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Distinctiveness and Similarity: How the Sub-Trait Facets of the Big Five Self-Organize to Create Personality Types

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Distinctiveness and Similarity: How the Sub-Trait Facets of the Big Five

Self-Organize to Create Personality Types

by

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"With light poise and counterpoise, Nature oscillates within her prescribed limits, yet thus arise all the varieties and conditions of the phenomena which are presented to us in space and time."

Johann Wolfgang von Goethe

Abstract

The belief that people can be placed within a personality typology has persisted for millennia. At least as far back as Hippocrates (ca. 460 BCE–370 BCE) people were believed to be of a kind based on the four humors—blood, yellow bile, black bile, and phlegm. Since then, there have been many conceptions of personality typologies. The Myers-Briggs Type Indicator and the Enneagram of Personality are likely the most well-known personality typologies among the general public. Despite their wide public usage, neither typology boasts strong empirical support. However, psychology continues to investigate personality for evidence of a typology of personality. In line with the research conducted by Gerlach et al. (2018) and Ferguson and Hull (2018), the current study analysed the 30 facets of the International Personality Item Pool 300 (IPIP-NEO-300) for evidence that personality exists as unique configurations of facet level personality *types*. Results of the Latent Profile Analysis performed on each of 12 dataset groupings revealed 3 facet-based personality types. These revealed types correspond partly with the Resilient, Overcontrolled, and Undercontrolled personality profiles previously uncovered in independent research by Asendorpf et al. (2001), Robins et al. (1996), and Caspi and Silva (1995)—the so-called ARC types.

Key words: personality typology, trait theory, facets, latent profile analysis

Distinctiveness and Similarity: How the Sub-Trait Facets of the Big Five Self-Organize to Create Personality Types

Each of us has a personality, our distinct way of interacting with others and being in the world. In regular conversation people consistently speak about others as possessing a personality that is recognizable, both for its distinctiveness—it is different than certain other personalities—and its similarity—it is like the personalities of some other people. The apparent paradox of sameness and difference that we find in the study and understanding of personality has resulted in myriad approaches to explaining what is meant by personality. Still, there is no consensus within the broader discipline of Psychology on the precise definition of personality (John et al., 2008), which aspects to include or exclude (Matthews, 2020), or whether it is a singular psychological construct, or a label that refers to numerous, discrete psychological constructs (Baumert et al., 2017; McCrae, 2009). Questions concerning the degree to which either nature (genetics) or nurture (environment) affect the development of personality continue to drive personality studies (Haworth, et al., 2013).

There is no dispute with the assertion that all people possess *a* personality. However, whether or not personality, as a construct or set of trait factors and facets, is *shared* among people—do certain groups of people share the *same* personality type—has been, and continues to be, a contentious issue. For both developmental and personality psychology, the question of whether personality develops into definable profiles or *types* is of significant interest. There are several reasons an empirically verified personality typology would be a meaningful addition to our psychological knowledge—a small sample of reasons follows.

First, if personality exists as a set of *types*, the developmental literature on temperament becomes even more significant in our understanding of personality

development. An empirically identified personality typology would require an understanding of the biopsychosocial mechanisms involved in personality development, beginning in childhood, and extending throughout the lifespan. Second, many of the questions social psychology has grappled with would benefit from reinvestigation through the lens of personality typology. It would no longer be the simpler questions of how people, on average, react to X. Rather, we would need to begin asking the more specific question: how do people with personality type A (or B, C, etc.) react to X? Third, an empirically supported personality typology would have much to add to a broad range of the social sciences (e.g., education, organizational psychology, team building, and so on). Both developmental and personality psychology would be impacted if it is the case that personality self-organizes into a set of types that begin to develop in infancy and early childhood.

Is personality a wholly unique phenomenon within each individual or is personality a shared phenomenon between people? Phrased more simply, is every individual personality sufficiently different to other personalities that it must be classified as altogether unique to the person, or are there *types* of people such that everyone can be accounted for within an appropriate personality typology? The current study analysed the 30 facets of the IPIP-NEO 300 personality questionnaire (Johnson, 2006) for evidence that the facets—specific and unique aspects of the principal Big Five (Goldberg, 1990) personality factors—self-organize into discrete groupings or clusters that can be reasonably considered to be personality *types*.

For the sake of clarity within this study, references to each of the elements of the Five-factor Model (McCrae & Costa, 1987) will apply the following convention: the Big Five traits will be referred to as factors, the 30 sub-trait facets—which are the focus of the current study—will be referred to simply as facets, and individual items from the

International Personality Item Pool (IPIP-NEO-300) will be referred to as nuances (Mõttus et al., 2017). Reference to personality *types* is distinct from the Big Five factors and the underlying 30 facets in that a personality type is a specific configuration or distribution of factor and facet scores shared among groups of people within the population.

The use of the term *self-organized* is intended to indicate that any extant personality types are the result of natural, nondirected processes. In this context, personality types are not the result of consciously made decisions by each separate individual (i.e., people do not consciously choose a personality type), but rather an essentially fixed set of factor and facet configurations which originate from innate processes, either subconscious or unconscious, and the stimulus response(s) these processes generate. This feed-back loop between temperamental set and behavioural and attitudinal responses to environmental stimuli likely acts as the self-organizing principle in personality type development. Self-organized personality types would exist as the result of genetically or epigenetically produced traits that set the *temperamental posture* of the individual. This temperamental posture then influences both the reactive and decisive processes of the individual such that their personality develops into 1 of the extant latent personality types.

This study hypothesises that a latent profile analysis (LPA) of the 30 facets that constitute the Big Five personality factors will support prior research indicating personality exists as at a minimum 3 broad types. Connected to this primary hypothesis it is further hypothesised that any revealed facet-based personality types will be observable across the lifespan (i.e., the personality type evident in adolescence is essentially interpersonally consistent with the personality type evident in later adulthood).

The following sections provide a review of relevant literature on temperament,

personality, personality development, personality complexity, and personality typology.

Temperament

As any close observer of children can attest, children exhibit a kind of *personality* when still very young (McAdams, & Olson, 2010). This early display of distinctive attitudes and behaviours is generally referred to as *temperament*. The American Psychological Association (APA; VandenBos, 2007) defines temperament as, "the basic foundation of personality, usually assumed to be biologically determined and present early in life, including such characteristics as energy level, emotional responsiveness, demeanor, mood, response tempo, behavioral inhibition, and willingness to explore" (p. 1071). Numerous studies indicate that temperament sets the stage for and direction of personality development across the life span (Caspi & Roberts, 2001; Cloninger, 1994; Halverson Jr., 2014; Rothbart & Ahadi, 1994).

Investigation of the links between childhood temperament and adult personality also includes examining the links between childhood temperament and adult temperament. Shiner and DeYoung (2013) argue that temperament and personality are "different ways of describing the same basic traits, with temperament research primarily focused on early emerging individual differences and personality research focused on individual differences that appear later in childhood and continue into adulthood" (p. 114). This description is important in helping to clarify the connections between the temperament of the child and the later personality of the adult. One example of this connection between child temperament and adult personality was revealed by Bohlin and Hagekull (2009). They were able to show that children (20 to 48-months old) who were assessed as temperamentally shy on the Emotionality, Activity, and Shyness/Sociability Temperament Survey grew into adults who struggled with social anxiety ($t = 3.10$, $p = 0.01$).

Chess and Thomas (1984) were able to show that the *easy/difficult* dimension ratings for 3-year-old children were related to *easy/difficult* temperament scores in early adulthood. Rothbart and Ahadi (1994) recovered 3 broad factors of temperament in children 3-years to 8-years old: surgency/extroversion, negative affectivity, and effortful control. The authors note that these 3 childhood temperament dimensions share significant similarities to the Big Five factors that emerged from studies of adult personality—extroversion, neuroticism, and conscientiousness (Eysenck & Eysenck, 1992; Goldberg, 1993; McCrae & Costa, 1987).

Rothbart (2007) highlights the developmental trajectories between childhood temperament dimensions and adult personality factors. The level of childhood effortful control sets the developmental trajectory for level of adult Conscientiousness; childhood negative affectivity scores indicate level of adult Neuroticism; and degree of childhood extroversion/surgency is linked to adult Extroversion scores. These childhood temperament dimensions displayed moderate correlations with personality factors and facets for adults and show considerable consistency over time (correlations ranged between $r = 0.43$ and $r = 0.59$) (Rothbart et al., 2000).

The connection between temperament dimensions and personality factors is crucial for understanding how personality is constituted and develops over the life span. As indicated above, childhood temperament appears to create the orientation or direction for subsequent personality development and structure. As Caspi (2000) affirms, "a fundamental assumption guiding the study of personality development is that early emerging temperamental differences shape the course of development, its problematic presentations and healthful outcomes" (p. 167).

Block (1971), in collaboration with Haan, identified 3 personality types— Undercontrolled, Overcontrolled, and Resilient. These 3 personality types are most often referred

to with the acronym ARC or the label Asendorpf-Robins-Caspi Types, in recognition of the

independent research of Asendorpf, Robins, and Caspi (Asendorpf et al., 2001; Robins et al.,

1996; Caspi & Silva, 1995) which provided empirical support to Block's (1971) original

conceptualization. Chapman and Goldberg (2011) investigated the replicability of the childhood

ARC types in adults as Big Five trait clusters and the predictive power of the ARC typology for

both general and cardiovascular health outcomes over a span of 40 years. The authors held 3

hypotheses; a) childhood types with low Agreeableness would become adults with higher risk of

incident hypertension and myocardial infarction, b) childhood types with emotional instability

and lower Extroversion would possess the same health risks with the added risk of coronary

heart failure, and c) an expectation that the incidence of stroke, hypertension, and diabetes would

be lower among childhood types that had displayed higher Conscientiousness. Pertinent to the

current study, Chapman and Goldberg (2011) found that childhood categorical ARC types and

prototypicality scores provided better predictions of adult hypertension, stroke, and

cardiovascular diseases than random guessing. The author's findings indicated that the ARC

types have long-term relevance for general health outcomes—the ARC types could be

represented as Big Five trait clusters, and these trait clusters improved the health outcome

predictability for everyone in the sample. Not only were the ARC types able to be represented by

Big Five trait clusters they also showed consistency over time and correlation to individual

health outcomes. Added to the results presented by Gerlach et al. (2018) and Ferguson and Hull

(2018), it appears personality can be confidently understood to exist, at a minimum, as a set of 3

types.

  Rothbart (2007) points out, childhood temperament is highly correlated to adult

temperament and personality. In particular, the childhood temperament dimensions of effortful

control (EC), negative affectivity, and extroversion/surgency are correlated to the Big Five traits of neuroticism (negative affectivity), contentiousness (EC), and extroversion (extroversion/surgency). This suggests that the temperamental profile of a child provides good evidence for the personality profile of the future adult.

As the present study aims to show, a typology of personality helps explain this temperament to personality consistency. Asendorpf and Van Aken (2003) suggest we take seriously the fact that a significant segment of variance in Big Five judgments is in the perception of the observer rather than in the judged persons. In other words, it is not necessarily the personality of the observed individual that has changed but possibly only the perception of the observer (e.g., observer bias). This supports the evidence that even during childhood, the individual's personality is remarkably consistent over time. Such a finding lends additional support to the view that personality develops into, and exists as, a set of *types* and these types are measurable across the lifespan.

Working with the data from the Dunedin Multidisciplinary Health and Development Study (Poulton, Moffitt & Silva, 2015), Caspi et al. (1996) found 3 broad personality types in children aged 3-years old—well-adjusted, undercontrolled, and inhibited. These types were found to be consistent intra-individually across many years (age 3-years to 21-years old). They also closely map to the so-called Asendorpf-Robins-Caspi (ARC) types (Asendorpf et al., 2001; Robins et al., 1996; Caspi & Silva, 1995); resilient, undercontrolled, and overcontrolled.

Personality Development

There is good evidence that personality develops over time (Evans & Rothbart, 2007; Helson et al., 2002; Roberts & Mroczek, 2008; Rothbart, 2007). The fact that personality *develops* suggests that this process of development from early childhood temperament to adult

personality isn't random. Randomness in a chaotic system (explained in the section on personality complexity) is not the same as true randomness in that it is deterministic randomness—the behavior of the system (personality) is determined by its underlying laws and equations (biopsychosocial constraints). The hereditary aspects of temperament shape the actions and reactions of the individual to their environment in ways that provide direction to the development of personality—a set of temperamental dispositions lead to a set of personality types, within which there is situational flexibility (Donnellan & Robins, 2010).

McAdams and Pals (2006) outlined what they called the "new Big Five" principles for an integrative science of personality. These principles are (a) evolution and human nature, (b) the dispositional signature (*factors and facets*), (c) characteristic adaptations, (d) life narratives and the challenge of modern identity, and (e) the differential role of culture. Principles (a), (b), and (e) can be seen as nomothetic in their focus, whereas principles (c) and (d) fit better within an ideographic approach, having as their focus those aspects of the person that are unique to the individual.

The present study will analyze the dispositional signatures of the participants at the facet level for evidence that an element of human nature is the coalescing of personality factors into distinct personality types. It is helpful to keep in mind the other elements of McAdams' and Pals' "new Big Five", as personality types may be a product of evolution in which the characteristic adaptations of the individual track with genetically determined personality dispositions. The resulting personality dispositions in turn influence the life narratives that individuals create about themselves within their specific cultural context.

McAdams and Olson (2010) argue for a 3-stage explanation of personality development which postulates that each person adds layers to their personality, from Actor (factors and facets)

to Agent (motivations and goals), and finally to Author of their life narrative. Each of the above theories and approaches are principally idiographic in their focus on the distinct experience of the individual. If a robust personality typology is revealed empirically, each of these elements will need to be reconsidered from the perspective of a personality *typology*. How does the personality *type* of the Actor influence their motivations and goals as an Agent and their approach to crafting a life narrative as an Author?

Social Roles

There is some evidence that social roles impact personality development. Wood and Roberts (2006) conducted 4 studies to examine the correlation between expectations for age-graded roles and personality factor change across the life course. The results of Study 2 indicate that the influence of role expectations on behavior (expressed personality traits) is greatest when expectations are consistent across different age demographics, giving role expectations a strong normative influence over behavior. They also found that the expectations people held for how others should behave in age-graded roles were related to actual developmental patterns (i.e., the pattern of personality development across the lifespan correlated to the expectations people from varying age demographics had for how personality should or would development across the lifespan). Phrased more simply, there is a shared expectation across age demographics for the personality of individuals in different age-graded roles.

The authors point out, however, that a limitation to their study was that no distinction was made between descriptive expectations—impressions of how people really behave in interactions—and injunctive expectations—impressions of how people ought to behave in interactions. As the author's note, although their findings make it clear that there is a significant correlation between age-graded personality expectations and perceived personality change across

the life course, it is not clear which direction this relationship takes—do people adjust their personality to meet age-graded expectations or are people's age-graded expectations a social response to the changes in personality that they have perceived in others? Additionally, Kornadt (2016) conducted a 10-year longitudinal study investigating whether social role expectations for older adults are related to personality development, also finding that it was not clear whether or to what extent social role expectations for older adults were related to personality development.

It appears that the link between social roles and personality traits is not a simple, one-way relationship. Lodi-Smith and Roberts (2007) found that an individual's trait levels influenced the types of and degree to which they committed to social investments. They specifically examined the social investments of work, family, religion, and volunteerism; with the definition of social investment being investment in, and commitment to, adult social roles. The authors found that work-related social investment was significantly related to levels of conscientiousness, agreeableness and emotional-stability (low neuroticism); family social investment was also significantly related to levels conscientiousness, agreeableness and emotional-stability; religious social investment was significantly related to levels of agreeableness and socialization, but not levels of conscientiousness or emotional stability; and volunteer social investment was only significantly related to levels of conscientiousness. These results indicate that a substantial proportion of what motivates commitment to adult social roles is the personality profile (*type*) of the individual. Phrased another way, although social roles require adjustments to an individual's displayed personality—keeping your job requires you to exhibit a reasonably high level of conscientious behaviours—the specific social roles people choose are significantly informed by their personality profile (e.g., individuals with low conscientiousness, agreeableness, and emotional-stability are unlikely to make consistent, positive social investment in work).

Therefore, it could be the case that trait changes outlined by social role change might also be an aspect of the inherent variability of personality expression within the "basins of attraction" that constitute a personality *type*, as outlined in the section on personality complexity.

Personality

The Five-factor Model

Throughout this manuscript there will be frequent references to the Five-factor Model (McCrae, 1992a) and the Big Five (Goldberg, 1990). Each of these terms is associated with the Trait Theory of Personality (Allport, 1931; Allport & Odbert, 1936; Cattell, 1965). Trait Theory posits 5 primary personality dimensions (referred to as factors, hence the Five-factor Model)— openness, conscientiousness, extroversion, agreeableness, and neuroticism (OCEAN). Each of the Big Five personality factors is the mean score of 6 underlying personality facets (see Appendix B), and each facet is comprised of the specific questionnaire items (nuances) that make up the personality scale being applied. The current study uses the full IPIP-NEO-300 questionnaire (Goldberg, 1999), which contains 300 items (nuances)—10 per personality facet.

