

RESEARCH

**TRUE GRIT: DEVELOPMENT AND
VALIDATION OF A NEW GRIT
SCALE**

Prepared by

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Table of Contents

I.	Executive Summary	3
II.	Beyond the Big Five Model	3
III.	Background and Contextual Information About the Construct	3
IV.	Construct Definition	4
V.	Scope and Purpose of the Test	5
	Purpose of the Test	5
	Nature of the Items and Interpreting the Results	5
	Intended Dimensionality	5
VI.	Item Generation	6
VII.	Strategies for Collecting Psychometric Evidence	6
	Purpose of the Validation Study	6
	Sources of Validity	6
	Validity Action Plan	7
VIII.	Results and Analysis	8
	Content Validity and Item suitability	8
	Item Analysis	9
	Construct Validity Evidence	12
	Criterion Validity Evidence	13
IX.	Summary and Discussion	13
X.	References	14

I. Executive Summary

Duckworth and Peterson sought to identify a single trait that could help predict success across different fields and disciplines. They developed a self-report questionnaire and scale to measure this new trait which they called grit and identified as a multi-dimensional construct consisting of two factors – consistency of interest and perseverance of effort. It is the aim of this study to identify an alternative model for grit based on more traditional theories of personality and achievement motivation.

A review of the literature in a hypothesis that grit was in fact a multi-dimensional model based on three factors common to personality theory and achievement motivation. These factors are work ethic as the motivation/driver, long-term orientation as the direction and resilience as the ability to overcome obstacles. However the results of the analysis found that the model for grit was very similar to Duckworth and Peterson's proposed model, though found that long-term orientation and resilience served well as the two factors of the trait. Work ethic or achievement motivation was not supported as part of the model.

The results of the study provide evidence for convergent and discriminant validity as well as criterion validity and provided a more reliable and valid measure of grit and predictor of workplace performance in the context of the organization which took part in the study.

II. Beyond the Big Five Model

The Five Factor Model FFM of Conscientiousness, Neuroticism, Extraversion, Agreeableness and Control developed by Goldberg and colleagues in 1980 was considered a breakthrough in personality testing as it made personality testing more accessible to test users (Tett & Christiansen, 2007). While the model has been widely accepted and has been found to be a valid predictor of job performance (Barrick & Mount, 1991), it has been argued that personality only accounts for 15% of the variance in performance under the best of conditions and as a result the use of personality questionnaires for selection purposes has been questioned in a 2007 symposium on the use of personality tests for selection (Morgeson et al., 2007). Furthermore, Paunonen and Jackson (2000) argued that while the FFM offers a suitable framework for organizing traits, it was developed based on factor analysis of adjectives that were most popularly researched. As such, traits that were not popularly researched at the time were omitted. This limitation within the FFM led Duckworth and Peterson (2007) to explore traits beyond the big five taxonomy.

III. Background and Contextual Information About the Construct

Duckworth and Peterson set out to investigate why some individuals accomplish more than others of equal intelligence. They sought to identify a single trait that could help predict success across different fields and disciplines. Their study led them to a trait or personal factor they identified as grit. They defined grit as “perseverance and passion for long-term

challenges" (Duckworth et al., 2007, p. 1087). Although they found the scale to be similar to conscientiousness and achievement orientation, they were careful to distinguish grit from the other personality or values constructs. They distinguished grit from conscientiousness in that it concerned consistency over long-term objectives and not only on a single task or objective. Furthermore, they distinguished grit from achievement-orientation as defined by McClelland (1961) in that the goals set by individuals who have a high need for achievement are achievable objectives and are driven by intrinsic or extrinsic rewards, whereas gritty individuals show commitment to long-term and challenging goals regardless of the associated rewards or the presence of positive feedback.

Duckworth and Peterson developed a self-report questionnaire and scale to measure grit. Through their research they identified that grit was a multi-dimensional construct which consisted of two factors. They defined these factors as consistency of interest and perseverance of effort. These factors were also corroborated in an independent study by Maddi et al. (2012) and both studies were able to establish the reliability of the self-report measure developed by Duckworth and Peterson and the ability of the scale to predict the achievement of long-term goals.

