Hemispheric Lateralization of Context Length and the Organization of the Big Five Traits

Abstract

This paper tests the hypothesis that the Big Five personality traits can be grouped into two distinct psychological meta-traits shaped by an individual's stable preference for either short- or long-context processing. This processing orientation, in turn, determines their perceptual preference for Sensing versus Intuition and influences the emergence of higher-order constructs conceptualized as Ego and Superego. Drawing on neuroscientific research that demonstrates differential temporal integration in the cerebral hemispheres, we conducted a weighted factor analysis on data from 3,121 participants collected via a modified IPIP-300 instrument. A frequency-based weighting algorithm was applied to correct for overrepresentation of certain cognitive types. The results revealed two clear factors: one defined by a Neuroticism–Extraversion axis indicative of short-context processing and the other defined by an Agreeableness-Conscientiousness axis reflective of long-context processing. These findings support the TRPI framework by suggesting that personality structure is fundamentally organized by context processing preferences, offering a neurocognitively grounded alternative to traditional trait taxonomies.

Introduction

Extraversion and Introversion as Contextual Processing Modes

The Trait Response Personality Indicator (TRPI) proposes that the core distinction between Extraversion and Introversion reflects a cognitive preference for context length. Extraversion corresponds to short-context processing, rapid, situational engagement with immediate stimuli. While Introversion reflects a preference for long-context processing, involving slower, integrative reasoning over extended time spans. This framing aligns with neuroscientific research showing that the left hemisphere processes information in shorter temporal windows, while the right hemisphere integrates longer-range contextual data (Pasquiou, A., Lakretz, Y., Thirion, B., & Pallier, C. (2023)) These differences in temporal integration provide a foundation for understanding attentional style and cognitive structure across personality types.

Hemispheric Specialization for Sensing and Intuition

Building on this, TRPI suggests that the hemisphere favoring short-context processing is more attuned to concrete (Sensing) information, while the hemisphere favoring long-context processing specializes in abstract (Intuition) information. These preferences determine how individuals perceive and organize incoming data. The Big Five trait of Openness, long associated with Intuition in typological models, supports this. In this way, the Sensing–Intuition polarity reflects a fundamental perceptual distinction underlying cognitive processing styles.

Ego and Superego as Psychological Constructs

Within the TRPI framework, the constructs of Ego and Superego emerge as higher-order psychological constructs that are related to an individual's contextual processing style. The Ego construct is associated with short-context processing, characterized by immediate engagement, reactivity, and situational responsiveness whereas the Superego construct is linked to long-context processing, reflecting prolonged, integrative reasoning and internal regulation. Importantly, these constructs represent emergent patterns of cognitive organization that guide behavior across diverse contexts.

Hypothesis

We hypothesize that the Big Five traits form two distinct meta-traits. These meta-traits are shaped by an individual's stable preference for either short- or long-context processing, which in turn determines their preference for Sensing versus Intuition and influences whether they predominantly exhibit patterns associated with the Ego or the Superego construct.

Methods

Participants and Data Collection

Participants completed an online assessment designed to measure the Big Five personality traits using a modified version of the IPIP-300 instrument. The assessment included 26 items covering Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Each participant's trait profile was computed as a normalized continuous score (ranging from 0 to 1). A total of 3,121 responses were analyzed.

Derivation of Brigg-Myers Types

Each participant's Big Five profile was represented as a five-dimensional vector in the order: [Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism]. Prototypical profiles for each of the 16 Brigg-Myers types were defined based on previous results. Each participant's profile was compared with these prototypes using a combination of similarity metrics:

- **Pearson Correlation**: Assesses the overall pattern or "shape" of the profile.
- **Euclidean Distancing**: Quantifies the absolute differences in trait levels. A composite similarity score was computed, and the Brigg-Myers type with the highest score was assigned to each participant.