A reasonable operational definition is required in order to productively study personality. The definition presented by Larsen and Buss (2018) is commendable in its ability to address most, if not all, of personality's constituent parts. They define personality as, "the set of psychological traits and mechanisms within the individual that are organized and relatively enduring and that influence his or her interactions with and adaptations to the environment" (p. 4). This definition can be separated into 6 parts: 1) a set of traits, 2) a set of mechanisms, 3) that exist within the individual, 4) that are organized, 5) that are relatively enduring, and 6) that influence the individual's interactions with and adaptations to the environment. This definition

provides insight into why personality has been approached from different perspectives—it is easier to study aspects of personality separately (e.g., affects, behaviours, cognitions, and desires; Wilt & Revelle, 2015) than to develop a unified theory of personality which is capable of incorporating each of its necessary components.

The first component of the Larsen and Buss (2018) definition of personality is a set of traits (factors and facets), which is the focus of the present study. Personality factors (traits) are enduring personality characteristics that describe or determine an individual's behavior across a range of situations (VandenBos, 2007). Allport (1931) was one of the first personality researchers to focus on traits as a way of explaining and defining personality (Allport's conception of *trait* encompasses what the present study divides into factors, facets, and nuances). Allport recognized the necessity of defining a unit of measurement for the study of distinctive individual behaviour (p. 368). He proposed that *trait* was the best option available when compared to the ideas of reflexes, habits, attitudes, dispositions, and tendencies. He listed 8 criteria for defining a trait; (a) a trait has more than nominal existence, (b) a trait is more generalized than a habit, (c) a trait is dynamic, (d) a trait can be established empirically or statistically, (e) traits are only relatively independent of each other, (f) a trait is not a moral quality, (g) acts and habits that are inconsistent with a trait are not proof of a lack of that trait, and (h) a trait can be viewed both within the personality that contains it and in its distribution in the population at-large. These 8 criteria are still relevant to the understanding of trait theory today.

Allport's work was later supplemented by the further lexical study of trait names undertaken by Cattell (1965). The use of trait names to explain and define personality is the result of natural language use—trait names are simply the words we use to describe specific

aspects of our own and others' attitudes, behaviours, and affective states (Goldberg et al., 2006). The use of natural language to define personality factors and facets is referred to as the lexical approach (Allport, 1931; Eysenck, 1990; Goldberg et al., 2006; Johnson, 2014). The lexical approach began with an examination of ~18,000 adjectives (Allport & Odbert, 1936). With the application of factor analysis, this list of adjectives was reduced to what is now known as the Five-factor Model (McCrae & John, 1992).

Goldberg (1990) subsequently coined the term "the Big Five" factors of the Five-factor Model. Each of the Big Five factors can be further divided into 6 facets (Costa & McCrae, 1995; see Table 1). It is these 30 facets—6 facets per Big Five factor—that form the measure of personality in both the NEO-PI-R (Costa & McCrae, 1992a) and the IPIP-NEO-300—the International Personality Item Pool Representation of the NEO-PI-R (Johnson, 2020).

Facets

Considering the substantial volume of psychological research that relies on scales that exclusively measure the Big Five factors, it can be reasonably inquired as to why the present study is focused on the facet level—instead of the factor level—of the IPIP-NEO-300. To obtain a broad-stroke conception of how an individual's personality correlates to or interacts with a host of developmental and social psychology research questions, the Big Five factor level is invaluable. However, to investigate the question of whether personality self-organizes into *types*, a higher fidelity image of personality is required.

Table 1. Each Big Five factor and the Corresponding Sub-trait Facets

Neuroticism	Extroversion	Openness	Agreeableness	Conscientiousness
1. Anxiety	1. Friendliness	1. Imagination	1. Trust	1. Self-efficacy
2. Anger	2. Gregariousness	2. Artistic Interests	2. Morality	2. Orderliness
3. Depression	3. Assertiveness	3. Emotionality	3. Altruism	3. Dutifulness
4. Self-consciousness	4. Activity Level	4. Adventurousness	4. Cooperation	4. Achievement-Striving
5. Immoderation	5. Excitement Level	5. Intellect	5. Modesty	5. Self-discipline
6. Vulnerability	6. Cheerfulness	6. Liberalism	6. Sympathy	6. Cautiousness

This difference between breadth and fidelity of personality structure was a key concern in the development of the Big-Five Inventory-2 (BFI-2). Soto and John (2017) recognized the need to identify a set of conceptually and empirically prominent facets within each Big Five factor (domain) in order to increase the fidelity of the consequent personality measure. The authors insist that the 15 facets of the BFI-2 scale constitute a minimally necessary set of facets underlying the Big Five factors that capture more nuanced personality information within the Big Five factors. Accepting that 15 facets is a minimally necessary set of facets to capture facet-level personality information, use of the IPIP-NEO-300—which contains 30 facets—exponentially increases the amount of personality information being made available for analysis.

In McCrae and Costa's (1995) NEO-PI they measure each Big Five factor as the sum of 6 facet scales. This decision was made following the advice of Gorsuch (1974) that "it is generally difficult to replicate factors with fewer than 5 or 6 salient variables per factor" (p. 295). The authors also reference Wiggins (1992) in acknowledging that it is generally regarded as more scientifically desirable to measure the facet scales—for their concreteness, specificity, and high fidelity—than the superordinate qualities of the Big Five factors. In their summary McCrae and Costa (1995) make the statement that, "The five NEO-PI-R domain scores quickly sketch the outlines of the client's personality; facet scales fill in the details". It is precisely these details that the present study wishes to detect in analysing the 30 facets that underly the Big Five trait factors in the IPIP-NEO-300 for evidence of personality typology.

An example of the informational content difference between the factor level and the facet level can be seen in the research completed by DeYoung et al. (2007), who were able to show that each of the Big Five factors could be understood as being comprised of 2 *aspects*. As an example, the factor of openness-to-experience, the aspects are Intellect and Openness. Both

aspects are further clarified by inclusion of a unique set of facets and nuances. Intellect contains nuances like, "Am quick to understand things", Have a rich vocabulary", and "Formulate ideas clearly", whereas Openness contains nuances like, "Believe in the importance of art", "Need a creative outlet", and "Get deeply immersed in music". It is clear that within the factor of openness-to-experience there is divergent categories of information. This is not a surprise, given the multi-dimensional nature of personality. This means that 2 people with equivalent scores on the factor which openness-to-experience represents (e.g., 62/100) could have very different levels of particular facets. The present study intends to leverage the breadth and depth of personality information available within the facet level of the IPIP-NEO-300 to clarify and possibly increase the number of previously uncovered personality types.

Approaches to the Study of Personality

Murray and Kluckhohn (1953) famously declared, "Every man is, in certain respects, (a) like all other men, (b) like some other men, (c) like no other man" (p. 53). The idea that every individual is like no other individual is the basis for the idiographic approach to the study of personality (Beck, 1953; Molenaar, 2004), whereas the perception of personality as a set of shared, or common, factors and facets—every individual being like all other individuals—is the basis for the nomothetic approach to the study of personality (Molenaar, 2004). Bem (1983) characterized the nomothetic approach as having a set of common descriptors, dispositions, or trait dimensions that are capable of labelling all people. He felt individual differences could be identified by placement at different locations on those dimensions. It is conceivable that an answer to the quandary posed by the fact that people are simultaneously highly distinctive (idiographic) and noticeably similar (nomothetic) is a flexible and robust personality typology—

the idea that some people share more in common with specific others than they do with those remaining (i.e., they are of a *type*).

Trait Theory (Allport, 1931; Goldberg 1990; McCrae & Costa, 1987) is an excellent example of the nomothetic approach to the study of personality and personality development. The principal position of trait theorists is that the personality of every person can be described and defined by the traits outlined in the Five-factor Model of personality. However, personality is not constant in the way a marble statue is constant—invariable over time. Rather, it is consistent in the way memory foam is consistent—adaptable to the situational context but essentially always returning to its fundamental profile. This observation has been made repeatedly in personality development literature (Caspi, 2000; Herzhoff et al., 2017; Roberts & DelVecchio, 2000; Hampson & Goldberg, 2006; Rothbart, 2007; Srivastava et al., 2003).

Exactly how stable personality is during adulthood was the focus of a meta-analysis conducted by Roberts and DelVecchio (2000), who analysed 152 longitudinal studies, generating 3,217 test-retest coefficients. The results of their meta-analysis indicated that Big Five trait consistency (individual scores on each of Openness, Conscientiousness, Extroversion, Agreeableness, and Neuroticism) increased from .31 during a 3-year period in childhood, to .54 during the college years, to .64 at 30-years old, and levelled off at .74 between 50 and 70-years old—the time interval was held constant at 6.7 years. Personality, as measured by the Big Five factors of the Five-factor Model, clearly continues to develop from childhood through early adulthood and then stabilizes in adulthood and later life, before undergoing a few final modifications in late adulthood (Srivastava et al., 2003). These adjustments in personality can be viewed as differential configurations of the individual's personality *type* and do not require that there is a change in the individual's personality in toto.

It has been shown that development of the Big Five factors begins in childhood and that it shows predictive capability for adult personality at an early age (Herzhoff et al., 2017). Hampson and Goldberg (2006) analyzed 40 years of personality data from a sample $N = 799$. Test-retest reliabilities during childhood ranged from .22 to .53, illustrating how personality development is at its most dynamic during childhood and into adolescence. The test-retest reliabilities during adulthood ranged from .70 to .79 over a period of 2.8 years, demonstrating that personality develops over the life course from a construct which is highly dynamic into a construct that is remarkably stable. As is discussed in the section on personality complexity, test-retest reliabilities during adulthood of .74 over 6.7 years and .70 to .79 over 2.8 years could be explained by the flexibility for personality presentation *within* a personality type.

Personality Complexity

In addressing the complexity of personality, psychologists have formulated various theories of personality (e.g., Bandura, 1977 & 1999; Cervone, 2004; Costa & McCrae, 1995; Eysenck, 1990; Fleeson, 2001; Kelly, 1955; McAdams & Pals, 2006; Mischel & Shoda, 1995). As Hall and Lindzey (1957) made clear, all personality psychologists are systems theorists (p. 329). It is this truism that highlights the importance of approaching personality complexity from the perspectives provided by the application of both General Systems Theory (Mayer, 2015) and Chaos Theory (Middleton et al., 1993). These approaches have in common an attempt to incorporate both linear and non-linear dynamical systems thinking into the theoretical and applied study of personality and personality development.

Developmental psychology saw an excellent implementation of General Systems Theory in the Dynamic Systems Approach advanced by Thelen et al. (1994). This approach is a theoretical framework for understanding the development of cognition and action in humans.

The Dynamic Systems Approach emphasizes the role of the interaction between the individual and their environment in shaping development. According to this approach, development is not a predetermined sequence of stages, but rather a continuous and dynamic process of adaptation to changing environmental demands. The individual's actions, perceptions, and cognitive processes are constantly influenced by the feedback and constraints of the environment, leading to the emergence of new skills and behaviors. Thelen emphasized the importance of exploring the complex, nonlinear relationships between various factors in development, including biological, psychological, and environmental factors. Overall, the Dynamic Systems Approach suggests that development is a product of the ongoing interactions between an individual's abilities, environmental demands, and contextual factors. It highlights the importance of context, variability, and change in shaping the emergence of new skills and behaviors over time.

The current study accepts that an individual's actions, perceptions, and cognitive processes are affected by a feedback loop between the environmental stimuli and the individual's cognitive, affective, and physiological responses. However, in distinction from the Dynamic Systems Approach, it is theorized that personality stabilizes into broadly defined types such that the cognitive, affective, and physiological responses of the individual are informed by the structure of their personality type.

Mayer (2007) argues that, tying together the myriad definitions of personality, there exists an agreed upon element, namely that personality is a system of parts which are organized, develops, and is expressed in a person's actions. Drawing on General Systems Theory (Von Bertalanffy, 1950), Mayer (2015) developed the personality systems framework to bring a focus on 4 topics of personality; (a) personality's definition—the boundaries of personality, its expressions, and the neighboring systems with which it interacts, (b) personality's parts—

motives, traits, schemas, and other key elements, (c) personality's organization—its structure and dynamics, and (d) personality's development—the developing and changing nature of personality over time. Personality *types* can be considered a form of personality organization, in that they define the structure of an individual's personality and help explain the dynamics of the individual's personality in and through time. Several authors have observed that the Five-factor Model is a structural model and not a model of the underlying psychological dynamics responsible for the model (Pervin, 1990). A comprehensive personality typology would include not only the structure of personality, but also the underlying psychological dynamics of the personality structure. Determination of the facet-level structure of personality typology would inform the direction of study for understanding the psychological dynamics of the personality structure.

Chaos theory helps further clarify the personality system by providing a theoretical model of a personality *type* by analogy to a "basin of attraction"—a delimited phase space with multiple attractor points (Middleton et al., 1993). Phase space refers to a mathematical space where all possible states of a dynamic system are represented (i.e., the total possible states and expressions of personality). An attractor is a point, or set of points, in the phase space that the system tends to move towards or settle into over time (e.g., the mean level of each of the 30 facets of personality). Multiple attractor points mean that the system has different stable states or configurations that it can settle into, depending on its initial conditions. Within the context of the current study this implies that a personality type is comprised of 30 attractor points (facet means) that define where an individual's personality will tend to *settle*. A delimited phase space with multiple attractor points means that the possible states of the system are confined to a specific region of the phase space, and there are multiple stable configurations that the system can settle

into within this region (e.g., an individual with a Type 1 personality will experience their life within a different region of the total phase space of personality than an individual with a Type 2, 3, etc. personality). The behavior of the system will depend on its initial conditions (childhood temperament), and it may exhibit complex, unpredictable behavior due to the presence of multiple attractor points (lifespan variability in personality expression).

The current study theorizes each of the 30 facets acting as an attractor point within the *basin of attraction* of an individual's personality *type*. Although the specific level of activation for each facet is situationally dependent (Nowak et al., 2002)—so that the exact expression of someone's personality in a specific situational context has freedom to vary—the individual's personality tends to revert to its *type* over time. Phrased another way, the fluctuations in personality expression in time occur "within" the personality type of the individual. This reversion to *type* helps explain the high degree of personality consistency across time, while awareness of the randomicity of the effects of each of the factors and facets helps explain how an individual's personality appears to adjust to the situational context (Mischel & Shoda, 1995). Personality *types* provide an explanatory framework for how every individual possesses a personality that is inherently unique to other individual's personalities—factor and facet activation is contingent on internal and external stimuli—while integrating the evidence that individual personalities share a great deal in common—factors and facets activate within the personality type *limit* posited by Chaos Theory.

Personality Typology Research

Robins et al. (1998) make the point that a typology of personality provides a system for separating people into categories. These categories would contain individuals who share similar compositions of personality structures—a typology would retain the same function in

psychology as taxonomic systems serve in other sciences. A 5-cluster solution for personality typology was uncovered in the research of Herzberg and Roth (2006). Their results presented a consistent 5-cluster solution—resilient, overcontrolled, undercontrolled, confident, and reserved. Kerber et al. (2021), using a set of 3 different clustering techniques, also identified 5 reliable and construct valid personality types. They labelled these personality types resilient, overcontroller, undercontroller, as well as reserved and confident.

Gerlach et al. (2018), working with 4 personality scales—the IPIP-NEO (Goldberg et al., 2006), Johnson-120 (Johnson, 2014), myPersonality-100 (Stillwell & Kosinski, 2012) and BBC-44 (University of Cambridge, 2009-2011)—were able to show the existence of 4 robust personality types. They labelled these personality types; Average, Self-centered, Reserved, and Role Model. Three of the robust types correspond closely, although not perfectly, with the 3 ARC personality types—undercontrolled, overcontrolled, and resilient. Ferguson and Hull (2018) utilized latent profile analysis to examine personality typologies with a sample of high school students, $n = 374$. Their primary focus was on the use of latent profile analysis in personality research, and the nature of function of the resulting personality profiles (*types*). Their study revealed a 3-profile solution, which was consistent with the ARC personality types. The 3 profiles also corresponded well with 3 of the 4 robust personality types delineated by Gerlach et al. (2018). Namely, the 'excitable' profile corresponds to the 'undercontrolled' type, the 'reserved' profile corresponds with the 'overcontrolled' type, and the 'well-adjusted' profile corresponds with the 'role-model' type.

The Present Study

The present study is focused on whether analysis of the 30 facets of the Big Five factors measured by the IPIP-NEO-300 (Johnson, 2020) reveals the same set of 3 (Asendorpf et al.,

2001; Robins et al., 1996; Caspi & Silva, 1995), 4 (Gerlach et al., 2018), or 5 (Herzberg & Roth, 2006; Kerber et al., 2021) personality types as presented by previous research, a different set of personality types, or no personality types. The present study will endeavor to answer 2 research questions. First, do the 30 facets of the Big Five factors self-organize into distinct personality types? Second, do the revealed personality types correspond to any existing personality typology (e.g., Ferguson & Hull, 2018; Gerlach et al., 2018)? The preceding review of the literature suggests there is both theoretical and empirical support for the notion of personality typology. The present study hypothesizes that analysis of the 30 facets of the IPIP-NEO will reveal as few as 3, and possibly as many as 9, distinct personality types and that the revealed facet-based personality types will show consistency across time (i.e., the type identified in adolescence is the same type presented in early and later adulthood).

