Measuring Both Ends of the Big 5 Personality Scales Independently

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Abstract

This paper outlines the development of the Lumina Spark psychometric tool designed to reduce evaluative bias (Bäckström, Björklund & Larsson, 2014) in the profiling of personality. Big Five personality theory guided the inductive development of 10 scale pairs in the new measure representing the two poles of each Big 5 factors. The 10 scale pairs have been further broken down into 32 facets. The results from Factor Analyses of the 32 facets from an international sample of 1,925 mixed working population, mapped significantly onto the Big Five Factors. Results showed that structuring personality, based upon measuring both polarities of the big five dimensions as scalar opposites and independent constructs, adds resilience and nuance to the subsequent personality profile whilst also reducing evaluative bias.

Keywords: big five, factor analysis, inductive, deductive, bifurcate, mandala, circumplex, evaluative bias

1. Introduction

1.1 Overview

This research set out to develop an integrated model of personality through the use of factor analysis to explore the measurement of both ends of the Big Five polarities independently. This approach to measuring the Big Five aims to integrate both the traditional Big Five personality factors approach, and concepts drawn from Jungian psychology (Jung, 1921), where both sides of the personality spectrum are conceptualised independently. This research investigated the impact of bifurcating the Big Five personality factors into 10 independent personality scales and the method's capacity to capture a finer grain representation of personality.

1.2 Defining the Bifurcated Big Five Scales

A literature review on the Big Five was undertaken and a framework designed to create items to bifurcate and measure both ends of the Big Five polarities. This process involved defining the constructs through reviewing the many facets of the 5 factors found in the literature, before hypothesising how the bifurcation of the 5 factors would create 10 bi-polar scales. An example of the models reviewed can be seen in Appendix 2. A key consideration in item creation was maintaining a balance between socially desirable and more extreme descriptions of the scales. For example, 'takes charge' reflects the 'surgency' component of extraversion and includes being persuasive (a positively framed item) as well as becoming overly controlling (a negatively framed item). An equal number of positive and negatively framed items were created for each bifurcated end of the Big Five.

This approach involves separating out the descriptive and evaluative contents of items and was first advocated by Peabody (1967). Borkenau and Ostendorf (1989) built on this method which Bäckström et al. (2014) described as taking a trait and presenting it as an item in four different ways, "One describes a high level of the trait with a

negative valence, one a high level of the trait with a positive valence, one a low level of the trait with a negative valence and one a low level of the trait with a positive valence." (p. 620). Pettersson, Mendle, Turkheimer, Horn, Ford, Simms and Clark (2014) have successfully applied this method to reduce evaluative bias in a clinical psychology context.

This approach minimises any social desirability bias between the polarities and aims to reinstate the balance inspired by the Jungian approach where both ends are valued equally and of intrinsic value (Myers, McCaulley & Most, 1985, p. 53). A content validity study was undertaken with subject experts to assure content saturation and breadth. This resulted in the 10 scales being broken down into 32 facets as detailed in Appendix 1. The 10 scales are also displayed in Figures 1 and 2 around what is termed a Mandala. Four of the Big 5 factors are shown in Figure 1 and the fifth factor modelling the facets of Emotional Stability and Neuroticism is shown in Figure 2.

1.3 Theoretical Objective
To separate the measurement of both poles of each Big Five personality construct, (rather than on one continuous scale with one more 'socially desirable' end). For example, measuring extraversion as 'socially bold', and introversion as 'contained and listening'. Importantly this separation enabled an individual to be scored potentially high (or low) on both.

1.4 Empirical Objective
To test whether the proposed model of personality is compatible with the Big Five structure.

To test if the methodology of Pettersson et al. (2014) to reduce evaluative bias in a clinical psychology context is also effective in the domain of business psychology when applied using the Big Five approach.

2. Method
In a cross-sectional design $N = 1,925$ participants from diverse occupational background were administered the new personality questionnaire through an online system which they self-scored on a five-point rating scale from "Strongly Agree" to "Strongly Disagree".

The 32 facets were expected to form five factors that resemble the Big Five Factors following Principal Component Analysis with Varimax rotation.