IV. Construct Definition

While Duckworth and Peterson were guided in their development of the grit scale by limitations in the development of the Five Factor Model (FFM) cited by Paunonen and Jackson as well as limitations in the current practice of personality tests cited by Morgeson and his colleagues (Duckworth et al., 2007), many of these limitations were later

refuted by Tett and Christiansen (2007). It is perhaps Tett and Christiansen's finding that higher validity estimates can be achieved through a combination of multiple factors that has led me to revisit Duckworth and Peterson's model for grit. In addition to this, Duckworth and Peterson focused mostly on the limitations of the FFM model but did not address other models of personality as well as achievement motivation. As a result, rather than rely on Duckworth and Peterson's two factors (consistency of interest and perseverance of effort) as the basis for defining the construct, I will relate grit to more established concepts found in personality theory and achievement motivation literature.

Although Duckworth has identified grit as a wholly new trait, the high correlation she has identified with conscientiousness ($r = .77$) and the seemingly strong link to established traits and values such as work ethic, resilience, perseverance and achievement-orientation beg the question of whether this is indeed a truly unique construct or if it is already being measured by other similar scales. As a result, in addition to creating a new scale, I hope to include a comparative study of the scale against established scales for work ethic, resilience and long-term orientation.

In keeping with the findings of Duckworth and Peterson, this study will define grit as "perseverance and passion for achieving challenging long-term goals." Based on a review of Duckworth and Peterson's model as well as a review of personality theory and achievement motivation literature, I have determined that grit can be related to three established constructs or factors. The first factor I will relate grit to is work ethic which has its origins in Weber's notion of *Protestant work ethic* (Cassidy &

Lynn, 1989). Here a gritty individual is one who is motivated to achieve. They find fulfillment in the work itself and not in the pursuit of other extrinsic rewards. The second factor I hope to relate grit to is Resilience. Although this construct has been researched as part of clinical psychology and specifically psychopathology, it has been strongly linked to the FFM's neuroticism scale and to Cattell's emotional stability (Friborg et al., 2005). Here I define resilience as perseverance in the face of setbacks and obstacles. Gritty individuals are resilient individuals who see that no problem is insurmountable and no challenge too daunting. The final factor in my model of grit is long-term orientation or future orientation. With foundations in behavioral psychology and delayed gratification (Cheng et al., 2012), this scale is intended to measure an individual's ability to avoid distractions and focus on long-term goals. The scale is probably also related to the FFM's factor for Control.

To further clarify the overall construct, individuals who are gritty are more likely than those who are not to stick with long-term goals. They are diligent and resilient and are less likely than others to stray from their main goals by setbacks, distractions or other temporary pursuits.

V. Scope and Purpose of the Test

Purpose of the Test:

The test was developed for selection purposes and the identification of success of high achievers.

Test Administration:

The test was administered as an individual online questionnaire with the aim of keeping the administration time down to under 5 minutes. The test was administered alongside Duckworth and Peterson's original grit scale as well as additional measures of work ethic, resilience and long-term orientation. As a result, the overall administration time for the combined tests was intended to be no greater than 30 minutes to reduce possible error caused by test fatigue or loss of interest by test takers.

Nature of the Items and Interpreting the Results:

The test is comprised of close-ended questions utilizing a multiple-choice, 5-point Likert scale measure of agreement which ranges from 'very much like me' to 'not like me at all'. The 5-point scale was selected as scales with a higher number of response options do not yield higher reliabilities (Hinkin, 1998). Reverse scored items were utilized in order to ensure that the full breadth of the construct is measured. Items were scored from 1-5 and then summed to obtain the individual factor scores for work ethic, resilience and long-term orientation.

Intended Dimensionality:

The construct of grit, as defined in this study, is a multidimensional construct which consists of three factors. These factors are work ethic, resilience and long-term orientation.

VI. Item Generation

In line with Hinkin's process for developing measures, a deductive approach was utilized for the development of the scale items (Hinkin, 1998). In this method, a review of the literature was conducted along with a review of existing scales for the measure and similar measures. This review formed the basis for formulating the definition of the construct and dimensions which form the construct and which subsequently form the basis for the development of the items. Careful attention was given to ensure that items for the new scale of grit did not copy or exactly match the original scale items. As such, the new items had to be unique in that they measured the revised model of the construct.

While Hinkin mentions that as few as three items could be sufficient to demonstrate adequate internal consistency reliabilities, it was felt that, in order to adequately measure the breadth of each dimension, more items would be needed in the final dimension scales (Hinkin, 1998). As a result, a total of thirty six items were developed for all the dimensions.