Factor analysis is fundamentally a dimension reduction technique (Trendafilov et al., 2017). By reducing personality to a set of 5 factors the amount of information available to be analyzed is also reduced. According to Wiernik et al. (2020), any attempt to reduce personality to a small number of dimensions, such as the Big Five of the Five-factor Model, falls short in capturing the intricate nature of personality phenotypes and should only be regarded as a possibly helpful simplification. The authors argue that any low-dimensional solution to personality—such as the Big Five of the Five-factor Model—is deficient for understanding the high complexity of any potential personality phenotype and should be understood as merely a potentially useful oversimplification. They make this claim because factor analysis reduces the dimensions being investigated, which is equivalent to reducing the quantity and quality of information available for analysis. By including each of the 30 facets of the IPIP-NEO-300 in

our analysis, we reintroduce information that is lost when the IPIP-NEO-300 is scored—reduced to the Big Five factor values from the raw scores of each facet and nuance.

In an analysis of the Baltimore Longitudinal Study of Aging, Terraccione et al. (2005) examined age trends for both the Big Five factors as well as the 30 underlying facets. What is of interest for the present study is the fact that the age trends for the Big Five factors were frequently not mirrored by their underlying facets. A good example of this are the results for Extroversion in which 3 of the 6 facets had markedly different age trends than the Big Five factor itself. Extroversion—as the Big Five factor—showed a negative curvilinear trend from age 30 to 90-years-old, decreasing over time, whereas the facets of excitement-seeking, activity, and assertiveness each exhibit a differently shaped age trend trajectory. This result illustrates the information lost in factor analysis by pointing out how facets behave independently from the trait they help comprise. As the present study will analyze the facet level of the IPIP-NEO-300, a personality typology of more than the 3 ARC types (Asendorpf et al., 2001; Caspi & Silva, 1995), the 3 profiles presented by Ferguson and Hull (2018), or the 4 types defined by Gerlach et al. (2018) is possible.

Each item in the IPIP-NEO can be thought of as a personality nuance (Mõttus et al., 2017). By investigating the 240 items of the NEO-PI-R, Mõttus et al. showed that each item (nuance) of the scale had significant cross-method agreement and rank-order stability. They argue that considering the nuances of trait theory will make personality psychology richer and may provide a bridge between the trait and social–cognitive approaches to personality. The present study agrees with this conclusion and expects the richness of information in the 30 facets—or a total of 300 nuances—to add to our knowledge of personality typology. Kerber et al. (2021) illustrated that the Big Five profiles—the specific configuration of traits and facets—for

all personality types were still clearly distinguishable even after the aggregation of data from multiple sources.

The goal of psychology is both to explain and to predict phenomena and behaviour. However, as Yorkani and Westfall (2017) point out, the model that most closely approximates the data-generating process is rarely the most successful at predicting real-world outcomes. They argue that psychology has a near-total focus on explaining the causes of behaviour or phenomena that has little ability to predict future behaviours with any appreciable accuracy; by incorporating the principles and techniques from the field of machine learning, psychology improves its capacity to become a more predictive science. The present study investigates potential personality types within the facet-level configuration of the IPIP-NEO-300 personality inventory using latent profile analysis (LPA)—a Gaussian (finite) mixture modelling approach to cluster analysis.

Method

Participants and procedure

The present study is an analysis of data from the IPIP-NEO personality inventory (Goldberg et al., 2006). The full IPIP-NEO-300 dataset consists of results for $n = 307,313$ participants from around the world—the countries include Iceland, Finland, India, Afghanistan, South Africa, China, Fiji, Ecuador, the USA, Canada, and many others (Johnson, 2020). Participant ages in the total sample ranged from 10 to 99-years old.

The IPIP-NEO-300 is a fully anonymous dataset containing only the demographic information of participant age, gender identification, and country of residence. Due to the large number of participants in the complete IPIP-NEO-300 dataset, the present study restricted analysis to data collected from Canadian participants ages 10 to 65-years-old ($n = 16,365$). Sixty-

one percent (n = 10,034) of the Canadian sample used in the present study identified as female. Participants aged 66 to 99-years-old were not included in this study as there were only 20 participants in total within that age range.

There is not a general agreement within the literature—only loosely agreed upon ranges—on specific age demarcations for developmental stages. Consequently, the age divisions chosen for this study are taken from the APA Dictionary of Psychology (American Psychological Association, n.d.). Adolescence is defined as individuals aged 10 to 19-years-old, Early Adulthood as individuals aged 20 to 35-years-old, and Middle to Late-Middle age as individuals aged 36 to 65-years-old.

Measures

The IPIP-NEO (International Personality Item Pool - NEO Personality Inventory) is a personality assessment tool designed to measure the Big Five personality traits: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. The inventory consists of 300 nuances, 60 for each trait (10 for each facet). The items were selected based on criteria for relevance, clarity, and psychometric properties. The selection process was as follows:

1. Generation of an initial item pool: The initial item pool was generated by a group of personality psychologists using existing personality measures, including the NEO-PI-R (NEO Personality Inventory-Revised), as a guide. The initial item pool consisted of over 1,000 items. Review of the initial item pool: The initial item pool was reviewed by a panel of experts in personality psychology who evaluated each item for its relevance to the Big Five traits, clarity, and potential for item bias.

2. Item reduction: The panel of experts used a variety of methods, including factor analysis and item response theory, to reduce the initial item pool to 300 items (60 for each trait).

The items were selected based on their ability to differentiate between individuals on each of the Big Five traits and their psychometric properties.

3. Cross-cultural validation: The 300 items were then translated into multiple languages and administered to samples from different cultures to ensure that they were relevant and meaningful across cultures.

4. Final item selection: The final 300 items were selected based on their performance in cross-cultural validation studies and their psychometric properties, including reliability and validity.

Overall, the 300 items of the IPIP-NEO were selected through a rigorous process aimed to ensure that the items were relevant, clear, and valid measures of the Big Five personality traits across different cultures (Goldberg et al., 2006) (see Appendix A). The IPIP is an open-source personality item pool developed to provide a resource for the development of myriad inventories and scales—there are presently 463 different IPIP-based scales (Goldberg, 2021). Completion of the IPIP-NEO-300 produces the mean scores of the nuances from the 6 facets that comprise each of the Big Five factors (e.g., a score of 34/100 for Contentiousness is the mean of the scores for each of the nuances in the scale that make up the factor of Contentiousness).

The IPIP-NEO personality inventory is a free, open, online personality inventory with 2 available configurations, either the 120 item (short form) or 300 item (full assessment) questionnaire (Johnson, 2006). The IPIP-NEO inventories are scored on a 5-point Likert scale (1= Inaccurate; 5 = Accurate). Examples of facet level nuances include "Dislike myself" for Depression, a facet of Neuroticism; "Can manage many things at the same time" for Activity-level, a facet of Extroversion; and "Am always prepared" for Self-discipline, a facet of

Conscientiousness (see Appendix A). Each nuance of the IPIP-NEO has been thoroughly

validated (Johnson, 2006).

The IPIP-NEO was designed to measure personality constructs comparable to those

measured by the NEO-PI-R. Consequently, the primary validity is represented by correlations

between the IPIP-NEO-300 scale items and the corresponding NEO-PI-R scale items. The

resulting correlation coefficients averaged $r = .77$ (ranging from .63 to .88) (see Appendix B for

complete reliability data; see Appendix C for full validity data; Johnson, 2014). Factor analysis

of the IPIP-NEO Big Five factors has been conducted numerous times, and in each instance the

Big Five factors were reinforced (examples include Ferguson & Hull, 2018; Gerlach et al.,

2018).

Analysis Plan

To assess whether a personality typology is present within the 30 facets of the Big Five

factors, the present study applied person-centered clustering analyses (latent profile analysis), in

preference to variable-centered clustering analyses (e.g., K-means; hierarchical; Laursen & Hoff,

2006). The core interest of this study is the personality *type* of each participant. Consequently,

this study is interested in the variables (IPIP-NEO-300 nuances) only in as much as they indicate

the shape of the personality *types*. A clear majority of trait analysis has been at the factor

verification level. A substantial number of personality studies replicate the factor analysis of the

Big Five traits to ensure personality measurement reliability. The current study relied on the

extensive volume of validation and reliability studies supporting the Five-factor Model and the

Big Five traits (see above) and focused specifically on what the configuration of personality

facets could tell us about the person—primarily, do they fit within a definable personality *type*?

Each of the age cohorts (10-19, 20-35, and 36-65) was analyzed in 3 categories—all participants, female participants, and male participants (e.g., data from participants aged 10- to 19-years-old were analyzed as the complete dataset, as the complete female dataset, and the complete male dataset). Both personality and developmental literature suggests an expectation that facet-based personality types will reveal measurable differences between females and males (Weisberg, DeYoung, & Hirsh, 2011). A randomly generated training dataset was used to determine what the most probabilistically accurate number of profiles was within the data. The complete dataset for each grouping functioned as the validation data, enabling an impartial assessment of the final model fit (James et al., 2013). The participants were separated into age cohorts as a means of investigating whether the factor and facet composition of any revealed personality types were consistent at different developmental stages. If the personality types that were found had noticeably different facet compositions at different age cohorts, the hypothesis that personality self-organizes into types that remain stable across the lifespan would be dubious. The present study expected the factor and facet composition of any revealed personality types to remain fundamentally consistent at different developmental stages, providing convincing evidence that the developmental trajectory from childhood temperament is towards the creation and maintenance of personality types across the lifespan (i.e., the personality *type* that you have at age 20 is the same personality *type* you have at age 65).

Assessing Cluster Tendency

Prior to conducting latent profile analysis on each of the 12 groups a determination of the data's tendency to cluster was established. Banerjee and Dave (2004) suggest analysing the data to determine a Hopkins value as a method for determining clustering tendency. As the tendency to cluster is an essential expectation for a latent profile analysis, 3 clustering tendency packages

were run—`performance()`, `factoextra()`, and `clValid()`. R packages `performance()` and

`factoextra()` were run on a random sample of 2,000 participants (`Cdn_2K`) drawn from the full

dataset ($n = 16,365$). The use of a random sample of 2,000 participants was intentional, in that

very large samples—such as the one used in the current study—tend to be computationally

expensive without adding valuable information in relation to the accuracy of the Hopkin's value.

Different R packages present Hopkin's values in different directions (e.g., the R package

`performance()` presents the Hopkins value as closer to 1 if the data has a tendency to cluster,

whereas the R package `factoextra()` presents the Hopkins' value as closer to 0 if the data has a

tendency to cluster). R package `performance()` (Lüdecke et al., 2021) indicates clustering

tendency when the outcome value is lower than 0.5. The analysis of `Cdn_2K` produced a value of

0.32 (Table 2). The `factoextra()` package (Kassambara & Mundt, 2020) can produce both the H

value (Table 3) and a graph (Figure 1), which provides visual confirmation of cluster tendency

within the data. Figure 1 is an ordered dissimilarity image (ODI) generated by package

`factoextra()` from the ordered dissimilarity matrix (ODM) created with function `fviz-dist()`.

In Figure 1 the cells that are the darkest blue are the most similar and cells that are the

darkest orange are the least similar cells. The Hopkins' value generated by R packages

`performance()` and `factoextra()` provide ample support for analysing the IPIP-NEO-300 facets

Table 2.

Hopkins' H Statistic

> `performance::check_clustersctructure(x = Cdn_2K; distance = "Manhattan") -> performance_Cdn_2K`

Clustering tendency value:
Hopkin's H = 0.32*

*The dataset is suitable for clustering

Table 3. Results from `factoextra()` Cluster Tendency Analysis

```
> factoextra::get_clust_tendency(data = Cdn_2K, n = 500, graph = TRUE,
gradient = list(low = "black", high = "white"), seed = 1969) ->
get_clus_tend_Cdn_2K
> get_clus_tend_Cdn_2K
```

$hopkins_stat: 0.67

for evidence of personality types (latent profile clusters). The final validation of tendency to

cluster was conducted with R package `clValid()` (Brock et al., 2008). The random sample of

2,000 participants (`Cdn_2K`) drawn from the full dataset ($n = 16,365$) was again used to ensure

consistency across analyses. There are 3 categories of validation measures reported by

`clValid()`; "internal", "stability", and "biological". As Brock et al. (2008) clarified, for data that

is highly correlated the "stability" validation measure is the best option. The consistency of a

clustering result is assessed by the `clValid()` function, which performs a comparison of each

clustering with the clusters obtained after removing each column one at a time. In the case of the

IPIP-NEO-300 data, each of the 30 facets is represented by one column.

The `clValid()` package uses four measures to evaluate clustering tendency, namely the

average proportion of non-overlap (APN), average distance (AD), average distance between

means (ADM), and figure of merit (FOM) (Datta and Datta, 2003; Yeung et al., 2001). For all these measures, the average is calculated over all deleted columns, and the smallest value obtained is considered as the most probable cluster number and clustering tendency (Brock et al., 2008). The results reported by `clValid()` for `Cdn_2K` ($n = $ 2,000) are presented in Table 4.

Figure 1.

Ordered Dissimilarity Image—[factoextra()]
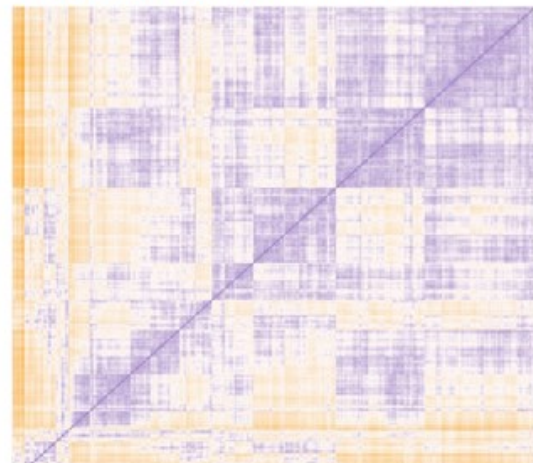
Table 4. `clValid()` Analysis of `Cdn_2K` ($n = 2,000$)

Clustering Methods: model

Cluster sizes:

	3	4	5	6	7	8	9	10	11	12

Validation Measures: model

	3	4	5	6	7	8	9	10	11	12
APN	0.3273	0.4107	0.5221	0.5907	0.5492	0.5402	0.5449	0.5927	0.6305	0.6579
AD	24.291	24.042	23.982	23.716	23.322	23.047	22.985	22.975	22.988	22.873
ADM	0.8015	0.9929	1.2999	1.5207	1.3668	1.3435	1.3027	1.4431	1.5622	1.6040
FOM	0.7143	0.7061	0.6964	0.6900	0.6843	0.6757	0.6772	0.6764	0.6708	0.6680

Optimal Scores:

Method	Score	Method	Clusters
APN	0.3273	model	3
AD	22.873	model	12
ADM	0.8015	model	3
FOM	0.6680	model	12

What is of interest for this study is that both the APN and ADM validation measures suggest 3 clusters are likely within the data. Brock et al. (2008) explain that the Average Proportion of Non-overlap (APN) is a measure that calculates the average proportion of observations that are not assigned to the same cluster by clustering based on the complete data and clustering based on the data with one column removed. Additionally, the Average Distance between Means (ADM) is a measure that computes the average distance between cluster centers for the observations that are assigned to the same cluster by clustering based on the complete data and clustering based on the data with one column removed. Olex et al. (2007) state that the Figure of Merit (FOM) validation measure is biased towards Euclidian distances, which likely explains the discrepancy with its result when compared to the APN and ADM results. The AD measure provides a measure of how well-separated the clusters are from each other. Clusters with low AD values have data points that are tightly clustered together and well-separated from other clusters, while clusters with high AD values have data points that are more spread out and

less well-separated from other clusters. A limitation of the AD measure is that it tends to favor solutions with a large number of clusters, as smaller clusters tend to have lower AD values. Therefore, it is important to use the AD measure in conjunction with other validation measures to ensure that the chosen clustering solution is both meaningful and parsimonious.

In general, Euclidean distance is more sensitive to differences in magnitude between different dimensions, while Manhattan distance is more robust to such differences. In a dataset where the magnitude of one dimension is much larger than that of the other dimensions—the values in one dimension of the dataset have a much wider range than the values in the other dimensions—the Euclidean distance measure may overweight the contribution of that dimension to the overall distance between two data points. In contrast, the Manhattan distance measure would not be affected by such differences in magnitude. Therefore, the choice of distance measure depends on the particular characteristics of the dataset and the goals of the analysis. This study used the Manhattan distance as it is better suited to high dimensional data, such as the IPIP-NEO-300 personality data which is comprised of 30 columns and 16,365 rows meets that criterion (Aggarwal et al., 2001).

Latent Profile Analysis

Latent profile analysis is a statistical technique used to identify unobserved subgroups, or profiles, within a population based on a certain set of variables (Gibson, 1959). The underlying expectation in using latent profile analysis is that people can be sorted, with varying degrees of probabilities, into types that have diverse configural profiles of personality factors and facets (Spurk et al., 2020). The initial step in latent profile analysis is selection of a set of observed variables that may be related to the latent subgroups of statistical or theoretical interest. Examples of such variables include demographic characteristics, psychological or behavioral

measures, or any other relevant factors. The next step is estimation of the number of subgroups, or profiles, that best fit the data using a model-based approach. The number of profiles is determined by a combination of both statistical fit indices, such as the Bayesian Information Criterion, and theoretical considerations. The estimated profiles are then used to interpret the results and make inferences about the underlying structure of the population. Latent profile analysis can include a) identifying distinct subgroups based on patterns in the observed variables, b) describing the subgroups in terms of their unique characteristics, c) or exploring how the subgroups relate to other variables. Latent profile analysis is increasingly being used in fields such as psychology, sociology, marketing, and education. An advantage of latent profile analysis for the current study is that it assumes population heterogeneity—that each individual within a population is distinct. Therefore, any personality profiles revealed by LPA are strong indicators for a typology of personality. Latent profile analysis can identify construct-based profiles, which makes it a good method of analysis for examining whether there are latent profiles (types) present within the 30 facets of the IPIP-NEO-300 scale. The *person-centered* nature of latent profile analysis is key to the present study in that verification of personality typology is fundamentally a person-centered exercise. Latent profile analysis was the primary method of analysis for this study.

