As Sartre pointed out, when we try to know ourselves, we can only use the knowledge provided to us by other people – it is hard to know oneself from the inside. Another way of saying this is that insight is more meaningfully provided from the outside. Since insight and feedback are the main force for change and development, the Core Drivers diagnostic is designed to provide self-awareness in a variety of ways. Organizations will want to use the Core Drivers diagnostic in order to:

1. **Apply scientifically validated and unbiased insight**s. Humans are biased decision makers. The Core Drivers diagnostic provides scalable, bias free, and scientifically validated data to:

- o Improve employee selection and development decisions
- o Guide leadership development
- o Understand the values of an organization
- o Shape team composition
- o Help organizations harness the cognitive diversity of its people.

2. **Empower change through self-awareness.** The Core Drivers diagnostic highlights behaviors with the biggest potential for change. This enables the individual to gain insight into their strengths and weaknesses and target effort in the most appropriate areas. Providing insight and understanding of internal states and traits has been shown to have meaningful effects on change, in-group identification and inter-personal liking.

3. **Identify critical gaps for training and development.** Most organizations practice a "one size fits all" approach to development, although of course this actually fits no one. Not everyone is open to change, or approaches development in the same way nor even needs the same amount of training. The Core Drivers diagnostic helps personalize development plans.

4. **Demonstrate the effectiveness of interventions**. As the old adage has it, you cannot manage what you don't measure. The Core Drivers diagnostic help individuals track progress towards their behavioral goals. Contrary to long standing beliefs, recent evidence demonstrates that behavioral dispositions can be impacted by well-designed interventions (Roberts et al., 2017).

5. **Leverage data to help organizations understand their workforce.** All organizations have problems. Most of those problems are to do with people. And most people problems are due to a lack of understanding. The Core Drivers diagnostic can help organizations better understand their people and its cognitive diversity.

TARGET AUDIENCE

The Core Drivers Diagnostic was designed to be used in talent management contexts. Specifically, it can be used to inform talent decisions for those working in individual contributor, management and leadership roles. The assessment is industry agnostic, and scores are not impacted by previous vocational or educational experiences. The assessment was not designed to be used by anyone under the age of 18. The diagnostic was developed for English speakers; however, translations are available upon request. When translating the diagnostic, replication studies would be conducted to ensure there is measurement invariance between English and non-English versions.

REPORT FEEDBACK & INSIGHTS

Once the diagnostic has been completed, respondents are presented with an automatically generated report. The report has three sections, *Core Drivers, Teamwork, Potential*. The follow section will describe each of these sections.

CORE DRIVERS

The diagnostic is built upon a scientific and empirical model, while leveraging the intuitiveness and ease of tools such as the Myers-Briggs Type Indicator. Rather than overwhelming the respondent with many scales and percentage scores, we only present feedback on their most extreme three scores. This is determined by comparing their scores to the normative database and identifying the three scales that deviate furthest from the sample mean. As a result, respondents are given three adjectives that describe their Core Drivers. For example, an individual with very low Agreeableness and Openness scores, and high Emotional Stability scores would be described as Candid, Pragmatic and Stable (see next chapter for a list of all possible Core Drivers). To help the respondent quickly get to insight and understanding, we do not provide feedback on scores that do not widely deviate from the mean, although this data is available to platform administrators.

In the Core Drivers section of the report, respondents will find two sub-sections labelled "Your Drivers" and "Your Extremes". The first tab describes their three Core Drivers through the lens of them being a strength. That is, how they positively impact their life at work. The second tab describes how these Core Drivers, while strengths, can create problems and get in the way of achieving their goals. The feedback contained in this tab is development focused and is designed to raise their awareness to potentially derailing behaviors so you can better manage them.

TEAMWORK

The second section is titled "Your Teamwork" and describes how an individual's Core Drivers impact the way they interact and relate with others and when working in a team. Based on their most dominant driver, they are designated a Team Role — this is the role that they are most likely play in group settings. There are six possible Team Roles:

1. **The Director**: Directors push the team forward and direct operations. They are comfortable taking charge of others and being the leader. They engage relationships to build collaboration and orientate the team around shared goals.
2. **The Innovator**: Innovators are inventive and produce ideas to help others see things differently. More than most, they want to see novel solutions to problems and won't be satisfied with the status quo. They are effective at generating creative solutions to ambitious problems.
3. **The Empathizer**: Empathizers are primarily interested in the needs and feelings of others. They build harmony and cohesion among teammates, and make sure that

conflict is quickly resolved. They can keep energy and collaboration alive in the group and build bridges between people.

4. **The Project Manager**: Project Managers have high standards and keep the team practical and focused. They value process, details and completion. They are skilled at keeping the team working against deadlines. Organized and efficient, they help set up the team for success.

5. **The Networker**: Networkers build connections both within and outside the team. They can help the team expand what it believes is achievable. They use their connections to identify new opportunities for the team, ensuring that they always have valuable problems to solve.

6. **The Team Player**: These are people who can be counted on to deliver high quality work. An essential team player, once given direction they are can trusted on working hard and playing their part. They pull their weight and won't let others down.

Again, based on an assigned Team Role, there are two additional sub-sections providing additional insight about the relative strengths ("At your best") and limitations ("At your extreme"). This feedback was designed to give the respondent with additional insight on the talent and value they can bring to teams, while providing tips around behaviors that may contribute to poor team performance, group conflict, and general ineffectiveness.

POTENTIAL

The final section of the report is "Your Potential". This section provides practical advice and tips to help individuals leverage the awareness gain from the previous report sections to help them achieve their goals, improve problematic behaviors, and help live a more satisfying and productive life.

The first sub-section, "Spark", describes what tasks, jobs, and environments the respondent is likely to find the most engaging and energizing. This awareness is helpful when the respondent is trying to identify a new career or decide what projects they should work on.

The second sub-section, "Knowledge", contains a carefully curated set of articles, videos and podcasts. Pulling from a huge library of content from leading scientists, thinkers and thought leaders, each piece has been selected based on the individual's personality profile. This content will help individuals gain further insight into the themes explored in the report.

The third sub-section, "Work Skills", describes how an individual typically perform three skills that are central to top performance at work — the ability to handle stress, make tough decisions, and solve challenging problems. Here, we describe they normally display these behaviors and ways that they can improve doing so.

The fourth sub-section, "Habits", describes three micro-habits that the individual can begin to practice. Again, these are unique to their personality profile and designed to help them

make simple changes and improvements to their behaviors so that they can more successfully achieve their goals.

The last sub-section, "Interests", describes specific recreational activities the individual may want to explore. There is more to life than work, and it is important for wellbeing to make space for downtime and hobbies. Based on an individual's scores, we provide a list of activities that match their profile and links to Meet Up (a website to support hobby-focused communities), so they can meet more like minded people.

Theoretical Rationale

Understanding other people is the consuming interest of nearly everyone. As an intensely social species, we are fascinated by trying to predict or explain the choices, preferences and peculiarities of the people in our lives. That's in order to make our interactions and relationships more rewarding and less stressful, or to improve our chances of influencing other people to do things that we want.

Although there are 7 billion people on the planet science has shown that although we like to think we are each unique, yet our behavior varies on a relatively small number of dimensions. Equally, while people change through the life span, the fact is that an individual's character has a behavioral "center of gravity". If you are a cheerful, disorganized teenager, you are more than likely to become a cheerful, disorganized pensioner. If you are an irascible and micromanaging marriage partner there is little chance that you transform into an even-tempered and empowering leader when you arrive at work.