VII. Strategies for Collecting Psychometric Evidence

Purpose of the Validation Study:

Similar to the original Grit scale, this measure of grit is intended as a predictor of success or high achievement in workplace scenarios. As such the validation effort will focus on gathering evidence to establish that the scale is an accurate measure of grit as defined in this study and that it can predict

the attribute of success in the workplace to an extent which would facilitate it's use as a decision making tool. If this tool is to be used for decision making purposes then three sources of evidence are required: evidence regarding the internal structure of the measure, evidence which establishes a relationship with other similar measures and evidence which establishes a relationship with a measure of workplace performance.

Sources of Validity:

Evidence regarding the content-related validity of the measure will be collected to help fine-tune the measure prior testing. As the proposed measure for grit is multi-dimensional it is important to ensure that the items are judged by other Subject Matter Experts (SMEs) to be relevant to their intended dimensions. This part of the study will be used to make amendments to items and even replace or remove certain items from the measure based on content adequacy and intended dimensionality.

As the newly developed grit scale is intended as a measure of success, criterion validity evidence will need to be investigated. However, Success can be subjective and the very definition can vary from one individual to another. As a result, objective performance results must be used. While predictive validity evidence would be the most natural form of validity to be used for measures intended for selection purposes, the constraints of this study would not allow for predictive validity to be investigated. This leaves two forms of criterion validity that can be investigated. The first is postdictive evidence which will be investigated if the organization has sufficient performance metrics archived that can be used for the purpose of this study. However, if it is deemed that the

organization does not have adequate archived performance metrics then the study will use concurrent evidence to help establish criterion validity. While this form of validity is not ideal for the purpose of measuring success and certainly not over the long-term, it has been found that validity estimates for predictive and concurrent designs are nearly indistinguishable (Shultz et al., 2014).

Finally, construct validity in its convergent and discriminant forms will be investigated by comparing the various dimensions from the newly developed grit scale to already established scales for grit, work ethic, resilience and long-term orientation. This method can also be used to provide insight into the dimensionality of the newly developed grit scale, though further investigation into the dimensionality of the measure will be further explored using internal consistency and confirmatory factor analysis (CFA).

Validity Action Plan:

For the purpose of this study, testing and data gathering will only occur once. As a result, investigation of reliability, internal consistency, intended dimensionality and all forms of evidence for validity will have to use a single set of data. While this poses a risk as the test cannot be trialed and tested for reliability prior to its use on the intended population, the number of items present in the measure and the intention of conducting a content validity study prior to the collection of sample data should give sufficient confidence that certain items can be extracted which result in adequate reliability ($\alpha > 0.7$) to be able to conduct the remaining investigations.

The first analysis conducted as part of the study will investigate internal consistency reliability

and intended dimensionality. As such, Item total correlations will be investigated in order to identify items which are redundant and do not add value to the measure or which have a detrimental effect on the measure. This study will be used to obtain a more reliable and efficient form of the measure, which will be used in the subsequent studies.

The second analysis will investigate construct validity. The original Grit scale developed by Duckworth and Peterson (2007) will be the main scale used to investigate evidence of construct-related validity. In the development of this scale the authors reported an internal consistency alpha coefficient of 0.85, giving me confidence that this scale can be used for such purposes. A Pearson correlation will be conducted for the overall scale scores of both grit measures, here we will look for strong correlations between both measures. The strength of the correlation will be dependent on whether the results are statistically significant, though a correlation of 0.6 or above is hoped for.

Three additional established scales will be used for convergent and discriminant validity evidence. These scales are:

1. The 19-item Mirels-Garret Protestant Work Ethic scale developed in 1971, which will be used to investigate convergent validity evidence for the work ethic dimension of the newly developed grit scale as well as divergent validity evidence for the resilience and long-term orientation dimensions. The authors reported a Kuder-Richardson reliability coefficient of 0.79 for a sample of 222 students, which was deemed satisfactory.
2. A short 10-item version of the Conner-Davidson resilience scale (Conner & Davidson, 2003).

The original 25-item scale was found to be too long for the purpose of this study and the short 10-item version demonstrated sound internal consistency ($\alpha=0.87$ with 95% confidence interval) (Coates et al., 2013). This scale will be used to investigate convergent validity evidence for the resilience dimension of the newly developed grit scale as well as divergent validity evidence for the work ethic and long-term orientation dimensions.