Participants were also invited to complete an alternative four-factor version of the new personality questionnaire, where they were instructed to rate the items in terms of how socially desirable they perceived them to be. Participants were also asked to rate the IPIP-NEO (Johnson, 2014) and Goldberg's (1992) one hundred Trait Descriptive Adjectives (TDA) instruments under the same instructions; sample sizes for these questionnaires were $N = 28$ for IPIP-NEO, $N = 40$ for TDA, and $N = 26$ for the new questionnaire. The different levels of evaluative bias were then compared across the IPIP-NEO, TDA and Lumina Spark Big Five models by calculating the difference between the average social desirability score of each polarity i.e. subtracting the "plus polarity" social desirability score from the "minus polarity" social desirability score to compute the differential.

3. Results

Five factors were extracted accounting for 16.4%, 15.2%, 14.5%, 13.3% and 12.2% of the variance respectively. Table 1 shows that results of the Principal Components Analysis of the 32 facets of the newly developed personality model after varimax rotation. The resulting factor solution replicates the Big Five Factor structure. The first factor has been named Risk Reactor/ Reward Reactor. The Risk Reactor aligns with the high end of the Neuroticism factor and Reward Reactor aligns with the low end, typically termed Emotional Stability in the other literature (Digman, 1997). 4 facets are then used to measure each of the factors at opposite ends. Following this approach, the second factor was labelled Introverted/ Extraverted and corresponds with the Big Five Extraversion factor and consists of 3 facets on each end. The third factor is Discipline Driven/ Inspiration Driven consisting of 3 facets each and is matched to the Conscientiousness factor. The fourth factor is termed People Focused/ Outcome Focused also consisting of 3 facets on each pole and aligns with the Agreeableness Factor. Finally, the fifth factor has been named Big Picture Thinking/ Down To Earth and corresponds to the Openness to Experience factor, also comprising of 3 facets on each side.

As hypothesised, neurotic and emotionally stable items loaded on the same factor, but with opposite loadings. Similarly, Introversion and Extraversion items loaded on the same factor with opposite loadings. Agreeable and Disagreeable items followed the same pattern of factor loading, as did Conscientious and low Conscientiousness items, as well as Closed and Open to experience items.

The data in Table 1 shows how the new model bifurcates the Big Five Factors into 10 scales that are in turn measured by 32 facets.

| | Factor 1 Neuroticism | Factor 2 Extraversion | Factor 1 Conscientiousness | Factor 4 Agreeableness | Factor 5 Openness |
	Risk Reactors & Reward Reactors	Introversion & Extraversion	Discipline Driven & Inspiration Driven	People Focused & Outcome Focused	Big Picture Thinking & Down to Earth
Responsive	**0.90**				
Impassioned	**0.88**				
Vigilant	**0.85**				
Resilient	**-0.84**				
Even-tempered	-0.71				
Modest	0.70				
Optimistic	-0.70				
Confident	-0.58				
Observing		**0.89**			
Measured		**0.89**			
Sociable		**-0.82**			
Demonstrative		**-0.81**			
Intimate		0.65			
Takes Charge		-0.48		-0.45	0.41
Purposeful			**0.88**		
Flexible			**-0.83**		
Structured			**0.82**		
Reliable			**0.82**		
Spontaneous			-0.76		
Adaptable			-0.74		
Empathetic				**0.84**	
Tough				-0.78	
Accommodating				0.75	
Logical				-0.74	
Collaborative				0.74	
Competitive				-0.54	
Conceptual					**0.85**
Imaginative					**0.84**
Radical					0.76
Practical					-0.66
Evidence-Based			0.42		-0.57
Cautious			0.41		-0.52

Table 1. Rotated components of PCA Factor Analysis of the new Personality measure ($N = 1,925$)

Note. Component loadings < .40 omitted; Component loadings > .80 in **bold**.

Analysis on the evaluative bias of the new questionnaire, as compared to the TDA and IPIP-NEO, found reduced levels of evaluative bias in the Lumina Spark questionnaire as compared to the established measures; data shown in Table 2 displays the difference in perceived social desirability between plus and minus polarities of the 4 factors considered.

For example, the TDA items for 'Extraversion' averaged 3.7 out of 5.0 for social desirability, whereas the items for the opposite polarity of 'Introversion' averaged 2.4 out of 5.0. The difference between 3.7 and 2.4 is 1.3 and this is the measure of evaluative bias shown for Extraversion in the TDA column of Tabel 2.

Tabel 2 shows the reduced disparity found between all the polarities of the Lumina Spark questionnaire compared to the TDA and IPIP-NEO established measures of the Big Five and provides evidence to support the claim that the Lumina Spark questionnaire contains less evaluative bias.