Typological Weighting

To address imbalances in type frequency (particularly the overrepresentation of intuitive and extraverted types) a frequency-based weighting algorithm was applied. For each participant, a weight was computed as follows:

$w_i = \max(0.25, 1 - (f_i / f_{max}))$

where f_i is the frequency of the participant's MBTI type in the dataset and f_{max} is the maximum frequency observed. These weights were then compiled into a diagonal matrix and used to compute a weighted covariance matrix, ensuring that underrepresented types contributed proportionately to the analysis.

Factor Analysis

A principal axis factor analysis with Varimax rotation was conducted on the weighted covariance matrix of the Big Five traits. Factors were retained based on eigenvalues of 1.0 or greater and visual inspection of the scree plot. Trait loadings with absolute values of at least 0.40 were considered significant, although the primary focus was on the extreme loadings (highest and lowest) in each factor to define the meta-trait axes.

Results

Factor Structure

Eigenvalue decomposition and scree plot analysis supported a two-factor solution. This is consistent with the TRPI model's predictions regarding the dual structure of personality based on context processing preferences.

Trait Loadings

The factor loadings for the Big Five traits are summarized in Table 1. Emphasis is placed on the highest and lowest loading values for each factor:

Trait	Factor 1	Factor 2
Openness	0.2706	**0.4638**
Conscientiousness	0.2653	0.1990
Extraversion	**0.4683**	0.3986
Agreeableness	−0.2678	**0.7321**
Neuroticism	**−0.7519**	0.2247

Interpretation

Factor 1 is defined by a strong negative loading on Neuroticism (−0.7519) and a strong positive loading on Extraversion (0.4683). This Neuroticism–Extraversion axis reflects a cognitive orientation geared toward short-context processing, characterized by rapid emotional reactivity and immediate engagement with external stimuli. Within TRPI, this axis corresponds to the emergent Ego construct, which organizes behavior around prompt situational responses.

Factor 2 is anchored by a high positive loading on Agreeableness (0.7321) and a weaker positive loading on Conscientiousness (0.1990). This axis represents long-context processing, reflecting sustained, integrative cognition and interpersonal regulation. The high Agreeableness suggests that individuals scoring high on this factor tend to exhibit socially adaptive and internally coherent behavior, characteristic of the Superego construct as described by TRPI.

Although Openness loads positively on both factors, its stronger association with Factor 2 supports its role as an index of the Sensing–Intuition polarity, with higher Openness indicative of an abstract, intuitive cognitive style.

Discussion

The factor analysis reveals two distinct psychological axes that support the TRPI framework. The first axis, defined by the sharp contrast between Neuroticism and Extraversion, represents a spectrum of short-context processing. Individuals at the high Extraversion/low Neuroticism end of this axis are characterized by immediate, reactive engagement, which is consistent with the cognitive configuration associated with the Ego construct. The second axis, dominated by high Agreeableness and supported by modest Conscientiousness, reflects long-context processing. This dimension aligns with the Superego construct, emphasizing integrative, reflective behavior and internal regulation.

Openness, while present in both factors, serves primarily to differentiate perceptual styles. Its stronger loading on the second factor underscores its association with Intuition, in contrast to lower Openness scores that would indicate a more Sensing-oriented, concrete perception. Thus, the dual-axis structure not only supports a reconceptualization of personality based on context processing preferences but also situates perceptual orientation (Sensing vs. Intuition) as an independent yet intersecting dimension.

These findings extend previous models of meta-traits by providing a neurocognitively grounded framework in which personality is organized along dimensions of temporal context and perceptual processing. The TRPI framework thus offers a dynamic, functional model of personality that transcends traditional static trait taxonomies.

Conclusion

This study provides empirical validation for the TRPI framework, demonstrating that the Big Five traits can be organized into two distinct psychological meta-traits. One meta-trait, defined by the Neuroticism–Extraversion axis, reflects short-context processing and is associated with the Ego construct. The other, defined by the Agreeableness–Conscientiousness axis reflects long-context processing and aligns with the Superego construct. Additionally, the role of Openness as an index of Intuition confirms the importance of perceptual orientation in personality structure. Overall, these findings support a model of personality that is dynamically organized by context processing preferences and perceptual orientation, offering a neurocognitive alternative to traditional trait frameworks.

References

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