Many of the problems people encounter in their relationships with others (whether at work or play or in love) are due to a lack of understanding. That has driven the growth of popular profiling tools like the MBTI, which puts people into one of 16 boxes, and assigns each one a 4-letter code. Although easy to understand, tools like this are flawed and inaccurate. In response scientists have pursued the development of more scientific and data-driven aids to provide insight and understanding of our own and others' personalities and behaviors.

The scientists at Deeper Signals (DS) have created a tool based on modern science that is easy to use and self-explanatory. This approach provides organizations and individuals with personalized and data-driven feedback to help them unlock their potential, work more productively with others and create lasting behavioral change. The following chapter describes the theoretical framework and rationale for the Core Drivers diagnostic.

THE FIVE FACTOR MODEL OF PERSONALITY

The central issue in personality research is not what personality traits are or whether personality traits exist or are useful, but, rather, which personality traits should be assessed. In the past twenty years, psychologists have provided compelling evidence for the fact that individual differences in personality can be classified on the basis of five major traits, namely Emotional Stability, Extraversion, Agreeableness, Conscientiousness and Openness to Experience.

Indeed, many psychologists believe that these traits capture the essence of interindividual variability by providing a general level of description of the person, which, if valid, should help us predict how people will behave in the future. Compared to other personality models the "Big Five" serve as a common currency and universal language in personality research and can be converted or translated into many different taxonomies. Accordingly, assessments built upon a "Big Five" model offering practitioners a degree of robustness and versatility when looking to identify, assess and predict future behavior.

It is noteworthy that although personality traits were neither identified to predict behavior at work nor for the purpose of talent management, and even though personality is supposedly unrelated to cognitive ability, the fact that personality traits describe general and consistent differences between individuals means they are useful also in the context of personnel selection, as predictors of work-related behaviors. In fact, the taxonomy has been found to predict a host of life and work-related outcomes (Chamorro-Premuzic & Furnham, 2010). We will now explain some of the research that has demonstrated the predictive validity of the Five Factor Model.

CONSCIENTIOUSNESS
Conscientiousness describes the extent to which an individual can be described as competent, orderly, dutiful, achievement orientated, disciplined and determined. This dimension has been found to be a consistent predictor of job performance and training proficiency, with meta-analytic coefficients rivaling that of cognitive ability (Mount & Barrick, 1998). To quote these researchers, "individuals who are dependable, persistent, goal directed and organized tend to be higher performers on virtually any job; viewed negatively, those who are careless, irresponsible, low achievement striving and impulsive tend to be lower performers on virtually any job." (p.851).

EMOTIONAL STABILITY
Emotional Stability describes the extent to which an individual is not anxious, hostile, impulsive, depressive, or overly self-conscious. Emotional Stability describes the inverse of what is called Neuroticism. Emotional Stability has been linked to job and training performance particularly under stressful conditions (Chamorro-Premuzic, 2007). Although meta-analytic research on the impact of Emotional Stability on work outcomes has been mixed, recent theories have postulated that the relationship between Emotional Stability and performance is curvilinear, where too high low on the dimension lowers performance. This explains why, under some circumstances, notably low situational pressure or tasks that are under-arousing, Neurotic individuals have an advantage over their stable counterparts because they are naturally more alert to potential environmental threats. In line with this, studies on air traffic controllers tend to report superior performance by Neurotic individuals (Matthews, 1999).

EXTRAVERSION
Extraversion describes the extent to which an individual is gregarious, proactive, assertive, excitement seeking and displays positive emotionality. Individuals that score low on this dimension can be described as *Introverted*. Extraversion scores have been found to predict sales performance, managerial effectiveness, and leadership emergence (Mount, Barrick & Stewart, 1998). Further, some researchers have argued that the dimension can be divided into two separate sub-dimensions: one describes the sociability and gregariousness of Extraversion, while the other describes the drive, ambition and proactivity (Hogan & Hogan, 2007; Judge & Kammeyer-Meyer, 2012). Thus, some Extraverts may be characterized more by

their tendency to experience positive affect, be sociable and enjoy the company of others (as well as dread being alone), whilst in other Extraverts the main trait would be dominance, self-confidence and leadership.

AGREEABLENESS

Agreeableness describes the extent to which an individual is trusting, altruistic, modest, empathetic and compliant. Agreeableness is advantageous in jobs requiring interpersonal interactions or where getting along is paramount (Mount et al., 1998). A typical case is customer service jobs, and indeed Agreeableness has been found to predict performance on these jobs quite well (Hurtz & Donovan, 2000), especially if based on teamwork rather than individualistic tasks (Barrick, Stewart, Neubert & Mount, 1998). Agreeableness also seems to moderate the effects of Conscientiousness – the strongest personality trait correlate of job performance – or work-related outcomes (Witt & Ferris, 2003). Thus, people who are Conscientious but Disagreeable will tend to have conflicts with others, whereas people who are Conscientious and Agreeable will benefit from the synergistic effects of discipline and cooperation. Continuing this, low Agreeableness scores are related to counterproductive work behaviors and social deviant behaviors that can disrupt others and harm performance (Mount, Ilies, & Johnson, 2006).

OPENNESS TO EXPERIENCE

Openness to Experience describes the extent to which an individual is driven by fantasy, artistic, feeling-oriented, action-oriented, ideational and having liberal values. Openness is often related to intellectual outcomes and activities, such as curiosity and learning agility, while a predictor of performance for those working artistic roles and environments (Ackerman & Haggestad, 1997; Kaufman et al., 2016). Furthermore, it related to holding more tolerant and inclusive attitudes, increased levels of cognitive ability, and producing more innovative output (Akhtar, Humpheys & Furnham, 2015; Lee et al. 2010; Leutner, Ahmetoglu, Akhtar & Chamorro-Premuzic, 2014). Individuals scoring low on this dimension typically think in more conservative ways, solving problems in a practical and pragmatic way, uninterested in abstract ideas, and unlikely to invest time into intellectual activities (Chamorro-Premuzic, 2007).

THE CORE DRIVERS MODEL

Given the evidence reviewed in the previous section, the decision to base the Core Drivers on the Five Factor model of personality was made. The Core Drivers diagnostic measures six global dispositions. There are two DS labels for each of the Big Five scales, one representing the high side of the scale and one representing the low side of the scale. We further divide Extraversion into two scales, Extraversion - gregariousness and Extraversion – proactivity, distinguishing between the outgoing and sociable dispositions of Extraversion and the ambitious, driven and energetic dispositions. A summary of the DS Core Drivers and how they relate to the Five Factor Model of personality can be seen in Table 1. For ease, when discussing the Core Drivers and reporting their psychometric properties we refer to their high label.

Table 1: The Deeper Signals Core Drivers Model

Core Drivers Low Label	Five Factor Model Dimension	Core Drivers High Label
Candid Critical and strong-minded	Agreeableness	Considerate Accommodating, cooperative, friendly
Flexible Flexible, reactive, impulsive	Conscientiousness	Disciplined Organized, reliable, deliberate
Reserved Reserved, quiet, introspective	Extraversion - *Gregariousness*	Outgoing Sociable, outgoing, chatty
Laid Back Laid-back, easy-going, unassuming	Extraversion – *Proactivity*	Driven Ambitious, risk-taking, goal-orientated
Pragmatic Pragmatic, practical, straightforward	Openness	Curious Creative, intellectual, inquisitive
Passionate Passionate, anxious, self-critical	Emotional Stability	Stable Emotionally stable, calm, relaxed

Assessment Development & Psychometric Overview

The following chapter first describes the process and methodology used to develop the Drivers diagnostic. We then present the diagnostic's psychometric properties, specifically descriptive statistics, estimates of internal consistency, and intercorrelations. Last, we also describe how machine learning methods were used to create a "short form" version of the diagnostic.