Data Preparation

To prepare the IPIP-NEO-300 data for analysis in this study the following data cleaning process applied. The original data was downloaded from https://osf.io/pfeq7/ (Johnson IPIP Data). SPSS 26 (IBM Corp., 2019) was used to separate the Canadian sample form the total IPIP-NEO-300 dataset. Next the data was separated by gender into female and male groups. Finally, the data was divided into the appropriate developmental age category (e.g., 10 to 19-

years-old, 20 to 35-years-old, and 36 to 65-years-old).

This process produced 12 group datasets (Table 5).

Each of the 12 groups was imported to Excel (Microsoft Corporation, 2018) and further prepared for latent profile analysis by creating facet-level means. Due to the dataset size limits in Excel, the IPIP-NEO-300 Canadian data ($n = 21,770$) was reduced to $n = 16,365$. As all IPIP-NEO-300 data is naturally randomized by virtue of how participants are obtained (voluntarily completing the IPIP-NEO-300 questionnaire online), the specific $n = 16,365$ participants analysed in this study remained truly random. The result was a data table of 30 facet means across each group's participant range (see Table 6 for an example). Each of the 12 groups were analysed separately in R (R Core Team, 2022) using RStudio 2022.07.1 Build 554 (RStudio Team, 2020). The latent profile analysis was performed with R package Mclust (Scrucca et al., 2016) (See Appendix D. for full list of R packages used for analysis).

Table 5.

Demographic Groupings for Latent Profile Analysis

Group	n
All	16,365
Female	10,034
Male	6,331
10 to 19-years-old	6,061
10 to 19-years-old female	3,648
10 to 19-years-old male	2,413
20 to 35-years-old	8,003
20 to 35-years-old female	4,821
20 to 35-years-old male	3,182
36 to 65-years-old	2,301
36 to 65-years-old female	1,565
36 to 65-years-old male	736

Cluster Analysis

Supported by the Hopkins' values, the factoextra() ordered dissimilarity image (ODI), and the clValid() analysis, R package Mclust() (Scrucca et al., 2016) was employed to conduct a latent profile analysis of the facet data of the IPIP-NEO-300 personality questionnaire (Johnson, 2020). Mclust was chosen as it is a specialist tool for finding latent

Table 6. Facet Means for Each Participant (Example Data)

Canadian 10 to 19-years old

Facet	First 5 Participants					
A1 Trust	4.1	3.5	3.9	3.2	3.3	3.5
A2 Morality	2.4	4.0	4.0	4.0	4.3	2.4
A3 Altruism	3.5	4.1	4.6	3.7	4.7	4.2
A4 Cooperation	3.7	3.0	3.1	3.0	4.1	3.0
A5 Modesty	2.4	2.3	3.7	3.9	3.8	2.7

profiles within *continuous* variable data (Wardenaar, 2021). The `Mclust()` analysis of the

Canadian dataset (*n* = 16,365) is presented as illustrative of the process followed for each of the

12 demographic groupings.

A separate R project for each of the 12 study groupings was created in RStudio (RStudio

Team, 2020). An RMarkdown (Xie et al., 2018) file was created for each project in which the

code for installing and loading each of the required R packages was saved. Scrucca et al., (2016)

make the point that to ensure replicability of the `Mclust()` analysis a seed should be set using the

base R function, `set.seed()`. The number chosen as the `set.seed()` value is not important, only

that the `set.seed()` value is consistent for each run of the `Mclust()` analysis. The current study

used the number 1969 as the random number generator seed value, as this is the author's wife's

favourite number.

For each of the 12 groups the total sample was analysed with the following Mclust code:

`Mclust(data = [the group data being analysed], G = 1:12)`. This generated an `Mclust()`

object with results for each of 1 to 12 clusters, across all 14 available Gaussian mixture models

(See Appendix F). The results from the initial latent profile analysis for each grouping echoed

the clustering tendency results, supporting the presence of 3 facet-based personality profiles,

with the most consistent result being G = 3 profiles within the VEE model (`modelNames =`

Table 7.

Summary table for `Mclust()` analysis of full Canadian data (*n* = 16,365)

```
> summary(object = Mclust_Cdn)
```

Gaussian finite mixture model fitted by EM algorithm.

Mclust VEE (ellipsoidal, equal shape and orientation) model with 3 components:

loglikelihood	n	df	BIC	ICL
-373582.7	16383	559	-752589.9	-760633.8

"VEE"). This was supported by both the Bayesian Information Criterion (BIC) and Integrated Complete-data Likelihood (ICL) values (Table 7). The VEE model has an ellipsoidal distribution, with **v**ariable volume, **e**qual shape, and **e**qual orientation. This model outcome is understandable when keeping in mind that the data structure being analysed is a two-dimensional table of averaged continuous variables. Mclust() uses the Bayesian Information Criterion (BIC) when determining the relative model fit for number of clusters or latent profiles within the data. This decision was made because of the parsimonious nature of the BIC and evidence it deals well with large sample sizes.

The next step was running the latent profile analysis on the full sample of each grouping (e.g., Mclust(data = [the data being analysed], G = 3, modelNames = "VEE")). Summary tables were generated for the results of the latent profile analysis of all 12 groups. The summary table (Table 8 as an example; see Appendix G for complete list) provides information on the size of each cluster and the mixing probability values. The "mixing probabilities" refer to the probabilities of belonging to each component in a mixture model, and they represent the proportion of the population (or sample) that belongs to each component. Each component is assumed to be generated from a different probability distribution, and the mixing probabilities specify the proportions of the population that

Table 8.

```
> summary(object = Mclust_Cdn)
```

Gaussian finite mixture model fitted by EM algorithm

Mclust VEE (ellipsoidal, equal shape and orientation) model with 3 components:

loglikelihood	n	df	BIC	ICL
-373582.7	16383	559	-752589.9	-760633.8

Clustering table:

1	2	3
9914	2787	3682

Mixing probabilities:

1	2	3
0.551	0.211	0.238

belong to each component. The means—for each profile from each grouping—were sorted and charted in Excel (Table 9).

Table 9.

Means for Types Revealed by Latent Profile Analysis of Canadian Sample (n = 16,365)
[only Neuroticism and Extroversion facets shown]

Facets	Canadian Profile 1	Canadian Profile 2	Canadian Profile 3
N1_Anxiety	3.127	2.820	3.089
N2_Anger	3.188	2.668	2.965
N3_Depression	3.071	2.409	2.879
N4_SelfConsciousness	3.044	2.744	3.006
N5_Immoderation	3.378	3.150	3.380
N6_Vulnerability	2.648	2.509	2.663
E1_Friendliness	2.963	3.786	3.464
E2_Gregariousness	2.610	3.454	3.041
E3_Assertiveness	3.316	3.485	3.349
E4_ActivityLevel	2.955	3.086	2.992
E5_ExcitementSeeking	3.222	3.491	3.343
E6_Cheerfulness	3.415	3.953	3.830

Results

The Latent Profiles

To visualize the results of the `Mclust()` latent profile analysis the means for each facet in each profile were reorganized such that the *Facets* column listed the facets in the order of neuroticism, extroversion, openness, agreeableness, and conscientiousness. This facet organization was intentional to allow better profile comparison with previous latent personality profile research (see Asendorpf et al. (2001); Robins et al. (1996); Caspi and Silva (1995); Ferguson & Hull, 2018; Gerlach et al., 2018 among others). All latent profiles for each grouping were converted to z-scores in SPSS 26 (IBM Corp., 2019) prior to creating the facet-based personality charts.

The visual inspection of latent profiles allowed for the correct labeling of each latent profile such that each demographic group's *profile 1*, *profile 2*, and *profile 3* reflect the Mclust() calculated distinctions between profiles. Examining Figure 2 we see that the latent profiles show greater variation at specific facets than at others. However, it remains clear that the 3 facet-based personality profiles revealed by the latent profile analysis of the IPIP-NEO-300 personality questionnaire are, in fact, distinct from each other.

Figure 2.

Facet-based Personality Types
Full Canadian Sample (*n* = 16,365)
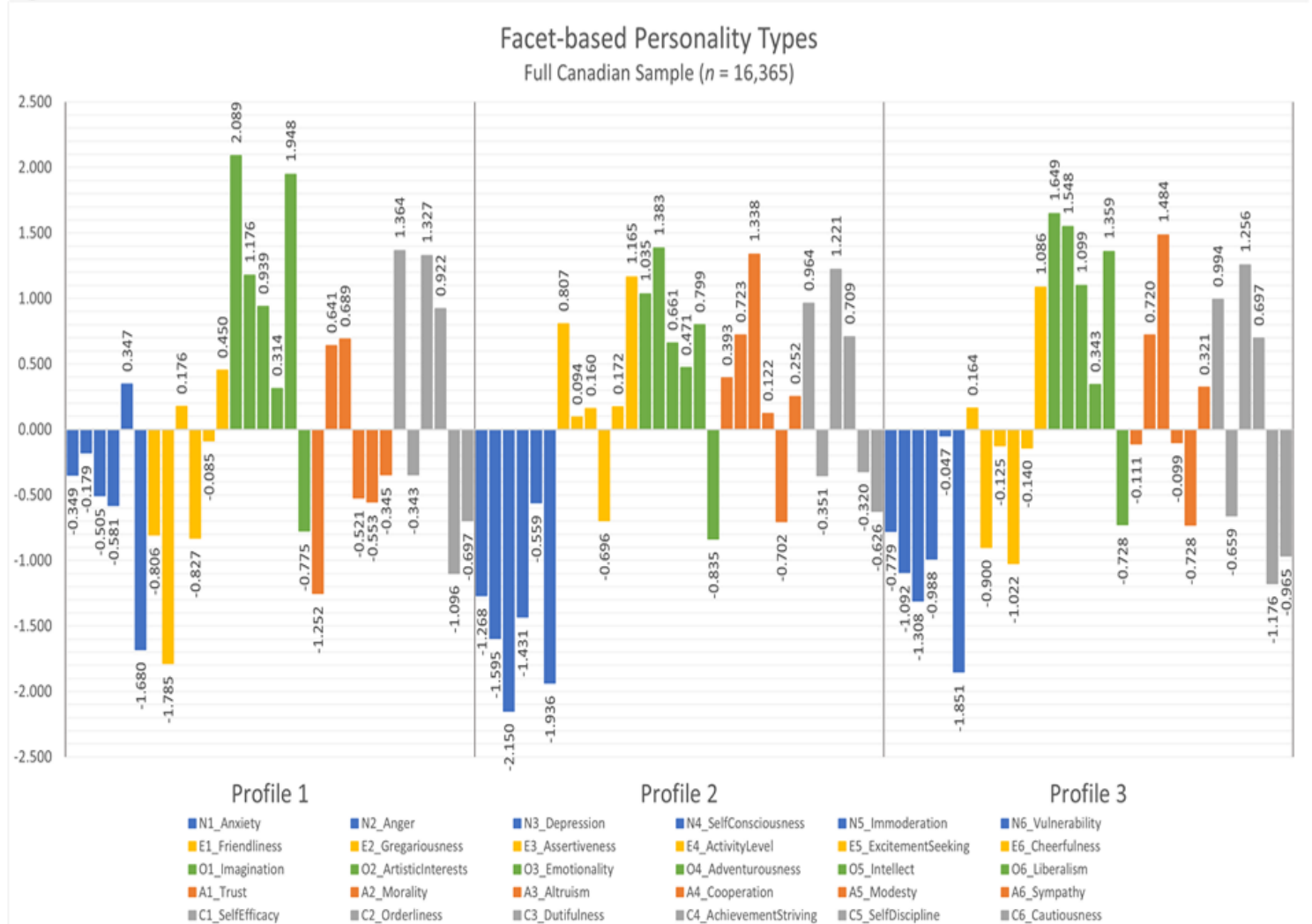
Facet-specific Type Distinction

One of the more striking features of the personality types revealed in this study is that specific facets within specific factors dictate the shape and uniqueness of each profile. The new personality types are differentiated almost exclusively by the facet scores within three factors, Neuroticism, Extroversion, and Agreeableness. Only 2 facets within the Openness factor and 1 facet within the Conscientiousness factor showed consistent differentiation across the 3 profiles. In particular, levels of Neuroticism facets (N1–Anxiety, N2–Anger, N3–Depression, N4–Self Consciousness, and N5–Immoderation), Extroversion facets (E1–Friendliness, E2–Gregariousness, and E6–Cheerfulness), and Agreeableness facets (A1–Trust, A3–Altruism, A4–Cooperation, and A6–Sympathy) account for the majority of difference between the facet-based personality profiles. Within the Openness factor the only facets that showed substantial difference across the personality profiles were O1–Imagination and O5–Intellect. Within the Conscientiousness factor only the facet of C5–Self Discipline was substantially different across personality profiles (Figure 3). For the remaining facets there was not a meaningful difference across personality profiles (Figure 4). The results of latent profile analysis of the facets of the IPIP_NEO-300 confirmed the hypothesis that personality self-organizes into *types*. It was not anticipated however, that the 3 facet-based personality types would be characterized by differences in only half of the 30 facets.

Profile 1 of the facet-based personality types is the most neurotic of the 3 types. This is most clear when viewing the facet means for N1–Anxiety, N2–Anger, and N3–Depression. The Extroversion facets of E1–Friendliness, E2–Gregariousness, and E6–Cheerfulness as well as each of the Agreeableness facets—with the exception of A5–Modesty—are the lowest facet means of the 3 types. The ARC type, "Undercontrolled", Ferguson and Hull's "Reserved", and

Figure 3.

Facet-based Personality Types
Full Canadian Sample (*n* = 16,365)
Most Distinct Facets

Figure 4.