	TDA	IPIP-NEO	Lumina Spark Questionnaire
Openness	1.8	0.7	0.6
Conscientiousness	2.2	2.2	0.7
Extraversion	1.3	1.2	0.4
Agreeableness	2.6	1.8	0.2

Table 2. Levels of evaluative bias of the Lumina Spark (N=26) across 4 factors as compared to the TDA ($N = 40$) and IPIP NEO ($N = 28$).

4. Discussion

This approach to assessing personality has identified that the ubiquitous nature of Big Five persists when the factors are measured at both ends of the big five factors separately. Building on the approach of Pettersson et al. (2014) this new approach has been shown to be effective for reducing evaluative bias when using the Big Five for business psychology purposes.

Figure 1 shows how the newly developed personality measure can be arranged parsimoniously around a circumplex or Mandala, which has been designed to represent four of the Big 5 factors, which are typically covered in developmental HR applications. The factors are ordered to form a circumplex where People Focused through to Discipline Driven broadly represent Digman's (1997) Alpha Factor while Inspiration Driven to Outcome Focus represents the Beta factor. The Emotional Stability (Reward Reactor) and Neuroticism (Risk Reactor) factor is represented through another Mandala (Figure 2). Combined, they make a powerful personality assessment tool.

Each Mandala has a colourful 'splash' at its centre, representing a novel infographic used for displaying an individual's Big Five scores, with measurement undertaken independently at each polarity.

Further research is ongoing to better understand the link between personality predictors and performance as conceptualised by the proposed bifurcated model. It will also be helpful to examine whether the features of the new measure can demonstrate improved criterion validity over and above the traditional Big Five construct through breaking out the Big Five factors to measure 'both ends' independently, with significant potential for recasting and enhancing behavioural competence.
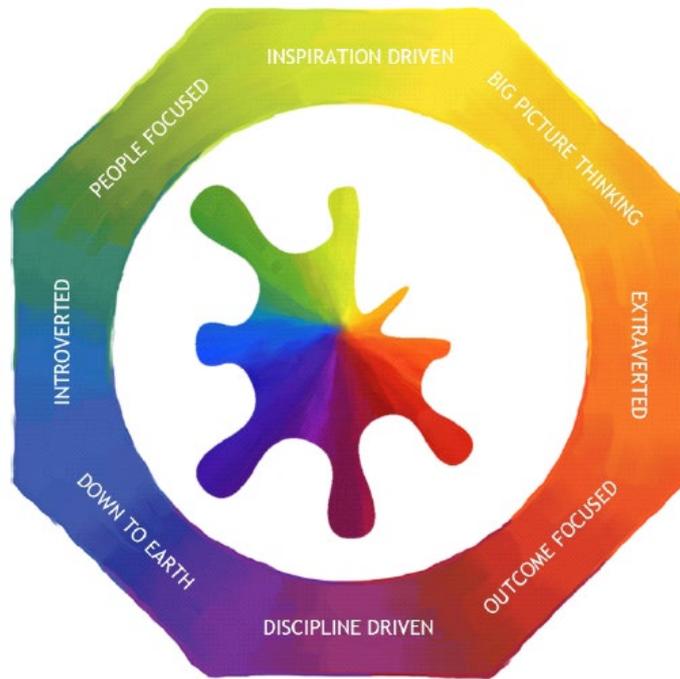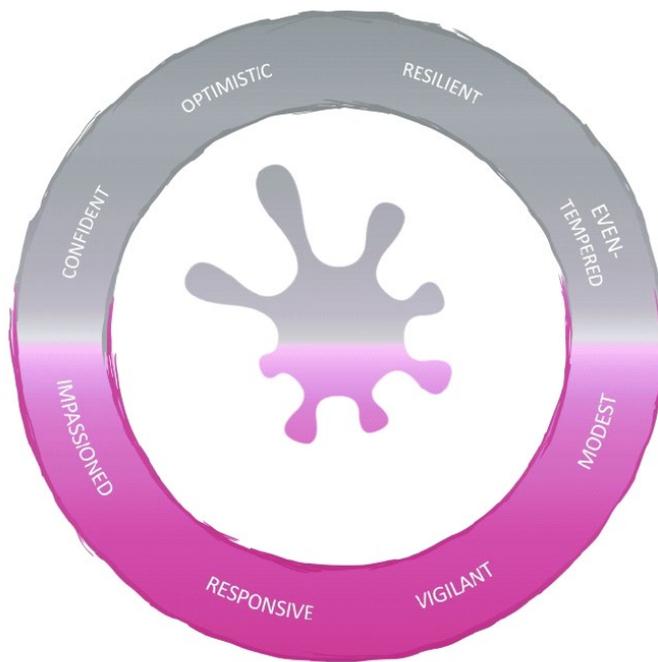
Figure 1. Mandala showing Four Bi-Polar Factors