ITEM DEVELOPMENT & VALIDATION

A scientific and robust development process was used to create the Drivers diagnostic. First, Subject Matter Experts (SMEs) with advanced degrees in I-O psychology and psychometric assessments reviewed the scientific literature on the Five Factor model of personality, alongside more recent taxonomies such as the HEXACO model (Goldberg, 1992; Lee & Ashton, 2004; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007; Saucier, 1994). This led to the identification of six behavioral domains most predictive of personal and professional success: the tendency to be *Considerate, Disciplined, Driven, Outgoing, Curious and Stable.*

Utilizing this behavioral taxonomy, the SMEs generated a pool of items hypothesized to measure the affect, cognitions and behaviors characteristic of the six behavioral domains. The diagnostic was designed so that participants choose between one of two adjectives that best describe themselves. Each adjective represents either end of the behavioral continuum. Examples include: "irritable" v "docile" (*Stable*), "quiet" v "talkative" (*Outgoing*), "collaborative" or "competitive" (*Driven*), "disorganized" v "obsessive" (*Disciplined*), "straightforward" v "respectful" (*Considerate*), "pragmatic" v "theoretical" (*Curious*). This forced-choice adjective format was chosen over traditional item statements to provide an improved testing experience and to counter the tendency for some to "fake good" (Meade, Pappalardo, Braddy, & Fleenor, 2018). These were adjective pairs were tested by the SMEs for face and content validity, critiqued, refined and winnowed down to a potential pool of 175 adjective pairs comprising ~30 for each for the six domains.

Second, the adjective pairs were tested for social desirability. Given the forced choice nature of the items, it was critical that either option is equally desirable or undesirable. To achieve this, a total sample of 15,148 working US adults to responded to each adjective pair. Any pair that had an adjective which was endorsed by more than by more than 60% of the sample were discarded. This reduced the item pool to 83 adjective pairs.

Third, we sought to further reduce the number of adjective pairs and retain those that created scales with the best psychometric properties. This was achieved by using data from a sample of 1,051 working adults and statistical techniques (i.e. descriptive statistics, item correlations, measures of internal consistency, exploratory & confirmatory factor analysis). Such a process revealed a clear factor structure, with six scales each consisting of 10 items and have good levels of internal consistency (see next section for psychometric properties). This analysis produced the final pool of item pool of 60 adjective pairs.

Fourth, we tested the diagnostics' construct and criterion validity. To achieve this, we collected three samples of working adults (Sample 1 N = 374, Sample 2 N = 2,218, Sample 3 N = 928). All samples completed the Drivers diagnostic, alongside a battery of psychometric inventories. Specifically, measures of the Five Factor Model, the Dark Triad, vocational interests, work engagement and self-reported job performance. Collecting data from multiple samples allowed us to test the stability and generalizability of the diagnostic's psychometric properties and validity.

Fifth, having established the psychometric properties and validity of the diagnostic we decided to further reduce the size of the diagnostic and create a "short-form". A short-form version of the diagnostic is of practical value as personality insights can still be collected where there are significant time or resource constraints, alongside reduce assessment fatigue if it is a part of a larger battery of inventories (Gosling, Rentfrow, & Swann, 2003). A sample of 928 US working adults completed the 60-item Drivers diagnostic and a measure of the Five Factor model. We then used a cross-validated genetic algorithm to reduce the size of the diagnostic by half, following a methodology used before with great success (Yarkoni, 2010). This algorithm identified 30 adjective pairs (five per dimension) that were found to hold good internal consistency and construct validity.

The final step involved building a normative database so that an individual's scores can be compared, benchmarked against a representative population, and tested for adverse impact. To achieve this, we aggregated all data that had been previously collected. In sum, data was collected from over 35,000 working adults to develop and validate the Drivers diagnostic. The following chapters describes the results of these analyses and the psychometric properties of each scale.

DESCRIPTIVE STATISTICS, RELIABILITIES & FACTOR ANALYSIS

The descriptive statistics for the six scales are presented in Table 2. For each scale, the mean score and its standard deviation are presented alongside the minimum and maximum scores, and an estimate of the scale's reliability.

Each item uses a force-choice response method whereby adjectives are either keyed with a '0' or '1'. With ten items per scale, scores can range between zero and ten. As an example, individuals selecting positive for every item from the Considerate scale will obtain a score of ten, implying that they are friendly, warm and act with integrity, whereas a score of zero would indicate that the individual is straightforward, candid, and manipulative.

When aggregating the data collected, the average score for each scale falls within similar ranges and the standard deviations are comparable. Respective minimum and maximum scores indicate that a wide range of scores were reflected. Further, the scales are normally distributed as evidenced by the Skewness and Kurtosis scores. Finally, the scales display acceptable levels of internal consistency (estimates greater than >.60 are desirable) suggesting that participants respond to each item in a consistent manner (Cronbach, 1951).

Table 2: Descriptive Statistics & Reliabilities.

Scale	N	M	SD	Med	Min	Max	Skew	Kurtosis	α
Considerate	1,712	5.42	2.53	6	0	10	-.14	-.75	.68
Discipline	7,173	5.56	2.79	6	0	10	-.15	-.97	.76
Drive	5,854	4.61	2.95	5	0	10	.10	-1.07	.80
Outgoing	6,820	4.63	2.93	5	0	10	.08	-1.12	.80
Curios	7,352	4.97	2.56	5	0	10	-.04	-.85	.70
Stable	6,237	4.90	2.19	5	0	10	-.04	-.59	.61

Note: M = Mean, SD = Standard Deviation, Med = Median, Min = Minimum, Max = Maximum, Skew = Skewness, Kurt = Kurtosis; α = Cronbach's alpha.

Table 3 displays the results of a Principal Components Analysis (PCA) with a varimax rotation. As standard practice, a Scree plot was inspected to identify the number of factors to extract. This indicated 5 components. Upon extracting 5 components and inspecting the rotated pattern matrix, items loaded on distinct components as hypothesized. The items belonging to the Driven scale cross-loaded across the Outgoing (positively) and Considerate (negatively) components. This was expected as the scale is a lower order behavioral dimension (Mount, Barrick, Scullen, & Rounds, 2005). Overall, the PCA explained 34% of the variance. Components one and two explained accounted for the most variance (10% & 8%, respectively), followed by component 3 (6%) and components 4 and 5 (5% each).

Table 3: Results from a Principal Components Analysis

Item	1. Outgoing / Driven	2. Considerable/ Driven	3. Disciplined	4. Stable	5. Curious
CON-1		.42			
CON-2	-.32	.32			
CON-3		.40			
CON-4		.55			
CON-5	.42	.34			
CON-6		.51			
CON-7		.36			
CON-8		.56			
CON-9		.47			
CON-10	.36	.47			
DIS-1			.39		
DIS-2			.36		
DIS-3			.46		
DIS-4			.64		
DIS-5			.59		
DIS-6			.58		
DIS-7			.49		
DIS-8			.59		
DIS-9			.60		
DIS-10			.65		
DRI-1	.49			.39	

Item					
DRI-2	.42	-.28		.39	
DRI-3	.19	-.61			
DRI-4	.20	-.55			
DRI-5	.19	-.37		.35	
DRI-6	.31	-.29		.30	
DRI-7	.13	-.54			
DRI-8	.22	-.42			
DRI-9	.28	-.40			
DRI-10	.29	-.38		.33	
OUT-1	.42				
OUT-2	.67				
OUT-3	.69				
OUT-4	.70				
OUT-5	.63				
OUT-6	.59				
OUT-7	.51	-.39			
OUT-8	.70				
OUT-9	.50				
OUT-10	.50				
CUR-1					.62
CUR-2					.56
CUR-3					.44
CUR-4		-.36	-.31		.37
CUR-5					.14
CUR-6			-.45		.23
CUR-7					.41
CUR-8					.60
CUR-9					.57
CUR-10					.66
STA-1				.53	
STA-2				.13	
STA-3				.60	
STA-4	.53			.35	
STA-5				.52	
STA-6				.44	
STA-7	.32			.41	
STA-8				.50	
STA-9		.53		.40	
STA-10				.51	

Note: N = 929. CON = Considerate, DIS = Disciplined, DRI = Driven, OUT = Outgoing, CUR = Curious, STA = Stable. For presentation purposes, item loadings greater/less than ± .30 are not shown. Exceptions were made to highlight where items loaded on to scale-congruent components.

