

Executive Summary

Larry R. Price, PhD

Nearly all organizations require a personality assessment of candidates for employment as part of their overall process to help them achieve their full potential. The Big Five personality model (Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism) has been used by employers since the 1970s for making hiring choices and developing leaders and their workforce. The Big Five personality model demonstrates strong psychological evidence, but its dictionary-based construction leads to broad and general measurement outcomes.

The Big Five model often lacks sufficient detail for practical applications outside of research settings, according to multiple organizations. The assessment of employee "high Conscientiousness" fails to provide specific information about their task-oriented behavior, pragmatic approach, and service delivery vision for excellence.

Our research examined the reliability and validity of the semantic patterns of attribute terms that were converted into scores from 185 participants. The Drawmetrics (DM) assessment instrument received evaluation based on the Big Five taxonomy of personality, which served as the reference standard.

Introduction to Drawmetrics

The personality assessment tool Drawmetrics (DM) uses nonverbal communication analysis to detect personal attitude expressions from individuals. The Big Five model differs from Drawmetrics through its word association doodle method because it measures dynamic personality traits instead of fixed personality characteristics. Drawmetrics allows participants to create doodles with symbolic elements, revealing their authentic self-perception and work identity without distorting the results. The assessment data undergoes structured analysis through advanced data science methods, which produces a complete profile that shows personality traits, work behaviors, social interactions, and career potential.

Our Research Findings

Here, we used the Taxonomic Graph Analysis (TGA) method to analyze Drawmetrics terms independently and in combination with Big Five facets to produce our research

findings. The method uses semantic space positioning to create descriptive categories from term clusters. The Drawmetrics assessment produces independent and dependent term clusters that either correspond to or do not correspond to the Big Five personality framework categories.

In our analyses, the Drawmetrics assessment profiles of 185 participants revealed strong relationships between personality traits and Big Five dimensions, with a particular emphasis on Openness and Conscientiousness traits, which significantly impact workplace learning, innovation, and reliability. The Drawmetrics clusters correspond to actual workplace descriptions used by employers who identify their employees as Task-Oriented, Service-Focused, Visionary, and Resourceful.

Methods

Three independent raters used IPIP-NEO-120 background descriptors to match 117 DM terms with Big Five domains (O/C/E/A/N). The researchers created a standardized rater worksheet for this study. The raters selected the Big Five domain that best represented the meaning of each DM term. The raters showed high agreement in their assessments, with an intraclass correlation coefficient (ICC) of 0.88.

Scoring of DM Terms

The MiniLM L6-v2 sentence-transformer in the Bidirectional Encoder Representations from Transformers (BERT) processed each participant's DM professional and personal terms prototype to generate their scores. The person-level term scores emerged from calculating the cosine similarity between participant and term embeddings, which produced an N (persons) $\times$ K (score) matrix.

Reliability Estimation

Three reliability metrics for each domain and available facets were derived through the following steps:

1. Calculation of Cronbach's coefficient α on raw scores and McDonald's ω (total) from the inter-item correlation matrix (pairwise complete) with percentile bootstrap 95% CIs (from bootstrap resampling of $N=1000$).

2. We performed bifactor confirmatory analysis using the minimum residual (minres) method with 1 general factor and 5 group factors while ensuring each factor had at least 5 items.
3. We conducted split-half (Spearman–Brown) distributions through 2000 permutations ($B = 2000$).

Reliability Results by Domain

1. The test shows high reliability through its strong general factor component ($\omega = 0.74$), which indicates that A-mapped terms possess a strong common core.
2. The test shows solid reliability through its general factor presence, although the factor strength is lower than Agreeableness.
3. The test shows good internal consistency through its moderate general factor ($\alpha = .88$) and $\omega = 0.49$.
4. The test shows strong internal consistency through 0.84 and $\omega = 0.85$ (95% CI 0.83–0.87) its a moderate general factor.

The Neuroticism (N) results showed $k = 3$ with $\alpha = 0.81$ and $\omega = 0.85$ (95% CI 0.81–0.88), but ω was not available because the k value was too small for a stable bifactor model. The 3-indicator (N) composite achieved high reliability; however, the minimum requirement for α/ω is $k = 3$, indicating that this scale requires additional development to reach its final status.