Facet-based Personality Types
Full Canadian Sample (*n* = 16,365)
Least Distinct Facets
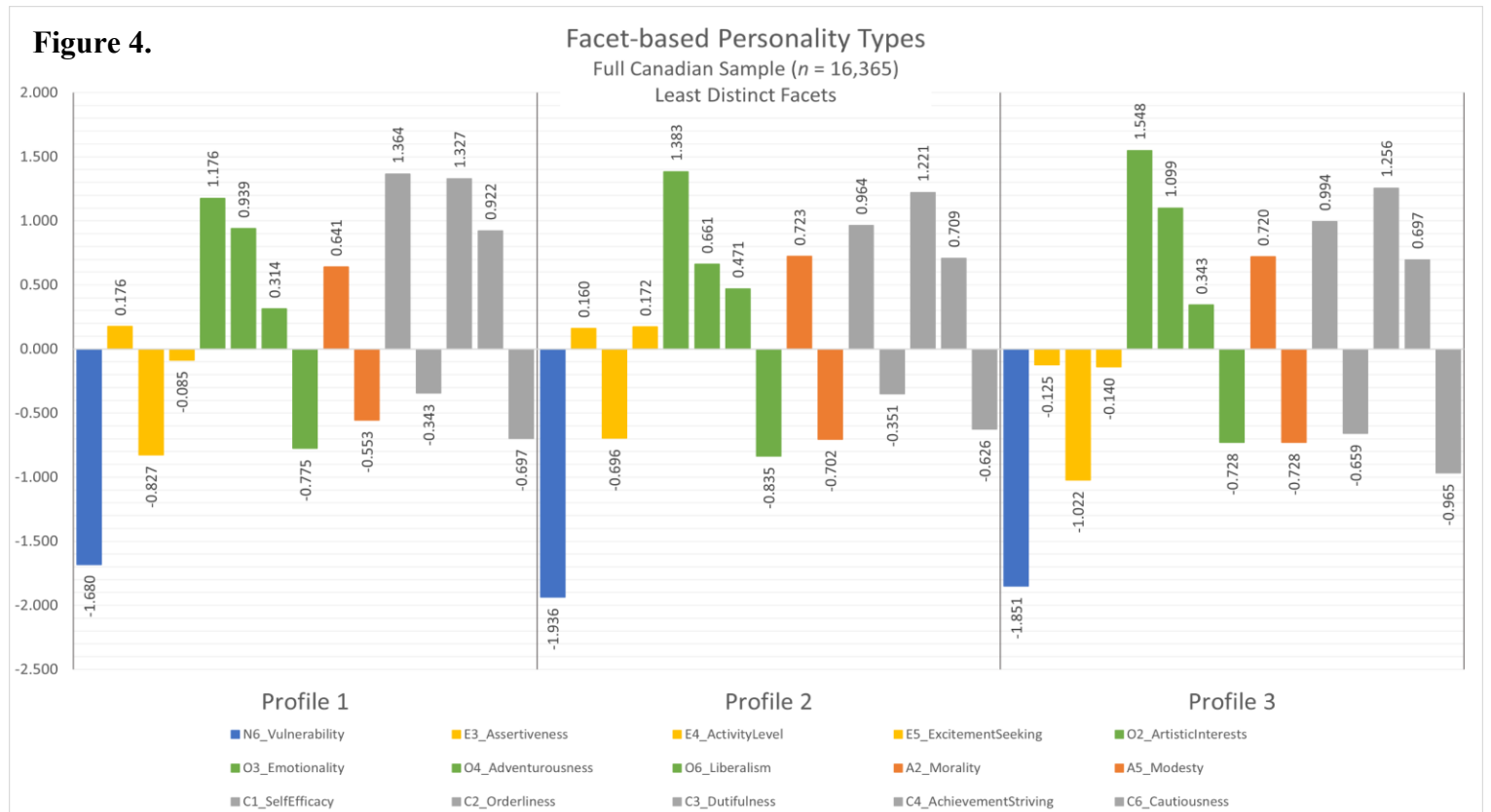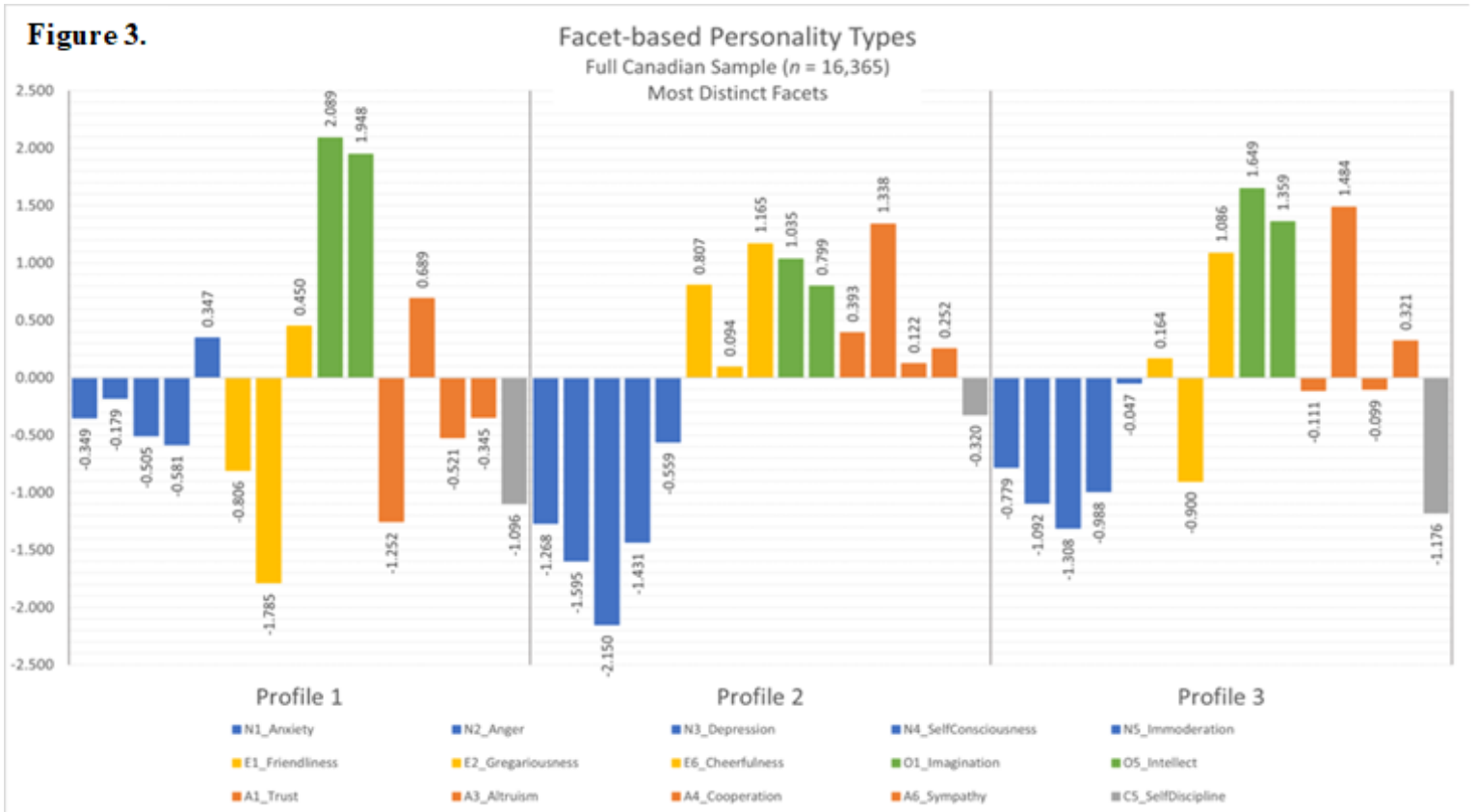
Gerlach et al.'s "Self-centered" types bear the closest resemblance to the facet-based Profile 1, in that each of these personality types has high Neuroticism and low Agreeableness. Of the facet means most responsible for distinguishing between facet-based personality types, Profile 1 has the lowest facets means for all except the Neuroticism facets and the Openness facets of O1–Imagination and O5–intellect. The facet mean for C5–Self-discipline is not statistically significantly different than the mean for that facet in Profile 3.

If the 3 facet-based personality types revealed in the present study, Profile 2 most closely resembles each of the "Resilient" so-called ARC types, Ferguson and Hull's (2018) "Well-adjusted" type, and Gerlach et al. (2018) "Role Model" type. Each of these types has very low Neuroticism scores and medium to high scores across the other factors. Profile 2's E1–Friendliness and E2–Gregariousness facet means are significantly higher than either Profile 1 or Profile 3. What stands out in regard to the facet means of Profile 1 and Profile 2 is that, among the most distinct facets, where Profile 1 has the highest Neuroticism, Profile 2 has the lowest. Also, Profile 1 has the lowest facet means for the most distinct Extroversion facets and the most distinct Agreeableness and Conscientiousness facets, but the highest facet means for the most distinct Openness facets (O1–Imagination and O5–Intellect) while Profile 2 is essentially the reverse. What is of immediate interest about Profile 3 is where its facet means are the "outside" value instead of the *middle* value (i.e., N5–Immoderation, N6–Vulnerability, O1–Imagination, O3–Emotionality, and A5–Modesty are the only facets in which the facet means are between the facet means for Profile 1 and Profile 2). This fact is crucial in clarifying that Profile 3 is not simply the mid-point profile between Profile 1 and Profile 2, but a measurably distinct personality type on its own. We can see that the differences exist at the 15 previously outlined facets (Table 10; each of which has a variance above .05 and is highlighted in green).

Each profile revealed by the latent profile analysis of the IPIP-NEO-300 data presents a personality type that is both statistically distinct and meaningful to our understanding of personality development and presentation across the life span (See Appendix J. for all demographic grouping figures).

Discussion

Block (1971), in his seminal volume *Lives Through Time*, wrote that none of us are "so exquisitely different as to defy a rather useful categorization" (p. 110). He also admits that there is often a blurring of boundaries in categorization, which makes it highly unlikely we can accurately identify individuals on the borders of our categorization. The present study aimed to determine whether latent profile analysis of the 30 facets of the IPIP-NEO-300 would provide evidence that personality a) self-organizes into types, b) if yes, how many types, c) are the revealed types similar to known personality types, and d) can the types be viewed as maintaining consistency across the lifespan. Keeping Block's comments on personality categorization in mind, the results of the current study are quite exciting.

The primary research question of this study was whether the sub-trait facets of the Big Five personality model self-organize into discrete groupings or clusters that can be considered as personality types. Specifically, the current study aimed to identify if there are empirically supported facet-based personality types that can be observed across the lifespan. The significance of the current study lies in its potential to contribute to our understanding of personality development, provide insight into how people with different personality types react to social stimuli, and have practical implications for various fields such as education, organizational psychology, and team building. The current study also sought to address the

contentious issue of whether personality is a wholly unique phenomenon within each individual or a shared phenomenon between people.

Number of Types

The present study revealed 3 facet-based personality types. This result is consistent with the number of personality types uncovered by previous research into personality typology. Referring to the broadly supported personality types of Resilient, Overcontrolled, and Undercontrolled, Caspi and Shiner (2007) wrote that "at the broadest level of generalization, psychological theories must account for the development of these types" (p. 309). Overall, the authors suggest that including potentially valid and important lower-order traits in the taxonomy can enhance our understanding of personality and improve our ability to assess, predict, and intervene in cases where personality may be a relevant factor.

Though it is encouraging that the latent profile analysis of the facets of the IPIP-NEO-300 revealed 3 facet-based personality types, it needs to be mentioned that it was hoped the additional personality information present at the facet level would provide a more nuanced set of types. However, the current study seems to have uncovered information on how the 3 facet-based personality types are configured at the facet level rather than information that would differentiate more than 3 types of personality. Given that the current study revealed 3 facet-based personality types that share some configural similarities to previously uncovered personality types it adds to the evidence that personality does exist in or as broad *types*, and that these types are evident already in adolescence and are consistent across the lifespan.

Self-organization of Personality Types

"When repeatedly exercised, habitual activations of clusters of thoughts, emotions, and action tendencies to a particular stimulus or situation become very likely to occur and difficult to

change" (Rothbart & Bates, 2006; p. 133). It is this phenomenological mechanism that drives and explains how personality "self-organizes". A phenomenological mechanism is a way of describing how an individual's subjective experience of the world is shaped by the workings of their mind and can include things like attentional biases, cognitive schemas, and emotional regulation strategies. The facet-based personality types revealed in the current study—as well as the previously revealed personality types—provide a framework for understanding both how and why individual personalities develop as they do. The subjective experience of an individual determines how they perceive and interpret the world around them. However, as the literature on temperament illustrates, people can be categorized within modes of being (set attitudes, behaviours, cognitions, and desires (Wilt & Revelle, 2015)), such that their adult *personality* is largely predictable by their childhood temperament (Shiner et al., 2003).

Figure 5.

Ferguson and Hull (2018) Personality Types
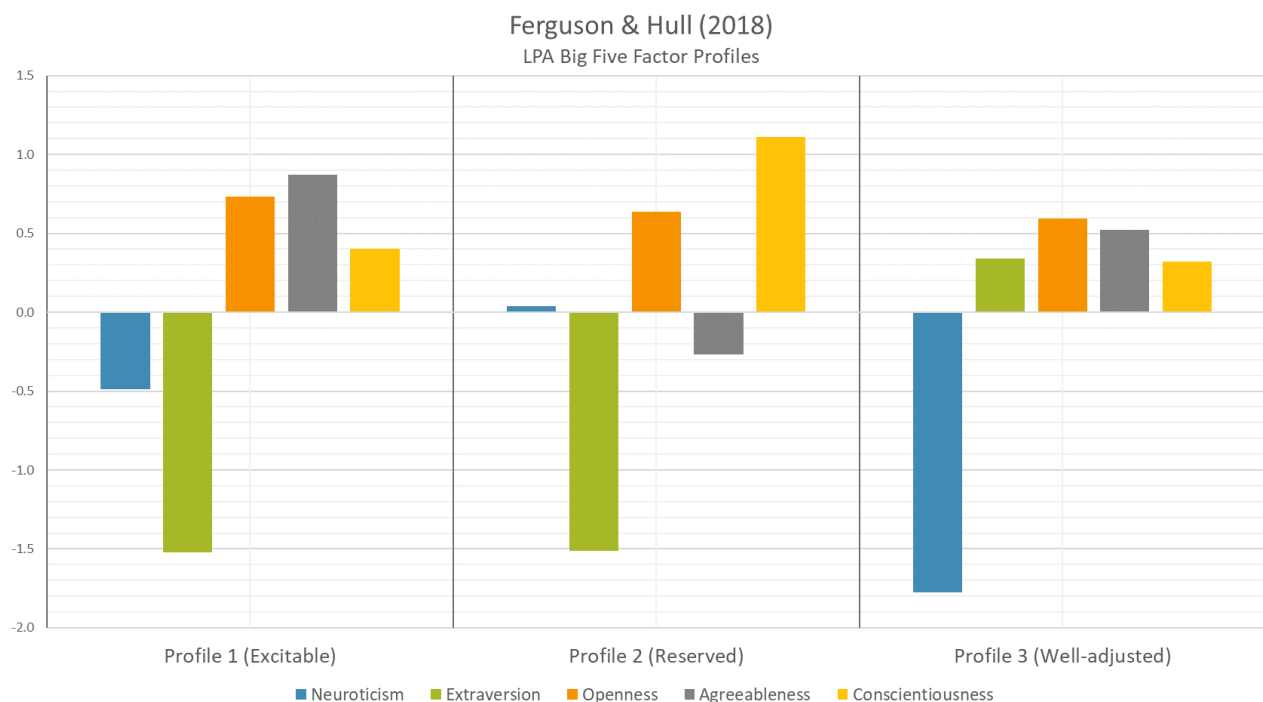
The results of the current study add support to the existing literature that personality is a self-organizing psychological construct which presents as 1 of 3 broad types. The 3 facet-based personality types revealed in this study share some similarities with the so-called Asendorpf–Robins–Caspi Types (ARC) personality types—Overcontrolled, Undercontrolled, and Resilient, as well as the types presented by Ferguson and Hull (2018)—Excitable, Reserved, and Well-adjusted (Figure 5). Comparing the types revealed in the current study with the 4-profile personality typology presented by Gerlach et al. (2018)—Average, Self-centered, Reserved, and Role Model, reveals similarity only between their Role Model type and Type 2 in the current studies facet-based personality typology.

Plasticity and Stability

Digman (1997) conducted research that used data from 14 different studies, which included a variety of measurement methods and participant populations, to determine the structure of the Big Five traits. Exploratory analyses indicated that two factors were typically evident, these factors were provisionally labeled α and β. Factor α was typically indicated by Big Five factors Agreeableness and Emotional Stability (reverse coded Neuroticism), and generally also by Conscientiousness). Factor β was indicated by Extraversion and Openness in all studies. The α and β factors were found to be robust across different populations despite the diversity of the data. Rushton and Irwing (2008) demonstrated in two studies that a General Factor of Personality (GFP) is at the top of personality's hierarchical structure. A re-analysis of 14 sets of inter-scale correlations assembled by Digman (1997) revealed the GFP, as did the re-analysis of Mount et al. (2005)'s Big Five interscale correlations. Importantly for the current study, Rushton's and Irwing's study also provided strong support for the Big Two factors of Plasticity and Stability.

Figure 5.

Ferguson and Hull (2018) Personality Types
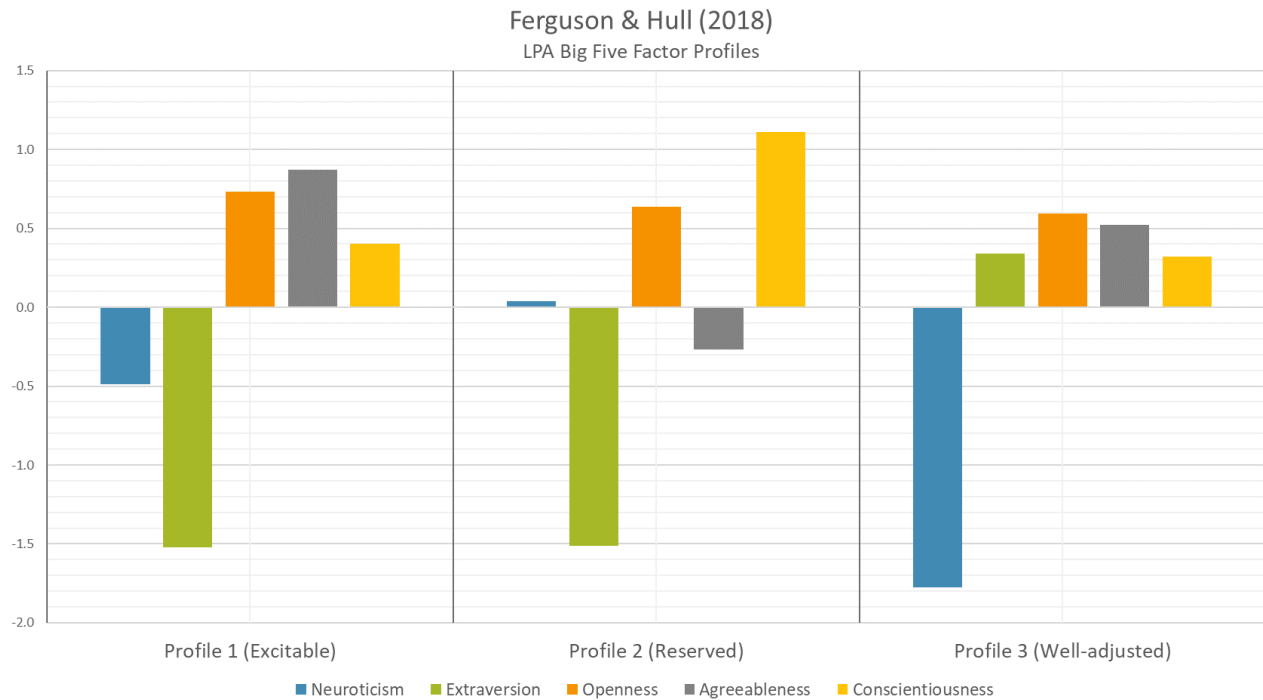
Given that Neuroticism, Agreeableness, and Conscientiousness are the Big Five factors that comprise the Big Two factor of Stability it is of real interest that the facet-based personality types revealed in the current study indicate that it is primarily 4 facets of Neuroticism, 3 facets of Agreeableness, and only 1 facet of Conscientiousness that drive personality type differentiation within the Stability factor. Similarly, for the Big Two factor of Plasticity it is only 3 facets of Extroversion and 3 facets of Openness responsible for type differentiation. Rushton and Irwing (2008) made the point that the Stability component (Neuroticism, Conscientiousness, and Agreeableness) overweighs Plasticity (Extraversion and Openness) in the Big One. As Musek (2007) points out, approximately 80 percent of the variance in the Big One factor of personality can be explained by just two dimensions of the Big Five, Neuroticism and Extraversion. This is informative in considering the facet-based personality types revealed in the current study, as both

factors play an outsized role in the personality type configuration. In the findings of the current study, 10 of the 15 facets most responsible type differentiation are facets within the Stability factor, adding support for the idea that facets of personality stability play a more critical role in how personality develops, is presented, and is maintained across the lifespan.