THE INTER-CORRELATION BETWEEN SCALES

Table 4 displays the correlation between the six scales. These correlations were computed to understand how scores on the six scales are related to each other. Replicating other analyses that have correlated the Five Factor model (Rushton & Irwing, 2008), the Drivers' scales are mostly correlated with each other. There are some relationships that are worth discussing.

First, Driven is negatively correlated with Considerate and Disciplines scores, while positively correlated with Outgoing scores. Given that the Driven scale samples a lower order behavioral domain, such relationships were hypothesized. These relationships are also reflected in the PCA analysis presented in Table 3. Second, Disciplined is negatively correlated with Curious scores. This suggests that organized and dependable individuals are somewhat unlikely to be curious and creative, a relationship supported by existing literature (Furnham, Zhang, & Chamorro-Premuzic, 2005). Third, the Outgoing, Driven and Curious scales are positively correlated with each other suggesting that sociable individuals are more ambitious and open minded. Last, the positive correlation between the Considerate and Stable scales suggest that friendly and empathetic individuals are emotionally stable and not prone to feelings of anxiety.

Table 4: Scale Correlations

	Considerate	Disciplined	Driven	Outgoing	Curious	Stable
Considerate	—					
Disciplined	.17*	—				
Driven	-.41*	-.19*	—			
Outgoing	.00	-.19*	.51*	—		
Curious	-.05	-.41*	.15*	.23*	—	
Stable	.18*	-.03	.28*	.32*	.05	—

Note: N = 938. * p < .05.

CONSTRUCTING A SHORT-FORM DIAGNOSTIC

It goes without saying that researchers and practitioners should always seek to use tools that have the best psychometric properties however the length of such tools may inhibit the collection of psychological data. As such, recent years have seen a growth of "short form" psychometric tools, with one of the most popular being a ten-item Big Five inventory (Gosling et al., 2003). Short forms allow researchers and practitioners to collect psychological data in contexts where they are significant restraints around respondent's time and attention (Yarkoni, 2010). In "high stakes" contexts, the most rigorous tools should be used. However, in developmental or research contexts a short-form would suffice. Given this rationale, a decision was made to create a short-form of the Drivers diagnostic.

To create a short form of the Drivers tool that was psychometrically robust, machine learning methods were used. Specifically, we replicated Yarkoni's (2010) use of genetic algorithms. This algorithm uses evolutionary principles to identify a subset of items that produce an optimal correlation with a dependent variable. In this case, the genetic algorithm trained the

Drivers items against the International Personality Item Pool's (IPIP) measures of the Big Five and Ambition (Goldberg et al., 2006). Using a sample of 928 individuals, the algorithm was specified to identify five items from each scale. The data was split into a training (N = 650) and test (N = 278) set, with the former used to train the algorithm and identify the optimal items and the latter used to evaluate the performance of the algorithm. Model performance was evaluated using the R2 statistic. The algorithm was initialized with a population of 100 and iterated over 200 times. For a full description of how this machine learning algorithm works please see (Yarkoni, 2010). This process was repeated for each Drivers scale. At the end of this process, the algorithm identified 30 items that form the "Drivers Short Form" diagnostic ("Drivers – SF").

Table 5 displays the psychometric properties of the Drivers – SF. Total scores for each scale can range between zero and five. Mean scores and standard deviations are comparable across each scale, with Disciplined having slightly higher average scores and Outgoing having slightly lower scores. The scales are mostly normally distributed, with Outgoing displaying a slight positive skew. The reliability for each scale meets or exceeds established cutoffs (Cronbach, 1951), with the exception of the Considerate and Stable scales. Last, each scale holds a moderately sized correlation with existing measure of behavioral domain. When evaluating these results, the Drivers – SF fulfills many psychometric criteria. That said, it is important to highlight when compared to the full diagnostic, it does not perform as well. This is to be expected and not a not entirely cause for concern given the rationale behind short form tools (i.e. insight over psychometric rigor & prediction over reliability; Gosling et al., 2003).

Table 5: Drivers SF - Descriptive statistics, reliability & convergent validity

Scale	M	SD	Med	Min	Max	Skew	Kurtosis	α	r
Considerate	2.57	1.35	3	0	5	-.05	-.76	.41	.35
Disciplined	3.11	1.49	3	0	5	-.40	-.83	.61	.53
Driven	2.33	1.55	2	0	5	.04	-1.08	.69	.64
Outgoing	1.90	1.80	1	0	5	.43	-1.24	.80	.74
Curious	2.34	1.53	2	0	5	.10	-1.02	.60	.46
Stable	2.54	1.50	3	0	5	-.09	-.94	.57	.61

Note: N = 938, M = Mean, SD = Standard Deviation, Med = Median, Min = Minimum, Max = Maximum, Skew = Skewness, Kurt = Kurtosis; α = Cronbach's alpha, r = correlation with an analogous IPIP scales (all correlations were statistically significant, p < .05).

Table 6 contains the correlation between each of the Drivers SF scales. Despite most of the correlations between scales being statistically significant, it is important to explore the size of the correlations. Most of which are small, suggesting that scores are mostly independent of each other. The direction of correlations between the scales are similar to those found in Table 4.

Table 6: Drivers SF - Scale Correlations

	Considerate	Disciplined	Driven	Outgoing	Curious	Stable
Considerate	—					
Disciplined	.01	—				
Driven	-.27*	.02	—			
Outgoing	-.07*	-.10*	.50*	—		
Curious	-.07*	-.26*	.11*	.14*	—	
Stable	.20*	.01	.19*	.10*	-.05	—

Note: N = 938. * p < .05.

Validity

Chapter 4 demonstrated that the scales exhibit good internal reliability and factor structure. In this chapter, we explore the scales' construct validity.

First, we answer the question: "to what extent do scores on the dimensions correlate with well-established psychological constructs?" Where convergent validity tests the extent to which a scale correlates with other variables that are hypothesized to measure a similar behavioral domain, discriminant validity tests the extent to which a scale does not correlate with variables that measure different behavioral domains. Establishing convergent and discriminant validity is important in psychometric construction as it places the scales within a nomological network of psychological constructs. This serves as additional evidence that the scales are measuring the intended behaviors and increases the interpretability of scores. Second, we provide evidence that demonstrates the scale's concurrent validity, thereby answering the questions: "to what extent do scores on the dimensions correlate with relevant work behaviors and outcomes?".

Although the below analyses demonstrate multiple forms of construct validity for the scales, further evidence is needed to confirm the scales' predictive validity. That is, their ability to predict future work outcomes. As stated by the American Psychological Association's guidelines and regulations, it is critical to demonstrate predictive validity if these scales are to be used in applied settings and inform selection or hiring decisions. When used in this way, Deeper Signals will partner with organizations to conduct such validation studies.