Figure 2. Mandala showing the Neuroticism and Emotional Stability Factor

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Appendix 1 – Description of the 32 facets

Facet Scale	Description	Big Five Equivalent	Jungian equivalent
Takes-charge	Assertive, takes the lead	Extraversion	Extraversion
Sociable	Friendly, chatty, outgoing, gregarious	Extraversion	Extraversion
Demonstrative	Expressive, enthusiastic, positive, energetic	Extraversion	Extraversion
Measured	Contained, low-key, serious	-Extraversion	Introversion
Observing	Introspective, reserved, thinks before speaking	-Extraversion	Introversion
Intimate	Prefers listening, one-to-one's	-Extraversion	Introversion
Structured	Methodical, planned, Attention to detail	Conscientious	Judging
Purposeful	Clear goals, proactive worker	Conscientious	Judging
Reliable	Honours commitments	Conscientious	Judging
Spontaneous	Acts on spur of moment, Follows instincts and impulses	-Conscientious	Perceiving
Adaptable	Emergent, laid-back	-Conscientious	Perceiving
Flexible	Prefers loose planning, avoids rigid structure	-Conscientious	Perceiving
Empathetic	Tender-minded, compassionate sympathetic	Agreeableness	Feeling
Accommodating	Diplomatic, avoids conflict, consensus-seeking	Agreeableness	Feeling
Collaborative	Supportive, trusting, cooperative, team-player	Agreeableness	Feeling
Competitive	Competitive, shrewd	-Agreeableness	Thinking
Logical	Hard-nosed, objective, unsentimental	-Agreeableness	Thinking
Tough	Candid, straight-talking, direct	-Agreeableness	Thinking

Facet Scale	Description	Big Five Equivalent	Jungian equivalent
Imaginative	Source of ideas, innovative	Open to Experience	Intuition
Conceptual	Intellectually curious, abstract thinker, theoretical	Open to Experience	Intuition
Radical	Takes risks, pushes boundaries, challenges status-quo	Open to Experience	Intuition
Evidence Based	Likes to know the details, facts and evidence	-Open to Experience	Sensing
Practical	Focuses on the here and now, Realistic	-Open to Experience	Sensing
Cautious	Conservative, conventional, Sticks to tried-and-tested methods	-Open to Experience	Sensing
Impassioned	Mood fluctuates frequently, irritable, easily agitated	Neuroticism	NA
Modest	Self-critical, lower-self-esteem, self-conscious	Neuroticism	NA
Vigilant	Anxious, tense, worries what can go wrong	Neuroticism	NA
Responsive	High sensitivity to stress	Neuroticism	NA
Even-Tempered	Stable moods, calm, takes a lot to irritate or anger them	-Neuroticism	NA
Confident	Self-confident, self-assured	-Neuroticism	NA
Optimistic	Positive, easy-going, not easily discouraged	-Neuroticism	NA
Resilient	Handles stress and pressure well	-Neuroticism	NA

Appendix 2 – Overview of the 32 facets in relation to other models

Bifurcated Big Five 5 factors 32 facets	Saville Wave by Peter Saville 5 factors, 12 facets 36 sub-facets 108 sub-sub-facets	WPB5 by Pierce Howard 5 factors 24 facets	FACET5 from Consultingtools.com 5 factors 13 facets 17 types

Big Picture Thinking (O+) vs
Down-to-Earth (O-)
  Radical vs Cautious
  Imaginative vs Evidence Based
  Conceptual vs Practical
	Thought
	
	Evaluation
	Judgement
	Vision
	- 3 facets
		Originality
		
		Preserver (O-)
		Moderate (O=)
		Explorer (O+)
		- 4 facets
			Will
			
			Determination
			Confrontation
			Independence
			- 3 facets

Discipline Driven (C+) vs
Inspiration Driven (C-)
  Reliable vs Spontaneous
  Structured vs Flexible
  Purposeful vs Adaptable
	Delivery
	