Consistency Across Lifespan

Shiner et al. (2003), found that personality in childhood is a reliable predictor of both adult personality and adaptation over a period of two decades and beyond. The researchers observed a moderate degree of consistency in personality over a 20-year period, despite the fact that childhood personality was assessed by external evaluators and early adulthood personality was assessed through self-report. As mentioned previously, Asendorpf and Van Aken (2003) emphasise that a considerable amount of variation in personality evaluations is due to the observer's perception, rather than the personality of the evaluated person.

The facet-level differences revealed in the current study between personality types for ages 10 to 19, and ages 20 to 65 are consistent with previous findings that personality remains surprisingly stable across the lifespan and suggest a lifespan personality development trajectory. As previously shown, there are good reasons to believe personality develops into 1 of 3 types which find their origin in childhood temperament (Caspi & Roberts, 2001; Cloninger, 1994; Halverson Jr., 2014; Rothbart & Ahadi, 1994). The facet-based types revealed in this study are present at age 10 and are consistent through early adulthood into later adulthood. The 3 facet-based personality types do not maintain the same mean-level facet scores (type configuration) over the lifespan. Rather, the types appear to remain consistent over the lifespan within the contexts of sex, maturation, and development.

As an example, on average, Type 1 females aged 10 to 19-years-old score higher than Type 1 males in N1–Anxiety, N2–Anger, N5–Immoderation, and O2–Artistic Interest, while scoring lower in 2–Gregariousness, A1–Trust, and A3–Cooperation (See Appendix J10). However, for Type 2 females and males aged 10 to 19-years-old the facet differences are located at N1–Anxiety (higher for females), E4–Activity Level (higher for males), and O1–Imagination, O2–Artistic Interests, and O3–Emotionality (higher for females) (See Appendix J11). For Type 3 the male sex-related differences are at the facets of N1–Anxiety, N2–Anger, N3–Depression (lower), E2–Gregariousness, E3–Assertiveness (higher), O2–Artistic Interests, O3–Emotionality (lower), O4–Adventurousness, O5–Intellect, O6–Liberalism (higher) (See Appendix J12), and so on (See Appendices J13 to J18).

Evidence that personality develops into types is present in the current study when we consider the facet level differences between 10 to 19-year-olds and 20 to 65-years-olds. For each of the 3 personality types and for both males and females the types stabilize at age 20 through age 65-years-old. The personality variability in adolescence appears to settle in early adulthood and maintain into later adulthood, which is consistent with previous research on personality development. There are differences within the facet-based personality types that are dependent on both the age and the sex of the individual, which are better understood through the lens of heterotypic continuity (see following section).

That the specific facet levels are critical to understanding personality type composition and development should not be surprising. Ashton et al. (1995) showed that, on average, specific facet scales were more strongly related to relevant external criteria (e.g., job performance, academic achievement, social behavior) than the broader factor scales. They also found that the facets within each factor varied in their predictive validity, with some facets showing stronger

correlations with external criteria than others. Overall, the authors concluded that specific facet scales are more valid measures of personality than broad factor scales. They suggested that researchers and practitioners should focus on using facet scales to measure personality, when possible, rather than relying on broader factor scales.

In a study of adult development, Soldz and Vaillant (1999) examined personality data from men who had been followed for 45 years, focusing on the stability of the Big Five traits and their relationship to life course functioning. The men were measured for each of the Big Five traits at the end of their college career in the mid-1940s and were administered the NEO-PI at ages 67-68. The study found that three of the five traits—Neuroticism, Extraversion, and Openness—were significantly correlated over this time interval. This study is unique in that it is the longest to examine personality stability using the Big Five as its conceptual base. It should not be surprising then, that the facet-based personality types revealed in the present study are so strongly dependent on only a selection (roughly half) of the facets underlying the Big Five factors. In particular, specific facets within Neuroticism and Agreeableness (Stability) and Extroversion and Openness (Plasticity) play the largest role in *type* differentiation. It needs to be kept in mind that $2/3^{rds}$ of the facets are within the Big Two factor of Stability (N1, N2, N3, N4, N4, A1, A3, A4, A6, and C5), whereas the remaining $1/3^{rd}$ are within the Big Two factor of Plasticity (E1, E2, E6, O1, and O5). This rather strikingly implies that facets of Stability are responsible for how personality is developed to a much greater extent than facets of Plasticity.

Heterotypic continuity

Heterotypic continuity is a term used in psychology to describe the phenomenon where a person's psychological characteristics, such as personality traits or behavioral tendencies, may manifest differently at different stages of development. This term refers to the idea that the

underlying trait or disposition remains stable over time, but the expression of the trait may change as a person grows and develops. Caspi et al. (1996) illustrate heterotypic continuity in their study of the correlation of psychiatric disorders to behavioural observations of 3-year-old children. They concluded that some forms of adult psychopathologic abnormality are meaningfully linked to behavioral differences observed among 3-year-old children.

Metric Invariance of Facets Over Time

Brandes et al. (2021) conducted an examination of the potential for invariance in facets and factors across age groups/time and gender. As a statistical property of measurement, measurement invariance refers to the assumption that the same factor structure exists across different groups or time points. In Configural Invariance the same set of items measures the same latent construct in the same way across groups, but the factor loadings and intercepts are allowed to vary freely. Metric invariance is a stronger form of measurement invariance than configural invariance and refers to the assumption that the factor loadings (the relationships between the items and the underlying construct) are equal across different groups or time points, while allowing for differences in the intercepts. This means that the items measure the same construct in the same way across groups, but they may have different means or intercepts. Strict invariance is the strongest form of measurement invariance and refers to the assumption that both the factor loadings and residual variances (the uniquenesses or measurement errors of the items) are equal across different groups or time points. This means that the items measure the same construct in the same way with the same measurement precision across groups. Any differences in the observed scores between groups can be attributed to true differences in the latent construct, rather than differences in the measurement properties of the items.

The results of Brandes et al.'s (2021) analysis of factors indicated that Agreeableness and Openness to Experience achieved strict invariance, while Conscientiousness achieved metric invariance, and Neuroticism and Extraversion achieved configural invariance across cohort/time. Overall, the study found more evidence of maturity than disruption in factor and facet mean-level trends in the transition from childhood to early adolescence. These findings appear to be reflected in the facet-based personality type distinctions between the 10 to 19-years-old sample and the 20 to 35-yeas-old and the 36 to 65-years-old groups. As individuals mature their personality type "settles" and is maintained throughout their life, only experiencing change in late adulthood—when the physiological and neurological changes of old(er) age begin to exert their greatest effects.

Changes in personality occur within a personality type (nomothetically), as opposed to within each individual (ideographically). As suggested in the introduction, a personality typology would help reframe developmental psychology's principal questions, "How much weight do nature and nurture contribute to development" and "How do nature and nurture interact in the developmental process"? The present study, among those referenced here and others, suggests nature (genetics and temperament) sets the boundaries and direction of personality development such that nurture takes the role of guiding personality type expression within the facet range boundaries of each type. A simple analogy would be that personality is 1 of 3 vehicles we each get to navigate life in and with. Our personality can and does vary, much like a vehicle can choose differing lanes and directions on a highway. However, with the exception of significant brain injury or neurochemical change (either physically or as a result of psychological trauma) the personality we have is the personality that "develops" and maintains across our lifespan (Terracciano et al., 2006).

Age-related Differences in Personality Type

It is consistent with what we know about personality factor and facet stability across the lifespan that there are marked differences between the 10 to 19-year-old group and the 20 to 35-year-old and 36 to 65-year-old groups. These age differences in the Big Five can be detected in large national datasets, as Donnellan and Lucas (2008) demonstrate. There is a similar pattern of age differences between Britain and Germany, and neither education nor sex appear to moderate cross-sectional age differences. Compared to individuals aged 20- to 65-years-old, adolescents have measurably different facet-based personality type configurations (as would be expected).

Sex-based Differences in Personality Type

Consistent with the existing literature, the facet-based personality types revealed in the current study present noticeable sex-based differences in personality type, at each of the developmental stages (e.g., 10 to 19 years olds, etc.). Prior research suggests that women tend to score higher than men on several facets of Neuroticism related to negative emotionality. For example, women tend to report higher levels of anxiety than men, on average. This includes worries about the future, fear of failure or criticism, and a tendency to feel nervous or tense in new or challenging situations (Mclean et al., 2009; Weisberg et al., 2001;). We see this expressed within the facet-based types revealed in the current study. Specifically, each of the 3 types, when analysed at the level of sex, has females scoring higher in anxiety than males (Figures 6, 7, and 8 represent Females vs. Males on each of the relevant facets and for each of the age demographic groupings). Females also tend to score higher on facets related to vulnerability, such as susceptibility to stress and a tendency to feel overwhelmed or emotionally exhausted. Females are more likely than men to experience symptoms of depression, which can include feelings of sadness, hopelessness, and worthlessness, as well as a loss of interest in

Figure 6.

Figure 7.

Figure 8.

Facet-based Personality Profiles
Differences in Neuroticism Facets between Female and Male Participants
36 to 65 Years Old
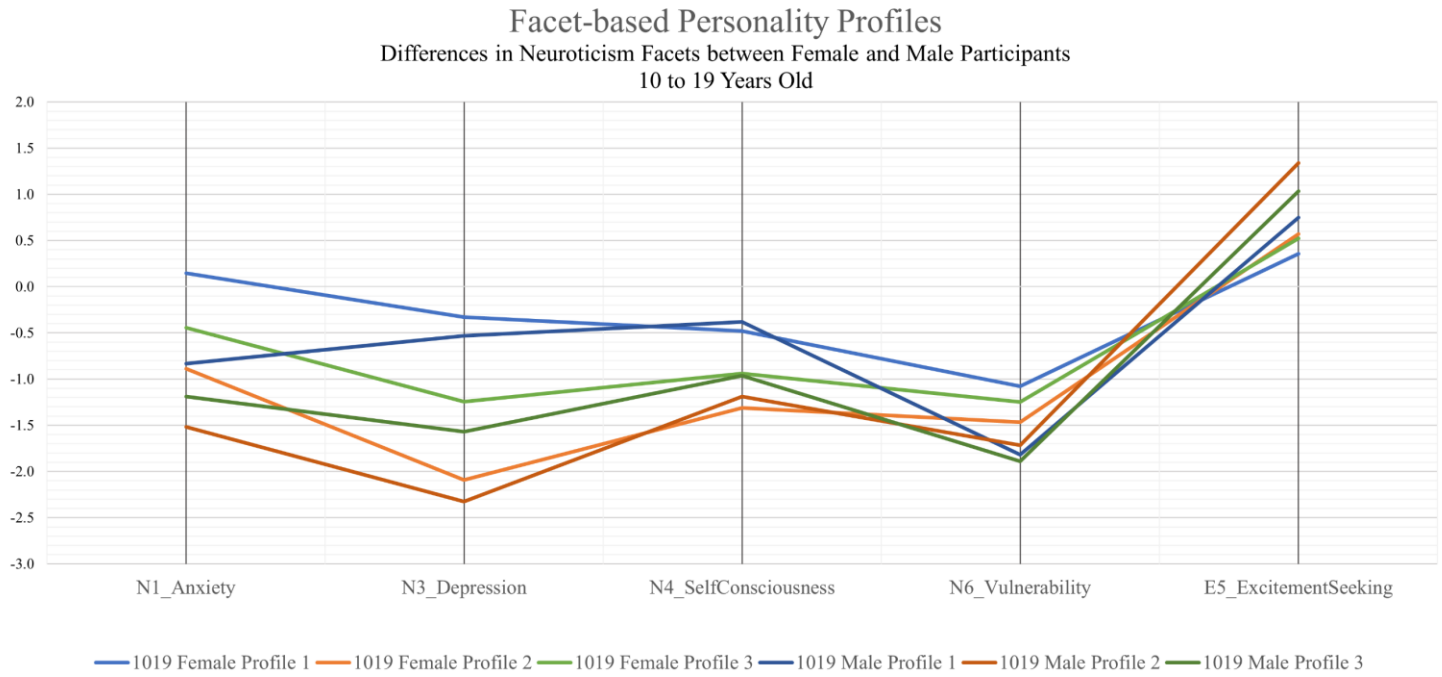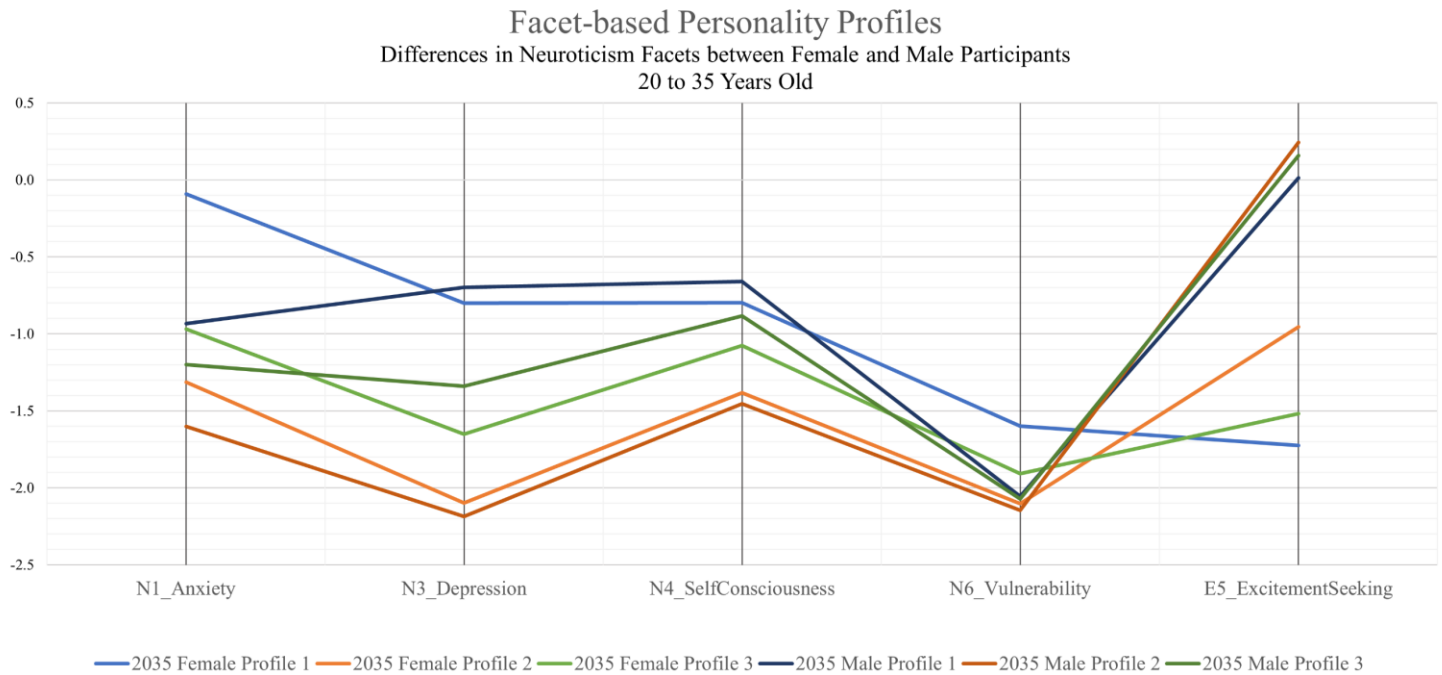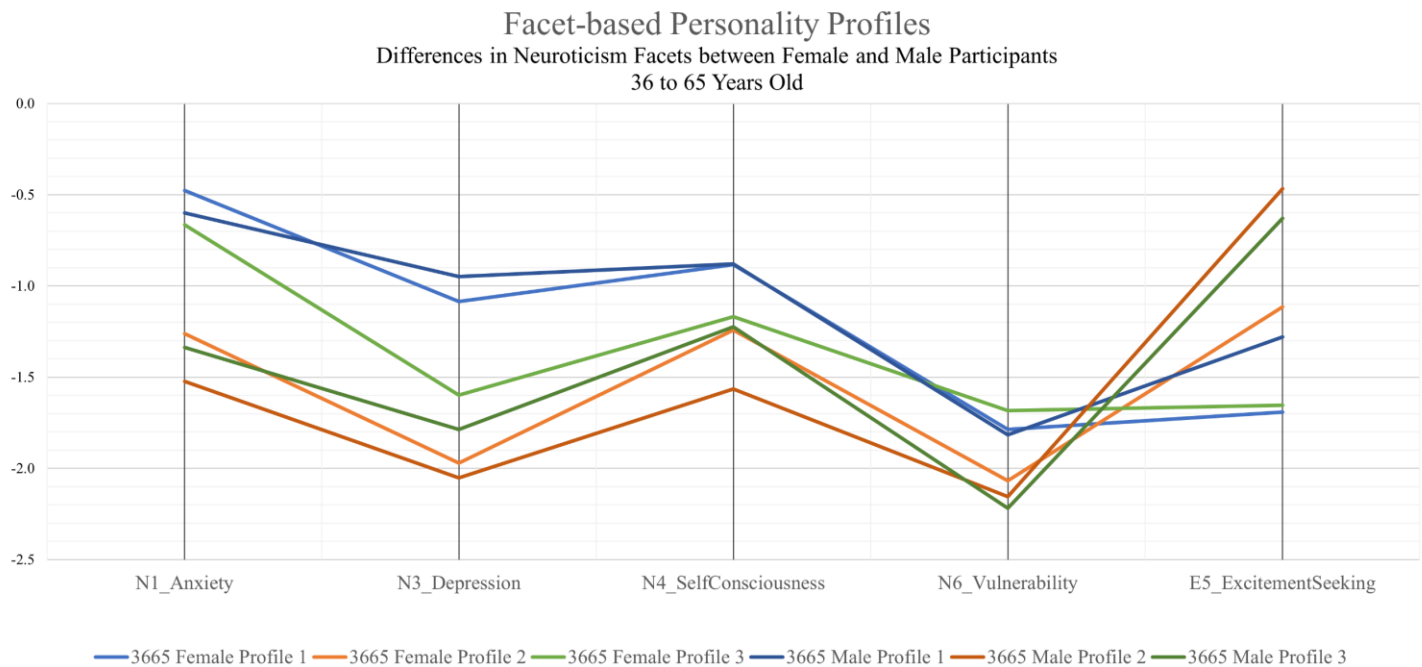
activities and difficulty sleeping or concentrating. At the same time, males tend to score slightly

higher than women on some facets of Neuroticism related to immoderation—which can be seen

for each facet-based personality type revealed in the current study. Males are more likely to seek

out novel or stimulating experiences, such as extreme sports, gambling, or thrill-seeking. This

can reflect a desire for excitement and adventure but can also be associated with impulsivity and

risk-taking (reflected in the elevated scores for E5–Excitement-seeking).