CONVERGENT & DISCRIMINANT VALIDITY

The below section describes the measures used to test the convergent and discriminant validity of the scales, alongside the presentation and interpretation of these analyses. To test the scales' convergent and discriminant validity, we chose inventories that were related to the diagnostic's theoretical model, and widely validated within research and applied contexts.

MEASURES

Mini-IPIP Big Five Personality Inventory (Donnellan, Oswald, Baird, & Lucas, 2006)
The Mini-IPIP Big Five inventory is a 20-item version of the widely used IPIP Big Five inventory (Goldberg et al., 2006). It measures five dimensions: Extraversion, Agreeableness, Conscientiousness, Emotional Stability and Openness. The Big Five model of personality has become the *de facto* taxonomy for organizing, describing and measure personality dimensions. The taxonomy has found to predict a host of life and work-related outcomes (Barrick & Mount, 1991). Participants responded to each item using a five-point Likert scale (Strongly Disagree to Strongly Agree).

Hogan Personality Inventory: International Personality Item Pool Form (HPI:IPIP; Goldberg et al., 2006; Hogan & Hogan, 2007)

The HPI:IPIP is a non-commercial version of the HPI — a popular personality assessment used in selection and development contexts. The HPI has been found to predict a range of relevant work outcomes, such as job performance, leadership effectiveness and innovation (for a review, see Akhtar, Humphreys, & Furnham, 2015). The HPI:IPIP measures seven behavioral dimensions: Adjustment, Ambition, Sociability, Interpersonal Sensitivity, Prudence, Inquisitiveness, and Learning Approach. The inventory consists of 70 items, with participants responding to each item using a five-point Likert scale (Strongly Disagree to Strongly Agree). The average correlation between the HPI:IPIP and HPI scales is .70, suggesting a high level of convergent validity between the commercial and non-commercial version of the assessment.

The HEXACO Personality Inventory (Lee & Ashton, 2004)

The HEXACO model of personality consists of six different factors of personality: Honesty/Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness, and Openness along with four facets of each factor. For the purposes of this analysis, participants only completed items from the Honesty/Humility scale. Persons with very high scores on the Honesty-Humility scale avoid manipulating others for personal gain, feel little temptation to break rules, are uninterested in lavish wealth and luxuries, and feel no special entitlement to elevated social status. Conversely, persons with very low scores on this scale will flatter others to get what they want, are inclined to break rules for personal profit, are motivated by material gain, and feel a strong sense of self-importance. Participants were asked their agreement (Strongly Disagree to Strongly Agree) with the statements. The scale consists of 10 items, has high levels of internal consistency and is found to be a valid predictor of life and work outcomes (Lee & Ashton, 2004).

O*Net Mini-Interest Profiler (Rounds, Ming, Cao, Song, & Lewis, 2016)

The O*Net Mini-Interest Profiler is a 30-item inventory that measures an individual's vocational interests and preferences. Based upon Holland's model of vocational Interests, the inventory measures six personality types: *Realistic, Artistic, Investigative, Social, Enterprising and Conventional* (Holland, 1997). Scores on these dimensions are keyed against a U.S. database of jobs (O*Net) and the tool is widely used for career guidance and understanding fit between an individual's personality and a given job.

The Dark Triad Dirty Dozen (Jonason & Webster, 2010)

The Dirty Dozen is a 12-item inventory for The Dark Triad of personality. The Dark Triad represents three broad social malevolent and agentic dimensions of personality: Psychopathy, Narcissism and Machiavellianism. Individuals who score highly on these three dimensions of personality are likely to be callous, uncaring and selfish (Psychopathy), egotistical and over-confident (Narcissism), and manipulative and exploitative (Machiavellianism). These dimensions have been found to predict job performance, engagement and work-related behaviors (Furnham, Richards, & Paulhus, 2013). Participants responded to each item using a five-point Likert scale (Strongly Disagree to Strongly Agree). Each scale was found to have acceptable levels of internal consistency (α > .70).

Social Dominance Orientation (Ho et al., 2015)

Social Dominance Orientation (SDO) measures one's attitude towards supporting inequality between social groups and has been found to play a central role in range of intergroup attitudes and behaviors. The SDO scale consists of 16 items that are rated by a seven-point Likert scale (Strongly Oppose to Strongly Support) and has high levels of internal consistency ($\alpha > .70$). Scores on this scale are correlated with the holding racist attitudes, expressing anti-immigrant sentiment, and endorsing nationalist political policies.

Right-Wing Authoritarianism (Zakrisson, 2005)

Right-Wing Authoritarianism (RWA) describes a willingness to submit to authorities that are perceived as established and legitimate, alongside a tendency to adhere to societal conventions and norms and react with hostility to people who do not adhere to them. High scorers value uniformity and are in favor of using group authority, including coercion, to achieve it. The scale consists of 15 items and participants respond using a five-point Likert scale. The scale has high levels of internal consistency ($\alpha > .70$) and is correlated to SDO scores alongside holding racist and sexist attitudes (Zakrisson, 2005).

CONVERGENT & DISCRIMINANT VALIDITY RESULTS

The following sections describe the convergent and discriminant validity of the Drivers diagnostic. Attention is paid to highlighting and interpreting statistically significant correlations.

CONSIDERATE

The Considerate scale measures the extent to which individuals are compassionate, cooperative and friendly verses argumentative, tough and suspicious. Based upon the Agreeableness dimension from the Big Five (Goldberg, 1992), high scorers are typically prosocial, empathetic and seek to avoid conflict. On the other hand, low scores are willing to break the rules, make tough decisions and act in self-serving ways. Table 7 contains the correlation between Considerate scores and a range of psychological constructs. Exploring the relationship between Big Five and HPI scores, Considerate was positively correlated with measures of Agreeableness and Interpersonal Sensitivity. A positive relationship was expected given that all three scales claim to sample the same behavioral domain. Interestingly, Considerate scores were not correlated with Conscientious scores but were positively correlated with the Prudence scale. Despite the two scales overlapping in sample behaviors, the latter emphases being detail-orientated, organized and reliable. The positive correlation with Prudence suggests that Considerate individuals are likely to also display such behaviors. Considerate scores were unrelated to measures of Neuroticism and Emotional stability. Considerate scores are negatively correlated to Extraversion and Sociability scores suggesting that high scores are not socially outgoing or seek a lot of engagement from others. Last, Considerate scores are unrelated to measures of Openness, Inquisitive and Learning Approach.

The Dark Triad was negatively correlated with Considerate scores, specifically Machiavellianism and Psychopathy. This relationship is in line with existing literature (Furnham et al., 2013). Individuals were low Considerate scores are likely to manipulative, callous and deceitful. High scores are likely to follow rules, honest and empathetic. Studying the relationship between vocational interests and Considerate scores indicates that high scorers are unlikely to be interested in careers that require physical activity and concrete problem solving (Realistic), creative expression and ambiguity (*Artistic*), and leading, influencing or persuading others (*Enterprising*).

Finally, Considerate scores were related to Honesty/Humility scores. Indicating that high scorers have a strong moral compass, act with integrity and fairness, are trustworthy and are not driven by feelings of Greed. Similarly, scores are negatively correlated with SDO, suggesting that High scorers are unlikely to have an unhealthy need to control others and hold favorable attitudes towards group-based discrimination.

DISCIPLINED

The Disciplined scale measures the extent to which an individual is described as being organized, reliable and deliberate, versus flexible, reactive, and impulsive. Based upon the Conscientiousness dimension from the Big Five (Goldberg, 1992), high scorers are typically efficient, self-disciplined and dutiful. Conversely, low scorers are flexible, spontaneous, reactive and impulsive. Table 7 contains the correlation between Disciplined scores and other psychological constructs.