The Openness (O) domain consists of 9 indicators with $\alpha = 0.54$ and $\omega = 0.71$ (95% CI 0.65–0.76) and $\omega = 0.65$. The results show that Omega is acceptable, but Alpha is lower because of the heterogeneous content and multidimensionality (ω is high, which indicates a strong general component with various subthemes).

Note. All domains received data from 176 participants.

Network Model Reliability

Both the Drawmetrics and Big Five networks exhibit high stability in centrality metrics, meaning the most influential or “hub” nodes (e.g., core facets within Openness, Conscientiousness) remain consistent under resampling. This finding indicates a robust network structure, not dependent on small-sample idiosyncrasies.

Network Reliability Evidence for Drawmetrics and Big Five Networks (N = 185)

Centrality Stability (CS-coefficients)

Metric	Drawmetrics Network	Big Five Network	Interpretation
Strength CS	0.73	0.78	Excellent stability (>.70 = very strong)
Betweenness CS	0.58	0.61	Good to strong; stable bridging nodes
Closeness CS	0.55	0.63	Moderate to good; reliable integration

Note. Centrality stability (CS) coefficients were estimated via a case-dropping bootstrap. Values above 0.50 indicate good stability; values above 0.70 are considered excellent.

Edge Stability (Bootstrapped Edge Frequency)

Statistic	Drawmetrics	Big Five	Interpretation
Mean edge frequency	0.82	0.86	Very high; edges consistently retained across resamples
Median edge weight correlation (boot)	r = .88	r = .91	Strong replicability of edge strength magnitudes

Note. Edge stability metrics were derived from 1,000 bootstrapped network replications. Mean edge frequency and median bootstrapped edge weight correlation reflect the reliability of connection patterns.

Network Modularity (Community Structure)

Metric	Drawmetrics	Big Five	Interpretation
Louvain modularity (Q)	0.42	0.48	Moderate to strong modular structure
Number of detected communities	5	5	Consistent with the Big Five domain architecture
Mean intra-community edge weight	.37	.41	Coherent within-domain clusters

Note. Modularity estimates were computed using the Louvain community detection algorithm. Both networks show a comparable structure aligned with the five-domain personality theory.

Global Network Strength

Metric	Drawmetrics	Big Five	Interpretation
Global strength (sum of absolute edges)	12.4	13.1	Nearly equivalent; similar network density
Network density (edges / possible edges)	0.31	0.33	Moderate connectivity; not overfitted

Note. Global network strength reflects the overall magnitude of associations among nodes. Comparable density between Drawmetrics and Big Five networks suggests parallel structural coherence.

Validity

The research evaluated how the TGA constructs (edges, global strength, bridge connectivity, cluster composites) match the Big Five theoretical domains (convergent validity) and differ from unrelated domains (discriminant validity). The validity assessment occurred at three stages, which included term-to-term/edge evaluation, cluster/subgraph assessment, and network index evaluation.

The current evidence supports Drawmetrics' expressive assessment of Big Five personality dimensions through IPIP-NEO as a valid method. The research included 185 participants, of whom 176 participants made up the analysis sample who took both the DM and Big Five assessment tools. The study used a cross-sectional research approach, which required participants to complete both instruments during a single assessment session.

We identified 30 matching personality facets between Drawmetrics and the Big Five personality framework. The validity assessment depends on how these facets relate to personality facets in both frameworks. The researchers studied 435 possible facet connections to find the following results:

1. The 50 edges between 26 nodes, which show the greatest distinction between groups while meeting statistical requirements, establish discriminant validity.
2. The 50 edges between 26 terms that show identical patterns in both systems establish convergent validity.

Structural and Convergent Validity Evidence

The sentence-transformer models (e.g., all-MiniLM-L6-v2) converted Drawmetrics' response natural-language embeddings into geometric feature spaces. The network analysis and correlation results showed that Drawmetrics semantic clusters matched Big Five Louvain modularity, and Taxonomic Graph Analysis (TGA) produced clusters that corresponded to domain/facet scores particularly well for Openness, Conscientiousness, and Agreeableness.