A valuable insight gained by the analysis of the facets of the IPIP-NEO-300 is what it

suggests about how personality is constituted (i.e., the fact that what fundamentally differentiates

personalities is differences at specific facets). These differences have been observed in prior

research on sex differences and personality traits in adolescence. As De Bolle et al. (2015)

demonstrate, Neuroticism begins to take on its adult form around the age of 14 (with females

scoring higher than males). As the results of the present study illustrate, males aged 10 to 19-

years-old present with lower Neuroticism facet levels than females aged 10 to 19-years-old in

each facet-based personality type. The exceptions lie at the facets of N4–Self-consciousness and N5–Immoderation, where the males score marginally higher for both Type 1 and Type 2, whereas the reverse is true for Type 3.

De Bolle et al. (2015) also indicate that females between the ages of 12 and 17 scored higher in Openness and Conscientiousness. The present study shows that for the facets of Openness males aged 10 to 19-years-old—with a Type 1 personality—scored higher for O1–Imagination, O4–Adventurousness (very slightly), and O5–Intellect, but noticeably lower for the other 3 facets. For Type 2 facet-based personalities in this age-range females scored higher in O1–Imagination, O2–Artistic Interests, and O3–Emotionality. Yet, the O5–Intellect score is essentially the same as for males in this age group, and lower for O4–Adventurousness and O6–Liberalism. For Type 3 in the 10 to 19-year-old age group, it is only at O2–Artistic Interests and O3–Emotionality that females show higher facet scores.

This is interesting for what it implies about the findings of De Bolle et al. (2015) regarding females scoring higher than males at the Openness factor level at all ages from 12 to 17. Namely, though this is true in the aggregate, a personality typology helps clarify why not all females score higher in Openness than all males aged 12 to 17-years-old; your facet level scores indicate what personality type you have, which affects the presentation of the overall factor comprised of those personality facets.

Social Roles and Personality Types

As touched on previously, the roles individuals have within their families, work environments, and society more broadly exert a degree of influence on how personality is presented (Wood & Roberts, 2006); the results of the current study are consistent with this observation. Examining the 3 facet-based personality types it is clear that adolescent personality

Figure 9. Facet-based Personality Type 1 at Each Age Cohort

Facet-based Personality Profiles
Facet-based Personality Type 1 at Each Age Cohort
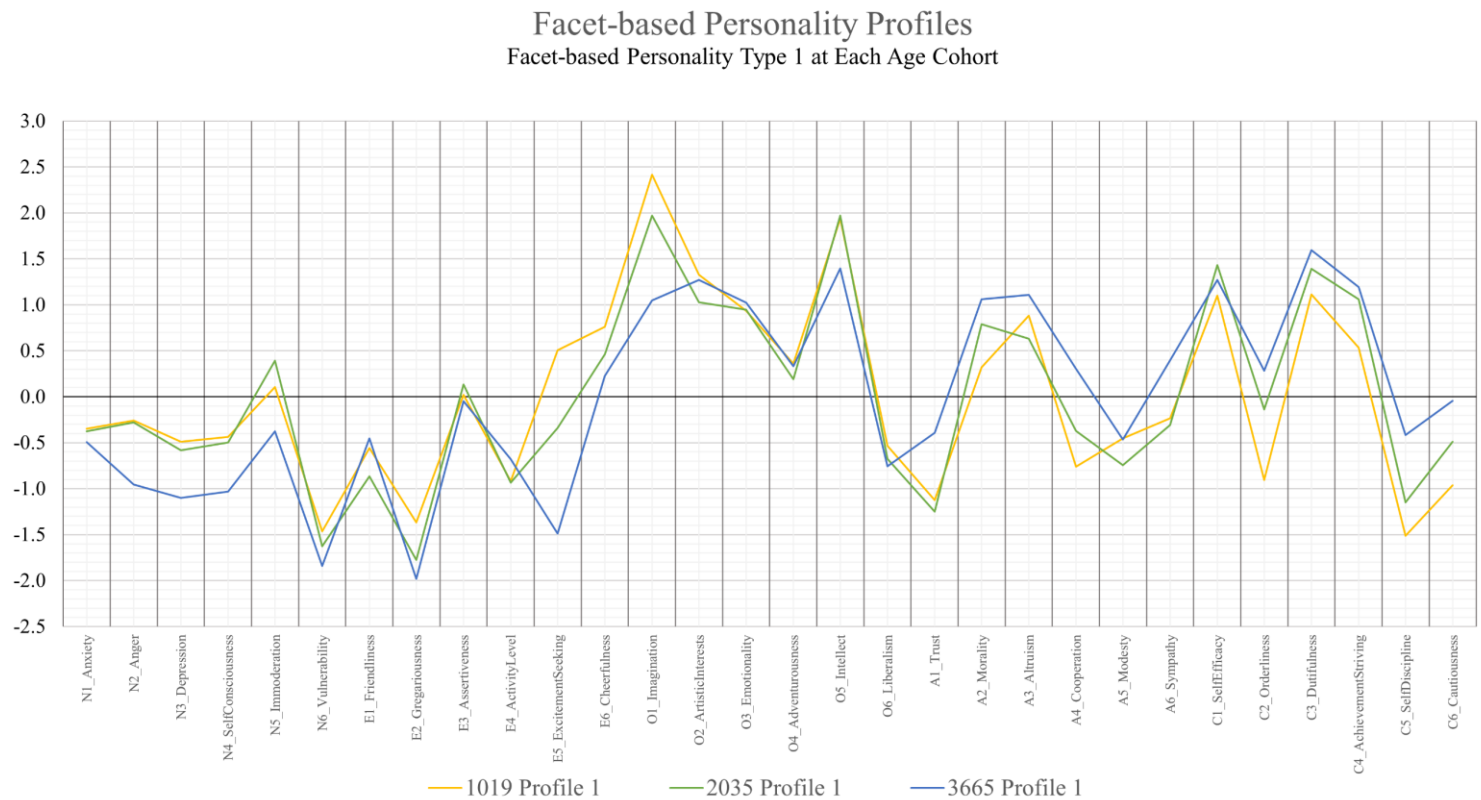
(regardless of Type configuration) is more volatile and extreme than early adulthood and later

adulthood personality. That the pressures exerted by our various social roles would function to

"adjust" our personalities is not surprising. Using Type 1 personalities as an example (Figure 9)

across each of the 3 age cohorts analysed in the current study, we can see how the revealed type

appears to adjust in relation to expected changes in maturity and social roles. The most obvious

change is found in the facets of Neuroticism, which show a significant reduction for the cohort

aged 36 to 65. This same "change" in personality is seen in the facet mean change for the facets

of Agreeableness and Conscientiousness for the cohort aged 36 to 65. However, as Wood and

Roberts (2006) illustrated in their set of studies, it is as likely to be the case that the personality

type of the individual remains consistent across time, and how that *type* is expressed is adjusted

in relation to social roles and maturity.

The Brain's Functional Architecture

Adelstein et al. (2011) investigated the relationship between personality traits and intrinsic functional connectivity in the brain. The authors used resting-state functional magnetic resonance imaging (fMRI) to measure functional connectivity in a large sample of individuals while they were not engaged in any specific task. They also measured participants' personality traits using the NEO Personality Inventory. The results of the study showed that different personality traits were associated with distinct patterns of intrinsic functional connectivity in the brain. For example, individuals who scored high on Neuroticism had greater connectivity between the amygdala and the prefrontal cortex, which are brain regions involved in emotional regulation and self-reflection; individuals who scored high on Extroversion had greater connectivity between the medial prefrontal cortex and the striatum, which are brain regions involved in reward processing and social behavior; individuals who scored high on Agreeableness had greater connectivity between the posterior cingulate cortex and the inferior parietal lobule, which are brain regions involved in social cognition and empathy; individuals who scored high on conscientiousness had greater connectivity between the dorsolateral prefrontal cortex and the anterior cingulate cortex, which are brain regions involved in executive control and goal-directed behavior; and individuals who scored high on openness to experience had greater connectivity between the default mode network and the frontoparietal network, which are brain networks involved in self-referential processing and attentional control.

The study provides compelling evidence that individual differences in personality traits are reflected in the brain's intrinsic functional architecture, even when individuals are not engaged in any specific task. These findings have important implications for our understanding of the neural basis of personality—and add a crucial perspective to the current study's hypothesis

that personality is a self-organizing construct with its fundamental structure already present in childhood temperament and that the personality type of the individual is consistent across the lifespan, while possessing a wide range of potential expression.

As was alluded to already, an empirically identified personality typology requires an increased focus on the biopsychosocial mechanisms involved in personality development—from birth, through childhood, and extending across the lifespan. Connecting the results of the current study to the findings in Adelstein et al.'s (2011) study, we can see that personality can be understood to be initiated, constructed, and maintained at a neurophysiological level. This implies strongly that the perennial belief that personality can be categorized into types is rooted in the "hard sciences" and not simply an artifact of a human tendency for pareidolia.

Implications

If, as the results of the current study (as well as previous research) suggest, personality self-organizes into 1 of 3 *types* and these types are defined primarily by a subset of personality facets, a clear implication is that the relationship *between* facets needs further investigation. The facet-based personality types revealed in the current study indicate that the facets E2–Gregariousness, A1–Trust, N3–Depression, E1–Friendliness, N2–Anger, O5–Intellect, O1–Imagination, C5–Self-discipline, N1–Anxiety, N5–Immoderation, A3–Altruism, N4–Self-consciousness, E6–Cheerfulness, A6–Sympathy, and A4–Cooperation exert more influence in personality type configuration than the remaining 15 facets of personality. This in no way denotes that the other facets aren't meaningful in describing and investigating personality. However, it could be the case that the expression (level) of the O3–Emotionality, C1–Self-efficacy, O2–Artistic Interests, C2–Orderliness, C6–Cautiousness, E3–Assertiveness, E4–

Activity Level, E5–Excitement Seeking, N6–Vulnerability, C4–Achievement Striving, A5–

Modesty, O4–Adventurousness, C3–Dutifulness, O6–Liberalism, and A2–Morality are in some

way contingent on the facet-based personality type of the individual. This would be an important

area of interest for future research.

The differences within the facet-based types evident between demographic groups (e.g.,

how Type 1 in 10 to 19-year-olds is configured differently than Type 1 in 20 to 35-year-olds) are

consistent with the developmental literature regarding both sex and age distinctives. However, if

future analysis of the IPIP-NEO-300 facets reinforces the finding that the personality types are

defined by mean differences between only specific facets and that these facet differences are

most pronounced for only 15 of the 30 facets it would indicate that deeper and more thorough

understanding of the personality facets is required in order to better understand the how's and

possible why's of personality development and expression.

As Mõttus and Rozgonjuk (2019) point out, however, even facets may not be sufficient

for an entirely comprehensive account of personality development, as nuances collectively

contained an additional 20% of age-sensitive information. This suggests that it may take several

dozen, perhaps even hundreds of trait constructs (nuances) to fully capture developmental

trajectories in behaviour, thinking, feeling and motivation. With this caveat, the present study

may provide an indication about which of the 30 personality facets, and subsequently which

personality nuances, are the best place to *begin* for clarifying how personality is both distinctive

ideographically, yet similar nomothetically. If follow-up research supports the facet structure of

the personality types revealed in this study, focusing on the specific personality facets

responsible for type distinction would be both theoretically and practically beneficial in

continuing efforts to understand personality development.

As one example among many possible examples, the fact that the facet-based personality profiles revealed in the current study are contingent on a subset of the total personality facets, and those particular facets have been shown to relate to consequential life outcomes, more intense investigation into these facets (see Table 11) should be a critical focus for future research.

Future Research

An exciting consequence of the results for the current study is how that they help frame potential theories of personality. What does it mean that what is measurably distinct about us is represented by only half of the facets of our personality? This study's findings support the increased focus on the facet level of personality measurement. As Mõttus et al. (2017) have argued, personality psychology needs to develop a greater interest in the nuances of personality. The evidence from this study suggests that the known distinction in adolescent behaviour and attitudes from adult and later adult populations is visible in the personality type of the individual. Future research should not only focus more intently on the facet level of personality measurement, but also examine how specific nuances of personality within specific facets both impact the development of personality types across the lifespan.

Working from the evidence of the current study that Neuroticism, Extroversion, and Agreeableness facets provide the greatest explanatory power for how individuals develop and exhibit their personality, future research would benefit from investigating specifically the ways in which these facets of

Table 11. Greatest Range Between Facets Among Facet-based Personality Types

N2–Anger	1.42
N3–Depression	1.64
E1–Friendliness	1.62
E2–Gregariousness	1.88
O1–Imagination	1.06
O5–Intellect	1.15
A1–Trust	1.64

personality act as predictors of and responses to affect, behaviour, cognition, and desire (Wilt & Revelle, 2015).

As suggested earlier, a personality typology impacts a very broad range of psychological inquiry. Within developmental psychology a typology of personality influences not only specific questions concerning human development from birth to old age, but also the way psychologists theorize about development. If personality develops into distinguishable types, questions about when this process begins, how it effects stages of development—whether Piaget's theory of cognitive development (Piaget & Coltman, 1970), Erikson's theory of psychosocial development (Erikson, 1963), or Kohlberg's theory of moral development (Kohlberg, 1981)—take on more significant meaning. An empirically verified personality typology modifies many of the questions developmental and personality psychologists ask.

There are innumerable areas in which a robust facet-based personality typology would both add clarity and generate meaningful research questions. Marcia's theory of identity development (Marcia, 1966) is an excellent example. Do different personality *types* progress or process these stages differently as a result of their personality structure? Does a Type 1 individual follow a different identity development trajectory than a Type 2 or Type 3? Are certain types more prone to a premature commitment to an identity without engaging in any meaningful exploration of alternatives—identity foreclosure? Marcia proposed that individuals in Identity Diffusion may avoid making commitments or may experiment with different identities without committing to any particular one. They may lack a sense of direction and purpose in life and may feel disconnected from their emotions and experiences. They may also experience feelings of anxiety, confusion, and low self-esteem. What if this is descriptive, not only of a stage of development, but of a personality type (i.e., facet-based Type 1)? Experiencing

feelings of anxiety, confusion, and low self-esteem would be consistent with having elevated

levels of facets of Neuroticism and lower levels of facets of Extroversion and Agreeableness. We

see this facet configuration in Type 1 personalities—they have the highest facet scores for

Neuroticism, the lowest scores for 3 of the facets of Extroversion, and the lowest scores for 5 of

the 6 facets of Agreeableness (the exception being A5–Modesty).

It is conspicuous that each of the personality typologies referenced in the current study,

including the types revealed by the current study, contains a personality type principally the

same as the ARC typology's "Resilient" type. Future research could explore how it is the case

that the factor and facet measurements of the population agree that there is a subset that can be

labelled "resilient". If personality typology continues to compile supporting evidence, important

questions regarding what it means and what, if anything can or should be done to provide

supports and opportunities for individuals whose personality is either Overcontrolled/Reserved

or Undercontrolled/Excitable need to be tackled. A typology of personality postulates that

personality is a self-organizing psychological construct, so the Western push for "success" and

"status" will continually be irrelevant to a significant proportion of the population, whose

personality types do not—and will not—resonate with those socially constructed imperatives.