When examining the relationship between Disciplined scores and the Big Five and HPI scales, the scale is positively correlated with Conscientious and Prudence scores. Given that these scales sample the same behavioral domain, high level of convergence was expected. The scale was unrelated to measures of Agreeableness and Interpersonal Sensitivity. Scores were unrelated to Neuroticism as well but held a weak, positive relationship with Adjustment. This suggests that high Disciplined scorers have a slight tendency to be emotionally adjusted, calm and experience low levels of anxiety. Disciplined scores were negatively correlated with measures of Extraversion and Sociability: high scorers are likely to value independence, autonomy, and their own company over interacting and socializing with others. Last, the scale was unrelated to measures of Openness, Inquisitive and Learning Approach.

The Disciplined scale was found to negatively correlate with many vocational interests. Specifically, high scorers are unlikely to be interested in careers that can be characterized as Realistic, Investigative, Artistic or Social. Last, the Disciplined scale was unrelated to all three dimensions of the Dark Triad, alongside measures of Honesty/Humility, SDO and RWA.

DRIVEN

The Driven scale measures the extent to which an individual is ambitious, risk-taking and goal-orientated, versus laid-back, easy-going and humble. As previously mentioned, the Drivers diagnostic is mostly based on the Big Five model of personality. The Driven scale deviates from this however and measures a lower order behavioral domain related to one's

ambition and need for achievement. High scorers are likely to be described as being persistent, hard-working and proactive. Conversely, low scorers will be laid-back, satisfied and humble. Table 7 contains the correlation between Driven scores and other psychological constructs.

First, Driven scores are significantly correlated with Big Five scales. Specifically, the scale is negatively correlated with Agreeableness and Neuroticism scores, alongside positively correlated with Extraversion and Openness. It can therefore be said that individuals with high Driven scores can be described as straightforward, critical of oneself and others, socially confident and receptive to new perspectives and ideas. These relationships are replicated when studying the scale's relationship with HPI scores (i.e. Adjustment, Inquisitive, Learning Approach & Sociability). In the case of Interpersonal Sensitivity, the data indicates a positive correlation with Driven scores. We interpret the differing directions of correlations as reflecting one's tendency to be diplomatic (Interpersonal Sensitivity) versus tendency to cooperate and peacefully resolve conflict (Agreeableness). Given what behaviors the Driven scale samples, it is of more importance to highlight the strong, positive correlation held with the Ambition scale which indicates strong convergent validity.

Second, Driven scores were positively correlated with two dimensions of the Dark Triad: Machiavellianism and Narcissism. This indicates that high scorers are more likely to bend and break the rules, influence others, and display high levels of self-confidence. Such relationships can be expected given that competitive, goal-orientated and achievement focused nature of the scale (Miller, 2015).

Third, Driven scores were positively correlated with all five of the measured vocational interests: Realistic, Social, Artistic, Enterprising and Conventional. While the multiple positive correlations are reflecting one's general desire for occupational and professional success, it is important to highlight that the strongest relationship is held with Enterprising — reflecting a desire to create and lead a business and influence others — a relationship that replicates previous research (Almeida, Ahmetoglu, & Chamorro-Premuzic, 2014).

Last, Driven scores were positively correlated with measures of SDO and RWA. These relationships can be interpreted as high scorers being very competitive, having a strong desire to control, and want to dominate and get ahead of others. Given the behaviors sampled by SDO and RWA, the positive relationship indicates potential toxicity and suggests there may be practical risks for individuals with very high Driven scores.

OUTGOING

The Outgoing scale measures the extent to which an individual is sociable, outgoing and chatty, versus reserved, quiet and introspective. Based upon the Extraversion dimension of the Big Five model of personality, high scorers are energetic, talkative and seek stimulation from others. Low scorers are comfortable with their own company, independent, and reflective. Table 7 contains the correlation between Outgoing scores and other psychological constructs.

First, Outgoing scores are positively correlated with Agreeableness and Interpersonal Sensitivity, suggesting that high scorers are somewhat friendly and easy to get on with. As expected, Outgoing scores are strongly correlated with measures of Extraversion and Sociability. Given that all three scales are hypothesized to measure the same behavioral domain, these relationships can be taken as evidence of convergent validity. Outgoing scores are also positively correlated with Openness and Inquisitive (suggesting a receptiveness to new experiences and curiosity), alongside Ambition and Adjustment (indicating a tendency to be somewhat goal-orientated and emotional stable).

Second, Outgoing scores are positively correlated with Narcissism, a relationship that has previously been established (Jonason & Webster, 2010). The scale was also correlated with all vocational interests, with the strongest relationship held with the Social scale, thereby indicating high scorers' desire to work in careers that involve frequent communication, interaction and collaboration.

CURIOUS
The Curious scales measures the extent to which an individual is creative, intellectual and inquisitive, versus pragmatic, practical and straightforward. Based upon the Open to New Experiences dimension of the Big Five, high scorers are described as imaginative, artistic and inventive. On the other hand, low scorers are pragmatic, practical and traditional. Table 7 contains the correlation between Curious scores and other psychological constructs.

First, the Curious scale is positively correlated with measures of Openness, Inquisitive and Learning Approach, indicating a high degree of convergent validity. The scale was also positively correlated with measures of Agreeableness and Interpersonal Sensitivity, and Extraversion and Sociability, while negatively correlated with measures of Conscientiousness and Prudence. When interpreting these findings, high scorers can be described as cooperative and sociable individuals who dislike rules and sticking to routines.

Second, the scale was unrelated to measures of the Dark Triad. The scale was positively correlated with the Realistic and Artistic vocational interest scales. Specifically, the scale had a strong relationship with the latter interest, suggesting that high scorers seek out careers that enable artistic expression and creativity.

Last, the Curious scale was negatively correlated with SDO and RWA scales. This suggests that high scorers are open, liberal and tolerant of differences. They are unlikely to endorse conservative attitudes, instead favoring humanist ideals.

STABLE
The Stable scale measures the extent to which an individual is emotionally stable, calm and relaxed, versus passionate, anxious and self-aware. Based on the Emotional Stability dimension of the Big Five personality framework, high scorers can be described as calm, confident and secure. Low scorers can be described as emotionally volatile, self-critical, and

prone to feelings of stress and anxiety. Table 7 contains the correlation between Stable scores and other psychological constructs.

First, Stable scores are negatively correlated with Neuroticism and positively correlated with Adjustment scores. Given that these scales sample the same the behavioral domain, these correlations serve as evidence of convergent validity. Furthermore, the scale is positively correlated with Extraversion and Sociability, Ambition, Prudence and Inquisitive scales. Based on these relationships, high scorers may be described socially outgoing, self-confident, organized and restrained, and open to trying new things.

Second, the scale is negatively correlated with one Dark Triad dimension, Psychopathy. Indicating that high scorers are unlikely to display callous or emotional behaviors. Third, individuals are likely to seek out careers that are Realistic or Enterprising. Last, Stable scorers were positively correlated with Honesty/Humility, suggesting that high scorers act with a sense of honesty and trustworthiness.

SUMMARY OF CONVERGENT & DISCRIMINANT VALIDITY EVIDENCE
The analyses presented below effectively demonstrate that the six scales have good convergent and discriminant validity. Not only do these analyses place the scales within a psychological taxonomy, the strong correlations provide evidence that the items are measuring the desired behaviors and overlap with adjacent psychological constructs. When compared to other modern adjective personality assessments, the Drivers diagnostic demonstrates equal or superior convergent validity with measures of the Big Five (Meade et al., 2018).