3. A scale for Long-Term Orientation (LTO) developed by Bearden, Money and Nevins (2006). This scale was developed as an alternative to Hofstede's Long-Term Orientation scale. The authors identified 8 items across two factors (Tradition and Planning) with a combined Cronbach's alpha coefficient of 0.83 for the US sample of 339 respondents (Bearden et al., 2006). This scale will be used to investigate convergent validity evidence for the long-term orientation dimension of the newly developed grit scale as well as divergent validity evidence for the work ethic and resilience dimensions. Due to the nature of the items (see table 7) it is expected that the newly developed Long-term orientation scale will correlate mostly with the planning dimension of Bearden and colleagues' LTO scale and not with the tradition dimension.

Convergent and discriminant validity evidence will be investigated by creating a matrix of the various dimensions and established scales. It is expected that the dimensions of the newly developed grit scale will correlate highly with their corresponding established scales and less well with the other established scales.

A third analysis will investigate criterion validity evidence. As mentioned earlier the investigation of criterion validity will take the form of postdictive evidence. The type of information sought for this purpose would be information such as the dollar value of projects handled by consultants, the dollar value of bonuses or delivery commissions awarded to consultants, the number of promotions given within a certain period to consultants or performance appraisal results for the previous years. Concurrent evidence will be gathered from consultant's managers via a performance survey. The items and dimensions of the survey have yet to be developed, though will be developed in coordination with the organization taking part in this study. It is expected that the newly developed grit scale will correlate positively with such criterion measures of work success.

VIII. Results and Analysis

Content Validity and Item Suitability:

Content validity was investigated using Lawshe's (1975) Content Validity Ratio. Surveys were gathered from 6 SMEs. SMEs confirmed the need for 24 out of the original 36 items developed for the scale (CVR = 1.00). Based on the provided definition of Grit, the majority of the Work Ethic sub scale items were put into question with extremely weak CVR scores (<.35). While a CVR of 0.99 would be required to be statistically significant when only 6 SMEs participate in the analysis, the changes that would result from eliminating an entire dimension would have a major effect on the proposed model. As a result, it was decided to retain all the items for the purpose of the study and further confirm the content validity findings through item analysis.

In addition to asking SMEs to ascertain how essential the items were to the proposed definition of grit, they were also asked to categorize each of the items to one of the dimension categories proposed. In accordance with Hinkin's (1998) proposed cut off for the proportion of correctly categorizing items, all items with a proportion less than 75% will be discounted. However, for the purpose of the study all items will be administered to respondents in order to confirm these findings through factor analysis.

The final aspect to be investigated as part of this analysis was item clarity. The same SMEs were also asked to provide their input regarding how clearly worded each of the items were. A criterion similar to Hinkin's cut off score for categorization agreement was used and it was found that only 3 items did not meet the cut off score of 75%.

Item Analysis:

The purpose of this analysis was to investigate the psychometric properties of the scales and determine the final items of the scale along with the content validity results before conducting further analyses regarding construct and criterion validity. Descriptive statistics of the items were investigated along with the item correlations, internal consistencies and factor reduction models in order to determine which items could be eliminated either due to redundancy or poor conceptual fit with the model and content validity findings.

All forms of analysis were conducted using the same set of data. In all, 31 participants took part in the study (53% female, 47% male), though the results of one of the participants were

discarded as they did not complete all sections of the questionnaire.

It was found that the original Grit scale and its dimension scales all exhibited strong internal consistencies ($\alpha = .789$ to $.941$). While the work Ethic dimension appeared to have an acceptable level of internal consistency, its items appeared to correlate highly to resilience items, long-term orientation items or both simultaneously. Factor analysis further demonstrated that the inclusion of Work Ethic items complicated the model and resulted in many more factors than originally proposed. These findings confirm content validity findings, resulting in a two dimension model based on Resilience and Long-Term Orientation. Work Ethic was originally included to cover the "passion" and "drive" described in the original definition, though items regarding "drive for success" were mostly interpreted as "long-term orientation", items regarding "effort" were mostly correlated with "resilience" and items regarding "perfection" ran contrary to most other items. The results clearly indicate the 3-dimensional model which includes work ethic is not supported and therefore an alternative model would have to be devised and further investigated.

Even after work ethic items have been eliminated (based on a combination of internal consistency, correlation and content issues), the remaining items display a 3 factor model which slightly resembles the revised 2-factor model. This amended model has a few issues which can be further addressed by conducting a revised investigation of the internal consistency and factor model of resulting model. Table 5 displays the base results of this phase of the analysis. The alpha coefficients for each of the three dimensions of the

model are .889 for long-term orientation and .939 for resilience and .789 for work ethic.