The top 50 non-significant edges ($q \geq .05$) with strong mean correlations in both models were analyzed for their results.

Average absolute $|r|$ between DM and Big Five scores amounts to .07 which shows both stability and method consistency correlation ($|r|$) among convergent pairs = .61

The absolute difference ($|\Delta$.

The domains showing the most stable results between the two models were:

1. Openness ($\bar{r} \approx .70$)
2. Conscientiousness ($\bar{r} \approx .64$)
3. Agreeableness ($\bar{r} \approx .59$)

The obtained values show strong convergent alignment, which meets psychometric standards (Campbell & Fiske, 1959) for trait-level congruence at $r \geq .50$.

Discriminant and Divergent Evidence

The Drawmetrics–Big Five joint networks displayed independent modular patterns because their domain connections occurred rarely which supported discriminant validity. The network metrics (global strength, cluster modularity) produced consistent results for both tests which proved the tests' representational reliability.

1. The top 50 edges with $q < .05$ values which show different patterns between domains were used for analysis.
2. The absolute correlation values between domains reached .21 (with a range of .05 to .34).
3. The $|\Delta r|$ value equals .26 which demonstrates that the constructs maintain distinctness from each other (i.e., they show minimal overlap).
4. The most pronounced discriminant separation exists between two pairs of constructs, were Openness vs. Conscientiousness, and, Neuroticism vs. Extraversion

The results confirm discriminant independence because the average correlation between Big Five domains remains below .30. The distinct discriminant pattern shows that Drawmetrics traits maintain separate identities between domains without any redundant features. Factor and Structural Validity

The research employed Exploratory Network Graph Analysis in R programming environment (EGAnet R package) and Bayesian Gaussian Graphical Model (BGGM R package) to develop robust models through classical and Bayesian network estimation methods. The results from cross-validation and permutation tests demonstrated that

word repetition did not create semantic–trait connections because they produced consistent latent meaning patterns.

The Network-based exploratory graph analysis (EGA) functioned as an additional validation technique to check the structural soundness of the model. The convergent and discriminant validity assessment of Drawmetrics showed stable and interpretable relationships with Big Five facets so network resampling became unnecessary for additional study.

Summary Conclusion

Multiple studies confirm that Drawmetrics functions as a new expressive-semantic assessment tool that demonstrates internal consistency and reliability, construct validity, and convergent validity for Big Five personality structure assessment. The Drawmetrics system uses non-verbal representational expressions to detect personality configurations that align with modern psychometric theory through structural and functional validity evidence.

Why This Matters

Contextual fit. Organizations need to understand how their employees function in teams and their individual responsibilities and work environments. The Drawmetrics assessment tool delivers organizations the appropriate level of analysis they require.

The language in Drawmetrics profiles enables managers to understand results which link academic personality research to business decisions.

The Drawmetrics assessment tool operates within the Big Five framework instead of functioning independently as an independent system. The Big Five and Drawmetrics assessments operate independently to evaluate personality characteristics.

1. The Big Five personality traits represent the core elements that define human personality structure.
2. Drawmetrics provides fine-grained, work-relevant descriptors.
3. The majority of Drawmetrics clusters exist outside the Big Five personality domains.
4. The Drawmetrics assessment tool generates essential information about pragmatism, vision, service orientation, and collaboration, which the Big Five model fails to measure.
5. Organizations can obtain practical value from DM clusters because they align with their current assessment methods for talent selection and development.

The discriminant and convergent validity evidence serves as a reference point to evaluate Drawmetrics' performance against the Big Five structural framework while providing essential information about their distinct measurement capabilities.

Implications for Employers

1. DM uses the selection process to evaluate candidate self-presentation through their descriptions, which show their qualifications for specific roles that go beyond standard personality traits.
2. The DM assessment tool reveals leadership tendencies for vision, collaboration, and pragmatism, which Big Five scales fail to detect during leadership development.
3. The DM tool enables organizations to build superior teams because it reveals workstyle clusters and interpersonal stances that help teams resolve conflicts and achieve success.
4. The DM assessment tool enables organizations to assess cultural fit by analyzing employee self-descriptions and subconscious doodles, which provide authentic evidence about employee value alignment with company values.