Table 7: Convergent & Discriminant Validity Results

Scale	Considerate	Disciplined	Driven	Outgoing	Curious	Stable
Agreeableness	.47*	.04	-.14*	.16*	.14*	-.06
Conscientious	.03	.54*	.01	-.06	-.24*	.06
Neuroticism	-.07	-.09	-.10*	-.05	.08	-.53*
Extraversion	-.22*	-.27*	.46*	.73*	.22*	.24*
Openness	-.06	-.05	.12*	.10*	.38*	.09
Adjustment	.10	.15*	.14*	.14*	-.05	.60*
Ambition	-.24*	.21*	.63*	.34*	.02	.41*
Sociability	-.17*	-.32*	.35*	.52*	.21*	.26*
Interpersonal Sensitivity	.18*	.10	.13*	.45*	.14*	.36*
Prudence	.29*	.44*	-.19*	-.10	-.31*	.17*
Inquisitive	-.08	-.04	.21*	.17*	.34*	.20*
Learning Approach	-.06	.06	.16*	.07	.16*	.07
Machiavellianism	-.28*	-.13	.20*	.09	-.06	-.25*
Psychopathy	-.15*	-.08	.04	-.08	-.15	-.21*
Narcissism	-.13	-.02	.23*	.26*	.03	.05
Realistic	-.31*	-.49*	.46*	.34*	.25*	.01
Social	-.09	-.26*	.33*	.50*	-.04	.26*
Investigative	-.17	-.40*	.14	.27*	.20	-.08
Artistic	-.25*	-.36*	.30*	.40*	.41*	-.01
Enterprising	-.25*	-.16	.54*	.48*	.05	.39*
Conventional	-.19	-.24	.39*	.24*	.10	.07
Honesty/Humility	.32*	.15	-.12	-.03	.04	.16*
Social Dominance Orientation	-.25*	.02	.29*	.14	-.11*	.03
Right Wing Authoritarianism	-.07	.03	.29*	.10	-.24*	.19

Note: 1-5: Big Five, N = 3,146. 6-12: HPI, N = 242. 13-19: The Dark Triad, N = 168. 16-21: Vocational Interests, N = 168. Honesty/Humility N = 361. Social Dominance Orientation, N = 142. Right Wing Authoritarianism, N = 142. * Correlations are statistically significant at *p* < .05 level.

CONCURRENT VALIDITY

The following section describes the concurrent validity of the diagnostic. We first describe the measures used to test for concurrent validity and then present correlations between the Drivers diagnostic and these measures. We then conclude with an interpretation and discussion of these results.

MEASURES

The Utrecht Work Engagement Survey-9 items (UWES-9; (Schaufeli & Bakker, 2006)
The UWES-9 is a 9-item scale measuring work engagement. It is a shorter version of the original 17-item UWES that characterizes work engagement by three subscales: Vigor, Dedication, and Absorption, which can be totaled to produce a single work engagement score — representing the extent to which an individual is cognitively, emotionally and physically engaged with, and motivated by, their work. Participants respond to each item using a frequency 7-point Likert-scale (1 = Never to 7 = Always). Work engagement has been found to hold a positive relationship with a variety of organizational measures of performance (Saks, 2006).

Counter Productive Work Behaviors (Bennett & Robinson, 2000)

Counterproductive behavior (CWBs) describe employee behavior that goes against the interests of an organization and its incumbents. This can include behaviors such as absenteeism, abuse towards others, bullying, loafing, incivility, fraud, sexual harassment, and sabotage (Spector et al., 2006). To measure CWBs we used the 18-item CWB checklist that was developed by Bennet and Robinson (2000). The checklist contains 18 specific CWBs and participants rated the frequency of which they have displayed a given behavior (0 = never, 7 = daily). The scale was found to have acceptable levels of internal consistency and has been used extensively in research contexts.

Self-Reported Job Performance

A five item, job performance scale was created by the Deeper Signals team. Participants indicated the number of promotions than had received in the last two years, alongside the frequency to which they:

- Planned their work so that it was done on time.
- Performed their work well with minimal time and effort.
- Collaborated well with others.
- Met or exceeded what their job demands from them.

Participants rated themselves on how frequently they display the above behaviors using a 1 to 5 Likert scale, ranging between Never to Daily. A single job performance score was created from the sum of the five items. While subjective ratings of job performance can be prone to bias and are typically less accurate than supervisor or peer ratings, this data was collected to indicate the extent to which an individual believe they perform well within their role.

CONCURRENT VALIDITY RESULTS

Table 8 contains the correlation between the diagnostic and three measures of relevant work behaviors: CWB, work engagement and self-reported job performance.

First, CWB was moderately and negatively correlated with the Considerate scale. The Curious and Stable scales were also negatively correlated, but comparatively less so. Such relationships are in line with the existing literature (Mount, Ilies, & Johnson, 2006): agreeable, empathetic and cooperative individuals are significantly less likely to display harmful and counterproductive behaviors at work.

Second, Work Engagement was positively correlated with the Disciplined, Driven and Outgoing scale. These relationships can be interpreted as organized, committed, goal-orientated individuals that somewhat outgoing tend to hold more positive attitudes towards their work (i.e. feelings of commitment, energy and satisfaction; (Schaufeli & Bakker, 2006). Again, such relationships are also in line with existing literature (Akhtar, Boustani, Tsivrikos, & Chamorro-Premuzic, 2015).

Finally, self-appraisals of job performance were significantly correlated with Driven. This indicates that individuals who are ambitious, goal-orientated and proactive are more likely to complete their work on time, exceed other's expectations and produce high quality work. While we recognize that self-reported measures of performance are subject to bias, this correlation can also be interpreted as an indication that Driven individuals are more likely to approach their work with confidence and boldness. This in line with previous research and highlights the continuous nature of personality dimensions that extend from adaptive to maladaptive (Grijalva, Harms, Newman, Gaddis, & Fraley, 2015; Widiger & Mullins-Sweatt, 2009).

Table 8: Concurrent Validity Results

Work Behavior	Considerate	Disciplined	Driven	Outgoing	Curious	Stable
CWB	-.31*	-.20*	.09	.01	-.12*	-.11*
Engagement	-.04	.28*	.17*	.16*	-.10	.13
Self-Rated Performance	.02	.13	.16*	.10	-.03	.09

Note: CWB N = 315; Engagement & Job Performance N = 168. Validity data for CWB was collected using the Drivers SF only. * Correlations are statistically significant at $p < .05$ level.

Group Differences & Score Normalization

This chapter reports on the extent to which different genders, age and ethnic groups have statistically significant different scores on the Drivers diagnostic. Understanding such differences may aid in the interpretation of feedback reports and scores. We then present the result for adverse impact simulations to demonstrate that the scales do not discriminate on the bases of age, gender and ethnicity. Finally, we report data on the distribution of scores.

GROUP DIFFERENCES

Independent samples t-tests were conducted to investigate whether males and females, under/over 45-years old, and White and Non-White individuals scored significantly different across the six scales. Cohen's d was also computed to understand to what extent are such differences practically meaningful.

Table 9 indicates that there are few statistical differences in average scores between individuals who are under or over 45 years old. Although age groups significantly differ on the Considerate and Curious scales, Cohen's d demonstrates that such differences are not practically meaningful. There were significant and practical differences on the Disciplined scale. This trend is in line with existing research (i.e. older individuals are typically more Conscientious; Soto, John, Gosling, & Potter, 2011). Similarly, Table 10 demonstrates that while there are statistically difference differences between females and males of some scales (i.e. Considerate, Driven, Curious & Stable), these differences are not practically meaningful. Finally, Table 11 tells a similar story. There are significant differences between White and Non-White individuals, however these differences are not of practical significance as indicated by Cohen's d scores.