Despite reducing the items for long-term orientation from 9 items to 7, the alpha coefficient for this dimension has increased to .902. The resilience scale underwent more drastic changes and was reduced from 15 items to 7 mostly due to issues of redundancy and poor conceptual fit. After taking into account all these changes the reliability (internal consistency) of the dimension remained high at .913. Internal consistency analysis of the remaining items further allowed us to reduce the items to the limited impact of the items on the reliability of the scale. A final investigation of the factor model strongly supports a 2 factor model consisting of long-term orientation and resilience. Only two items have fairly strong incorrect factor loadings, which can be further investigated in the item correlation tables to determine if they

negatively impact the conceptual model. Table 1 presents the item correlations for the remaining items.

Four items stand out from the table as being problematic. While removing them from the model reduces the reliability of the scales it does not impact the scales so greatly as to make any of the scale unreliable. Furthermore, removing any of the other problematic items would reduce the breadth of the conceptual models by entirely eliminating one of the domains of dimensions.

In addition to conducting the item analysis for the dimensions involved in the scale, the remaining items have also been chosen to maintain a strong overall grit scale. The item descriptive statistics, the dimension and scale internal consistencies and the factor loadings are presented in tables 2, 3 and 4 below.

Table 1: Item Correlations

Item	LTO_7	LTO_11	LTO_18	LTO_21	LTO_30	RES_8	RES_14	RES_17	RES_20	RES_36
LTO_3	.523**	.656**	.664**	.745**	.455*	.319	.300	.384*	.485**	.325
LTO_7		.593**	.613**	.546**	.466**	.436*	.215	.370*	.507**	.421*
LTO_11			.659**	.733**	.421*	.522**	.321	.554**	.605**	.450*
LTO_18				.777**	.706**	.513**	.373*	.460*	.622**	.545**
LTO_21					.586**	.477**	.478**	.552**	.674**	.714**
LTO_30						.331	.324	.228	.368*	.480**
RES_8							.682**	.708**	.701**	.593**
RES_14								.729**	.671**	.787**
RES_17									.714**	.627**
RES_20										.623**

Table 2: Final Grit Scale Descriptive Statistics

Mean	Variance	Std. Deviation	N of Items
35.033	65.068	8.0665	10

Table 3: Item Descriptive Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
G_LTO_3	31.533	51.775	.616	.599	.905
G_LTO_7	32.333	52.437	.620	.524	.904
G_LTO_11	31.533	52.257	.724	.658	.897
G_LTO_18	31.533	49.637	.785	.761	.893
G_LTO_30	31.600	54.938	.565	.572	.906
G_RES_8	31.500	53.086	.692	.660	.899
G_RES_14	31.133	55.706	.618	.827	.903
G_RES_17	31.000	54.759	.688	.702	.900
G_RES_20	31.333	53.264	.784	.704	.894
G_RES_36	31.800	54.510	.701	.742	.899

Table 4: Overall Dimension and Scale Internal Consistency Reliabilities

Dimension	Cronbach's Alpha	Number of Items
Long-Term Orientation	.871	5
Resilience	.914	5
Grit	.909	10

Table 5: Factor Loadings (Rotated Factor Matrix)

	Factor	
	1	2
G_LTO_3		.718
G_LTO_7	.221	.687
G_LTO_11	.340	.714
G_LTO_18	.303	.857
G_LTO_30	.206	.611
G_RES_8	.727	.340
G_RES_14	.923	
G_RES_17	.786	.288
G_RES_20	.694	.481
G_RES_36	.718	.348

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization.

Construct Validity Evidence:

Additional scales for establish measures were included in the analysis in order to ensure that the new scale indeed measures what it was intended to measure. These additional scales were the original Duckworth and Peterson Grit scale, the Bearden, Money and Nevins Long-Term Orientation scale, the Mirels-Garret Protestant Work Ethic scale and the Conner-Davidson Resilience scale. Convergent and discriminant validity evidence were investigated by creating a matrix of the various dimensions and established scales. Alpha's for the construct validity scales ranges from .748 to .897 giving confidence that they could indeed be used for this purpose. Only the Mirels-Garret Protestant Work Ethic scale had a fairly weak internal consistency which came at .676, though should be sufficient for the purpose of this analysis. Table 5 presents the results of this analysis, where blue highlighted cells indicate relationships that were expected to be strong, green highlighted

cells indicate relationships that were expected to be moderately strong, and red highlighted cell indicate relationships that were expected to be less strong or weak.