	Implementation
	Structure
	Drive
	- 3 facets
		Consolidation
		
		Flexible (C-)
		Balanced (C=)
		Focused (C+)
		- 5 facets
			Control
			
			Discipline
			Responsibility
			- 2 facets:

Extraversion (E+) vs
Introversion (E-)
  Takes charge vs Observing
  Expressive vs Measured
  Sociable vs Intimate
	Influence
	
	Communication
	Impact
	Leadership
	- 3 facets
		Extraversion
		
		Introvert (E-)
		Ambivert (E=)
		Extravert (E+)
		- 6 facets
			Energy
			
			Vitality
			Sociability
			Adaptability
			- 3 facets

People Focused (A+) vs
Outcome Focused (A-)
  Collaborative vs Competitive
  Empathetic vs Logical
  Accommodating vs Tough
	Adaptability
	
	Support
	- 1 facet
		Accommodation
		
		Challenger (A-)
		Negotiator (A=)
		Adapter (A+)
		 - 5 facets
			Affection
			
			Altruism
			Support
			Trust
			- 3 facets

Risk Reactor (N+) vs
Reward Reactor (N-)
  Vigilant vs Optimistic
  Responsive vs Resilient
  Modest vs Confident
  Impassioned vs Even Tempered
	Adaptability
	
	Flexibility
	Resilience
	- 2 facets
		Need for Stability
		
		Resilient (N-)
		Responsive (N=)
		Reactive (N+)
		- 4 facets
			Emotionality
			
			Anxiety
			Apprehension
			- 2 facets

Bifurcated Big Five 5 factors 32 facets	Quintax by Stuart Robinson. 5 factors, 25 types. 10 (5 x 2) poles creates 25 types	HPI by Robert Hogan 7 factors 41 facets	NEO-PI-R by Costa & McCrae 5 factors 30 facets

Big Picture Thinking (O+) vs
Down-to-Earth (O-)
  Radical vs Cautious
  Imaginative vs Evidence Based
  Conceptual vs Practical
	Intellectual Focus
	Grounded(O-)
	Theoretical(O+)
	No facets
		Inquisitive
		v - 6 facets
		Learning
		Approach
		- 4 facets
			O - Openness to Experience
			O1: Fantasy
			O2: Aesthetics
			O3: Feelings
			O4: Actions
			O5: Ideas
			O6: Values

Discipline Driven (C+) vs
Inspiration Driven (C-)
  Reliable vs Spontaneous
  Structured vs Flexible
  Purposeful vs Adaptable
	Organisation
	Adaptable(C-)
	Structured(C+)
	No facets
		Prudence
		v - 7 facets
			C – Conscientiousness
			C1: Competence
			C2: Order
			C3: Dutifulness
			C4: Achievement Striving
			C5: Self-Discipline
			C6: Deliberation

Extraversion (E+) vs
Introversion (E-)
  Takes charge vs Observing
  Expressive vs Measured
  Sociable vs Intimate
	Extraversion
	Introvert(E-) v
	Extravert(E+)
	No facets
		Ambition
		- 6 facets
		
		Sociability
		- 5 facets
			E – Extraversion
			E1: Warmth
			E2: Gregariousness
			E3: Assertiveness
			E4: Activity
			E5: Excitement Seeking
			E6: Positive Emotions

People Focused (A+) vs
Outcome Focused (A-)
  Collaborative vs Competitive
  Empathetic vs Logical
  Accommodating vs Tough
	Criticality
	Personable(A+)
	Logical(A-)
	No facets
		Interpersonal
		v Sensitivity
		- 5 facets
			A - Agreeableness
			A1: Trust
			A2: Straightforwardness
			A3: Altruism
			A4: Compliance
			A5: Modesty
			A6: Tender-Mindedness

Risk Reactor (N+) vs
Reward Reactor (N-)
  Vigilant vs Optimistic
  Responsive vs Resilient
  Modest vs Confident
  Impassioned vs Even Tempered
	Emotional
	Involvement
	Calm(N-) v
	Volatile(N+)
	No facets
		Adjustment
		- 8 facets
			N – Neuroticism
			N1: Anxiety
			N2: Angry Hostility,
			N3: Depression,
			N4: Self-Consciousness,
			N5: Impulsiveness