Table 9: Age Differences

Scale	Under 45 Mean	Over 45 Mean	t	df	d
Considerate	5.71	5.32	2.630*	713	.15
Disciplined	5.27	6.65	6.273*	147	-.57
Driven	4.17	4.34	.561	139	-.05
Outgoing	4.76	4.50	-.980	142	.09
Curious	5.12	4.25	-3.711*	140	.34
Stable	4.71	4.80	.450	142	-.04

Note: t = t value, df = degrees of freedom, * p < .05, d = Cohen's d effect size (.00 - .19 = negligible; .20 - .49 = small; .50 - .79 = moderate; .80 <= large).

Table 10: Gender Differences

Scale	Female	Male	t	df	d
Considerate	5.69	5.05	5.200*	1,523	.25
Disciplined	5.27	5.45	-1.520	1,601	-.07
Driven	4.10	4.38	-2.221*	1,584	-.09
Outgoing	4.75	4.71	.280	1,568	.01
Curious	5.23	4.74	4.640*	1,529	.21
Stable	4.42	5.25	-8.719*	1,512	-.40

Note: *t* = t value*, df* = degrees of freedom, * p < .05, *d* = Cohen's d effect size (.00 - .19 = negligible; .20 - .49 = small; .50 - .79 = moderate; .80 <= large).

Table 11: Ethnic Differences

Scale	Non-White	White	t	df	d
Considerate	5.51	5.38	1.060	1,251	.05
Disciplined	4.90	5.91	-9.021***	1,929	-.39
Driven	4.46	3.86	4.831***	1,899	.21
Outgoing	4.83	4.61	1.904	1,978	.08
Curious	5.30	4.73	5.571***	1,898	.24
Stable	4.84	4.52	3.492***	1,916	.15

Note: *t* = t value*, df* = degrees of freedom, * p < .05, *d* = Cohen's d effect size (.00 - .19 = negligible; .20 - .49 = small; .50 - .79 = moderate; .80 <= large).

ADVERSE IMPACT SIMULATIONS

Adverse Impact (AI) can be defined as "a substantially different rate of selection in hiring, promotion, or other employment decisions which works to the disadvantage of members of a race, sex or ethnic group" (see section 1607.16 of the *Uniform Guidelines on Employee Selection Procedures*; Equal Employment Opportunity Commission, 1978). The "Four-Fifths rule" can be used to determine whether an assessment has AI. Specifically, when the "selection rate for any race, sex or ethnic group which is less than four-fifths (4/5) (or eighty percent) of the rate for the group with the highest rate will generally be regarded by the Federal enforcement agencies as evidence of adverse impact." (1978, see section 1607.4 D). Furthermore, given the Age Discrimination in Employment Act (ADEA, 1967) states that individuals over 45 years old need protection, assessments should not adversely impact younger or older individuals.

While the previous analyses demonstrated statistically significant, although not practically meaningful, group differences, AI simulations of the 4/5ths rule were conducted to further demonstrate that six scales do not adversely impact protected groups. To test for AI, we compared the selection rate of protected groups (e.g. females, over 45 year olds & non-white individuals) against the selection rate of non-protected groups (e.g. males, under 45 year olds & white individuals). Ratios greater than or equal to .80 indicate that the assessment as no AI.

Although organizations do not need to conduct validity studies for selection tools that do not adversely impact protected groups, it is best practice that organizations do continually test for AI and continue to build evidence of criterion validity. As such, Deeper Signals recommends that organizations who use the Drivers diagnostic pilot the tool and collect such evidence before using the diagnostic to inform their employee selection and development practices.

Table 12 contains the recommended cutoff scores when using Drivers diagnostic assessment for selection, promotion and hiring decisions. Cutoff scores represent a balance between screening out individuals with the lowest scores and not create adverse impact. While we supply these scores, we stress that low scores do not imply negative, unproductive or harmful behaviors. Personality lies on a continuum whereby behavioral strengths and challenges can be found at either end (Widiger & Mullins-Sweatt, 2009). Accordingly, we recommend organizations conduct a job analysis to identify the most suitable personality profile before using the tool to make personnel decisions. Adding to this, if organizations use different cutoff scores to those listed below, it is their responsibility to evaluate the potential for AI.

Table 12: Recommended Selection Decisions Rules for Using the Drivers Diagnostic

	N	Does Not Meet Cutoff		Meets Cutoff	
		Raw Score	Percentile Score	Raw Score	Percentile Score
Considerate	1,712	≤ 3	≤ 17%	> 3	> 17%
Disciplined	7,173	≤ 3	≤ 18%	> 3	> 18%
Driven	5,854	≤ 3	≤ 29%	> 3	> 29%
Outgoing	6,820	≤ 3	≤ 29%	> 3	> 29%
Curious	7,352	≤ 3	≤ 22%	> 3	> 22%
Stable	6,237	≤ 3	≤ 19%	> 3	> 19%

Using the cutoff scores listed below, we conducted AI simulations for three demographic dimensions: age, gender and ethnicity. Table 13 contains the results of our AI analyses for gender groups, Table 14 contains the results of AI analyses for age groups, and Table 15 contains the results of AI analyses for ethnic groups. Given that the AI ratio was greater than .80 across each scale and demographic group, we conclude that when using the recommended cutoff scores organizations should not expect to see adverse impact or bias.

Table 13: Selection & Adverse Impact Ratios for Gender

	Female SR	Male SR	AI Ratio
Considerate	.78	.72	1.09
Disciplined	.73	.75	.97
Driven	.55	.57	.97
Outgoing	.64	.62	1.03
Curious	.76	.68	1.12
Stable	.65	.76	.86

Note: SR = Selection Ratio; AI = Adverse Impact Ratio.

Table 14: Selection & Adverse Impact Ratios for Age

	Over 45 SR	Under 45 SR	AI Ratio
Considerate	.75	.75	1.00
Disciplined	.87	.73	.84
Driven	.55	.56	1.01
Outgoing	.61	.63	1.03
Curious	.59	.74	1.25
Stable	.69	.69	1.01

Note: SR = Selection Ratio; AI = Adverse Impact Ratio.

Table 15: Selection & Adverse Impact Ratios for Ethnicity

	Non-White SR	White SR	AI Ratio
Considerate	.79	.73	1.08
Disciplined	.69	.80	.87
Driven	.62	.48	1.28
Outgoing	.65	.61	1.07
Curious	.78	.67	1.15
Stable	.73	.63	1.16

Note: SR = Selection Ratio; AI = Adverse Impact Ratio.

NORMATIVE SCORING

When reporting scores on the diagnostic, users may find it easier to interpret such results if they are standardized and converted into percentiles, thereby helping an individuals and groups understand how they compare to the rest of the test-taker population. Table 16 contains the distribution of raw scores across three interpretative groups: Low, Medium and High.

Table 16: Distribution of Raw Scores & Interpretative Groups

Scale	N	Low 0% – 33%	Medium 34% – 66%	High 67% – 100%
Considerate	1,712	0 – 4	5 – 6	7 - 10
Disciplined	7,173	0 – 4	5 – 6	7 - 10
Driven	5,854	0 – 3	4 – 5	6 - 10
Outgoing	6,820	0 – 3	4 – 5	6 - 10
Curious	7,352	0 – 3	4 – 6	7 - 10
Stable	6,237	0 – 3	4 – 6	7 - 10

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