The results provide evidence for convergent and discriminant validity. The newly developed scale for grit correlated highly to the Duckworth and Peterson grit scale, the Money and Nevins Long-Term Orientation Scale (Planning) and the Conner-Davidson Resilience scale. It correlated less significantly to the Money and Nevins Long-Term Orientation Scale (Tradition), which was not used to formulate the new grit scale and did not correlate at all with the Mirels-Garret Protestant Work Ethic scale as would have been expected since work ethic was eliminated from the grit model. Similarly, the grit dimension for long-term orientation had a significant correlation with the Money and Nevins Long-Term Orientation Scale (Planning) and the grit dimension for resilience had a strong correlation with the Conner-Davidson Resilience scale.

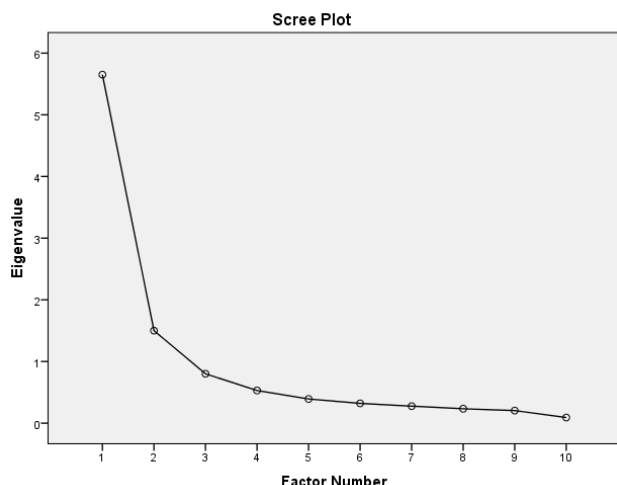
Table 6: Scale Matrix for Convergent and Discriminant Validity

	G_LTO	G_RES	G_GRIT	V_GRIT	V_LTOP	V_LTOT	V_PWE	V_RES
G_LTO (New Grit Scale: Long-Term Orientation)		.595**	.910**	.582**	.649**	.241	-.206	.425*
G_RES (New Grit Scale: Resilience)			.875**	.587**	.469**	.427*	.016	.794**
G_GRIT (New Grit Scale)				.654**	.633**	.365*	-.116	.666**
V_GRIT (Duckworth and Peterson Grit Scale)					.563**	.323	-.095	.658**
V_LTOP (Money and Nevins Long-Term Orientation Scale: Planning)						.290	.182	.554**
V_LTOT (Money and Nevins Long-Term Orientation Scale: Tradition)							.083	.442*
V_PWE (Mirels-Garret Protestant Work Ethic scale)								.064
V_RES (Conner-Davidson Resilience scale)								

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Chart 1: Cattell's scree test confirming the two factor model



Criterion Validity Evidence:

Grit was originally developed as a predictor of academic performance and success. The new grit scale was intended for work place purposes and so evidence must be gathered to demonstrate workplace performance and success. Postdictive evidence was gathered from the participating organization in the form of annual performance results from their 2013 employee survey (n=30). The results were provided as scale values from 1 to 5, where 1 indicates weak performance and 5 indicates performance that exceeds expectations.

The New Grit Scale provided the highest correlation to the criterion among the other scales measured indicating that it can act a strong predictor of performance in this context.

IX. Summary and Discussion

The study found that the Duckworth and Peterson's two factor model was mostly retained though instead of the model consisting of dimensions of consistency of interest and perseverance of effort; it was related to more established concepts found in personality theory such as long-term orientation and resilience. While it was hypothesized that gritty individuals are motivated to achieve and are fulfilled by the work itself, no evidence was found that work ethic plays a part in the determination of an individual's grit. The main issue with the work ethic items is that the concepts of 'perfection' and 'passion' appear to interfere with the ability to overcome obstacles – a main theme of the scale which ultimately put it at odds with the overall definition. This was confirmed through SME feedback, item analysis and factor analysis giving confidence that the final resulting model and scale are sound.

Table 7: Scale and criterion correlations

	Criterion (Performance)
G_LTO (New Grit Scale: Long-Term Orientation)	.468**
G_RES (New Grit Scale: Resilience)	.416*
G_GRIT (New Grit Scale)	.497**
V_GRIT (Duckworth and Peterson Grit Scale)	.379*

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

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