Moving past the facets to the nuances to discover if *types* of personality are also evident

at that level is another import future research focus. Using the results of the current study it could

be further investigated which of the 10 nuances that comprise the particular facet are primarily

responsible for the facet level score. An example is Openness, which consists of the facets of

Imagination, Artistic Interests, Emotionality, Adventurousness, Intellect, and Liberalism. Each of

the facets is further made up of 10 nuances, the actual scale items. Is it possible that personality

typology has been so evasive in part because the *types* of personality are functionally multiplied by being constituted by different levels within a single facet?

Limitations

The present study was affected by a few notable limitations. The most significant limitation was the nature of the dataset itself. Specifically, the data represents the personality facet scores for an individual at a specific point in time. Although the data includes facet-level scores from a sample ranging in age from 10- to 65-years-old, there is no repeated measure of facet-level personality to clarify individual *type* across time. This study's results assume the personality profiles represented at each age cohort represent personality change across lifespan at the individual level. In other words, that the profile facet structure of each type would be replicated in a sample being tracked across time with a longitudinal study. This limitation was mitigated by previous research on personality stability over the lifespan, and the results are consistent with what would be expected at the facet level of a facet-based personality typology. Confirming the 3 facet-based types revealed in the current study in a longitudinal dataset would be a research priority for those interested in the development and maintenance of personality across the lifespan. Another limitation connected to the principal dataset is that there are no participants above the age of 65-years-old included in the current analysis. Consequently, it is not possible to address important questions related to personality typology and older age (i.e., 66 to 99-years-old).

Another limitation for the current study was the fact the dataset lacked a breadth of ethnic and cultural demographic detail. Although it is likely a sum positive that the sample ($n = 16,365$) includes Canadians from a wide range of cultural and ethnic backgrounds and identities—

making the results more adequately generalizable—not being able to parse that data to investigate possible culture driven differences in facet-based personality *types* leaves open an important question, "What impact does environment (culture) have on the formation and expression of facet-based personality typology"?

Connected to the limitations already referenced, is the fact of how participants were included in the dataset. The IPIP-NEO-300 is an online personality questionnaire which is completed by whomever chooses to do so (i.e., there is no active recruitment of participants). The potential concern is whether those who completed the IPIP-NEO-300 are generally inclined to complete personality related surveys and questionnaires.

Conclusion

As Larsen and Buss (2018) make clear in their definition of personality, it is among the most complex of the psychological constructs. Consisting of no less than 6 different elements, personality is likely to enjoy many decades, or even centuries, more of intense theorizing, research, and analysis. The current study revealed that, at the facet level of personality trait theory, we find personality presents as 3 distinct *types*. These personality types are distinguishable from each other by statistically significant variance between half of the 30 facets used to measure personality. This result suggests that, although we see variation at every facet level, it is only half of the facets of personality that self-organize such that they exist as distinct *types* in relation to the overall facet means of the population.

Each of us *is* unique—no other person is exactly like us—and each of us *is* of a type— many other people are similar to us. The current study helps our understanding of this apparent paradox by highlighting the fact that roughly half of the facets we use to describe our personalities vary ideographically within a population, while the other half of the facets we use

to measure our personality vary nomothetically within a population, such that personality types are formed. It is hoped that further research will continue to identify the myriad ways each of us is unique, while also researching how our personality type forms, develops, and affects our life outcomes. As Allport said, "behavior is variable, but always within the limits and ranges set by the [person's] structure itself" (1961. p. 572).

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Appendix A.

IPIP-NEO-300
(International Personality Item Pool Representation of the NEO PI-R®)

Name:
Age:
Gender:
Nationality:

Today's Date:

The following pages contain phrases describing people's behaviors. Please use the rating scale next to each phrase to describe how accurately each statement describes you.

Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age.

So that you can describe yourself in an honest manner, your responses will be kept in absolute confidence. Please read each statement carefully, and then click the circle that corresponds to the accuracy of the statement.

Please answer every item by marking the relevant answer circle with a diagonal 'cross' sign ( ). Note that the answer circles appear directly to the right of each question. Please make sure that the circle you are choosing corresponds to the question you are considering. If you want to change your answer, that is fine – just mark an 'X' in the originally chosen circle(s) and mark your final answer with the cross sign.

Please note that this questionnaire tends to take about 35 minutes to complete.

Additional Information
- The full IPIP contains 3,320 items assembled by Dr. Lewis R. Goldberg: http://ipip.ori.org/ .The IPIP is in the public domain and its items can be freely downloaded from that site.
- The IPIP-NEO is not equivalent to the commercial inventory on which it is based, the NEO PI-R®, authored by Paul T. Costa, Jr. and Robert R. McCrae. The genuine NEO PI-R® (240 items) is considered by many psychologists to be the best inventory for measuring traits within the Five Factor Model (FFM) of personality. The NEO PI-R® is copyrighted by Psychological Assessment Resources (PAR) in Florida, and can only be ordered by professionals and used by permission. You can contact PAR at: 1-800-331-TEST, or http://www.parinc.com.
- The scoring system for these items was created by Dr. John A. Johnson, Professor of Psychology, Penn State University, USA. This hard-copy questionnaire was collaboratively created by Dr. Johnson and Dr. Conal Twomey, Clinical Psychologist, Health Service Executive, Ireland. The layout of the questionnaire was modelled on the M5-120 Questionnaire, created by Dr David M. McCord, Western Carolina University, USA.
- Scoring keys and an automatic scoring spreadsheet for this questionnaire are available at Dr. Johnson's IPIP-NEO data repository: https://osf.io/tbmh5/

- An online (soft-copy) version of this questionnaire – with accompanying report generation procedures – is available at this URL: http://www.personal.psu.edu/~j5j/IPIP/ipipneo300.htm
- Anyone with further questions may contact Dr. John A. Johnson at j5j@psu.edu.

> ## Turn the page over now.

IPIP-NEO-300 (1 of 6)				Inaccurate	Moderately Inaccurate	Neither	Moderately Accurate	Accurate
Item	Factor	Facet	Nuance					
1	N1	Anxiety	Worry about things.	O	O	O	O	O
2	E1	Friendliness	Make friends easily.	O	O	O	O	O
3	O1	Imagination	Have a vivid imagination.	O	O	O	O	O
4	A1	Trust	Trust others.	O	O	O	O	O
5	C1	Self-Efficacy	Complete tasks successfully.	O	O	O	O	O
6	N2	Anger	Get angry easily.	O	O	O	O	O
7	E2	Gregariousness	Love large parties.	O	O	O	O	O
8	O2	Artistic Interests	Believe in the importance of art.	O	O	O	O	O
9	A2	Morality	Would never cheat on my taxes.	O	O	O	O	O
10	C2	Orderliness	Like order.	O	O	O	O	O
11	N3	Depression	Often feel blue.	O	O	O	O	O
12	E3	Assertiveness	Take charge.	O	O	O	O	O
13	O3	Emotionality	Experience my emotions intensely.	O	O	O	O	O
14	A3	Altruism	Make people feel welcome.	O	O	O	O	O
15	C3	Dutifulness	Try to follow the rules.	O	O	O	O	O
16	N4	Self-Consciousness	Am easily intimidated.	O	O	O	O	O
17	E4	Activity Level	Am always busy.	O	O	O	O	O
18	O4	Adventurousness	Prefer variety to routine.	O	O	O	O	O
19	A4	Cooperation	Am easy to satisfy.	O	O	O	O	O
20	C4	Achievement-Striving	Go straight for the goal.	O	O	O	O	O
21	N5	Immoderation	Often eat too much.	O	O	O	O	O
22	E5	Excitement-Seeking	Love excitement.	O	O	O	O	O
23	O5	Intellect	Like to solve complex problems.	O	O	O	O	O
24	A5	Modesty	Dislike being the center of attention.	O	O	O	O	O
25	C5	Self-Discipline	Get chores done right away.	O	O	O	O	O
26	N6	Vulnerability	Panic easily.	O	O	O	O	O
27	E6	Cheerfulness	Radiate joy.	O	O	O	O	O
28	O6	Liberalism	Tend to vote for liberal political candidates.	O	O	O	O	O
29	A6	Sympathy	Sympathize with the homeless.	O	O	O	O	O
30	C6	Cautiousness	Avoid mistakes.	O	O	O	O	O

31	N1	Anxiety	Fear for the worst.	O	O	O	O	O
32	E1	Friendliness	Warm up quickly to others.	O	O	O	O	O
33	O1	Imagination	Enjoy wild flights of fantasy.	O	O	O	O	O
34	A1	Trust	Believe that others have good intentions.	O	O	O	O	O
35	C1	Self-Efficacy	Excel in what I do.	O	O	O	O	O
36	N2	Anger	Get irritated easily.	O	O	O	O	O
37	E2	Gregariousness	Talk to a lot of different people at parties.	O	O	O	O	O
38	O2	Artistic Interests	Like music.	O	O	O	O	O
39	A2	Morality	Stick to the rules.	O	O	O	O	O
40	C2	Orderliness	Like to tidy up.	O	O	O	O	O
41	N3	Depression	Dislike myself.	O	O	O	O	O
42	E3	Assertiveness	Try to lead others.	O	O	O	O	O
43	O3	Emotionality	Feel others' emotions.	O	O	O	O	O
44	A3	Altruism	Anticipate the needs of others.	O	O	O	O	O
45	C3	Dutifulness	Keep my promises.	O	O	O	O	O
46	N4	Self-Consciousness	Am afraid that I will do the wrong thing.	O	O	O	O	O
47	E4	Activity Level	Am always on the go.	O	O	O	O	O
48	O4	Adventurousness	Like to visit new places.	O	O	O	O	O
49	A4	Cooperation	Can't stand confrontations.	O	O	O	O	O
50	C4	Achievement-Striving	Work hard.	O	O	O	O	O
51	N5	Immoderation	Don't know why I do some of the things I do.	O	O	O	O	O
52	E5	Excitement-Seeking	Seek adventure.	O	O	O	O	O
53	O5	Intellect	Love to read challenging material.	O	O	O	O	O
54	A5	Modesty	Dislike talking about myself.	O	O	O	O	O
55	C5	Self-Discipline	Am always prepared.	O	O	O	O	O
56	N6	Vulnerability	Become overwhelmed by events.	O	O	O	O	O
57	E6	Cheerfulness	Have a lot of fun.	O	O	O	O	O
58	O6	Liberalism	Believe that there is no absolute right or wrong.	O	O	O	O	O
59	A6	Sympathy	Feel sympathy for those who are worse off than myself.	O	O	O	O	O
60	C6	Cautiousness	Choose my words with care.	O	O	O	O	O
61	N1	Anxiety	Am afraid of many things.	O	O	O	O	O
62	E1	Friendliness	Feel comfortable around people.	O	O	O	O	O
63	O1	Imagination	Love to daydream.	O	O	O	O	O
64	A1	Trust	Trust what people say.	O	O	O	O	O

65	C1	Self-Efficacy	Handle tasks smoothly.	O	O	O	O	O
66	N2	Anger	Get upset easily.	O	O	O	O	O
67	E2	Gregariousness	Enjoy being part of a group.	O	O	O	O	O
68	O2	Artistic Interests	See beauty in things that others might not notice.	O	O	O	O	O
69	A2	Morality	Use flattery to get ahead.	O	O	O	O	O
70	C2	Orderliness	Want everything to be "just right."	O	O	O	O	O
71	N3	Depression	Am often down in the dumps.	O	O	O	O	O
72	E3	Assertiveness	Can talk others into doing things.	O	O	O	O	O
73	O3	Emotionality	Am passionate about causes.	O	O	O	O	O
74	A3	Altruism	Love to help others.	O	O	O	O	O
75	C3	Dutifulness	Pay my bills on time.	O	O	O	O	O
76	N4	Self-Consciousness	Find it difficult to approach others.	O	O	O	O	O
77	E4	Activity Level	Do a lot in my spare time.	O	O	O	O	O
78	O4	Adventurousness	Interested in many things.	O	O	O	O	O
79	A4	Cooperation	Hate to seem pushy.	O	O	O	O	O
80	C4	Achievement-Striving	Turn plans into actions.	O	O	O	O	O
81	N5	Immoderation	Do things I later regret.	O	O	O	O	O
82	E5	Excitement-Seeking	Love action.	O	O	O	O	O
83	O5	Intellect	Have a rich vocabulary.	O	O	O	O	O
84	A5	Modesty	Consider myself an average person.	O	O	O	O	O
85	C5	Self-Discipline	Start tasks right away.	O	O	O	O	O
86	N6	Vulnerability	Feel that I'm unable to deal with things.	O	O	O	O	O
87	E6	Cheerfulness	Express childlike joy.	O	O	O	O	O
88	O6	Liberalism	Believe that criminals should receive help rather than punishment.	O	O	O	O	O
89	A6	Sympathy	Value cooperation over competition.	O	O	O	O	O
90	C6	Cautiousness	Stick to my chosen path.	O	O	O	O	O
91	N1	Anxiety	Get stressed out easily.	O	O	O	O	O
92	E1	Friendliness	Act comfortably with others.	O	O	O	O	O
93	O1	Imagination	Like to get lost in thought.	O	O	O	O	O
94	A1	Trust	Believe that people are basically moral.	O	O	O	O	O
95	C1	Self-Efficacy	Am sure of my ground.	O	O	O	O	O
96	N2	Anger	Am often in a bad mood.	O	O	O	O	O
97	E2	Gregariousness	Involve others in what I am doing.	O	O	O	O	O
98	O2	Artistic Interests	Love flowers.	O	O	O	O	O

99	A2	Morality	Use others for my own ends.	O	O	O	O	O
100	C2	Orderliness	Love order and regularity.	O	O	O	O	O
101	N3	Depression	Have a low opinion of myself.	O	O	O	O	O
102	E3	Assertiveness	Seek to influence others.	O	O	O	O	O
103	O3	Emotionality	Enjoy examining myself and my life.	O	O	O	O	O
104	A3	Altruism	Am concerned about others.	O	O	O	O	O
105	C3	Dutifulness	Tell the truth.	O	O	O	O	O
106	N4	Self-Consciousness	Am afraid to draw attention to myself.	O	O	O	O	O
107	E4	Activity Level	Can manage many things at the same time.	O	O	O	O	O
108	O4	Adventurousness	Like to begin new things.	O	O	O	O	O
109	A4	Cooperation	Have a sharp tongue.	O	O	O	O	O
110	C4	Achievement-Striving	Plunge into tasks with all my heart.	O	O	O	O	O
111	N5	Immoderation	Go on binges.	O	O	O	O	O
112	E5	Excitement-Seeking	Enjoy being part of a loud crowd.	O	O	O	O	O
113	O5	Intellect	Can handle a lot of information.	O	O	O	O	O
114	A5	Modesty	Seldom toot my own horn.	O	O	O	O	O
115	C5	Self-Discipline	Get to work at once.	O	O	O	O	O
116	N6	Vulnerability	Can't make up my mind.	O	O	O	O	O
117	E6	Cheerfulness	Laugh my way through life.	O	O	O	O	O
118	O6	Liberalism	Believe in one true religion.	O	O	O	O	O
119	A6	Sympathy	Suffer from others' sorrows.	O	O	O	O	O
120	C6	Cautiousness	Jump into things without thinking.	O	O	O	O	O
121	N1	Anxiety	Get caught up in my problems.	O	O	O	O	O
122	E1	Friendliness	Cheer people up.	O	O	O	O	O
123	O1	Imagination	Indulge in my fantasies.	O	O	O	O	O
124	A1	Trust	Believe in human goodness.	O	O	O	O	O
125	C1	Self-Efficacy	Come up with good solutions.	O	O	O	O	O
126	N2	Anger	Lose my temper.	O	O	O	O	O
127	E2	Gregariousness	Love surprise parties.	O	O	O	O	O
128	O2	Artistic Interests	Enjoy the beauty of nature.	O	O	O	O	O
129	A2	Morality	Know how to get around the rules.	O	O	O	O	O
130	C2	Orderliness	Do things according to a plan.	O	O	O	O	O
131	N3	Depression	Have frequent mood swings.	O	O	O	O	O
132	E3	Assertiveness	Take control of things.	O	O	O	O	O
133	O3	Emotionality	Try to understand myself.	O	O	O	O	O

134	A3	Altruism	Have a good word for everyone.	O	O	O	O	O
135	C3	Dutifulness	Listen to my conscience.	O	O	O	O	O
136	N4	Self-Consciousness	Only feel comfortable with friends.	O	O	O	O	O
137	E4	Activity Level	React quickly.	O	O	O	O	O
138	O4	Adventurousness	Prefer to stick with things that I know.	O	O	O	O	O
139	A4	Cooperation	Contradict others.	O	O	O	O	O
140	C4	Achievement-Striving	Do more than what's expected of me.	O	O	O	O	O
141	N5	Immoderation	Love to eat.	O	O	O	O	O
142	E5	Excitement-Seeking	Enjoy being reckless.	O	O	O	O	O
143	O5	Intellect	Enjoy thinking about things.	O	O	O	O	O
144	A5	Modesty	Believe that I am better than others.	O	O	O	O	O
145	C5	Self-Discipline	Carry out my plans.	O	O	O	O	O
146	N6	Vulnerability	Get overwhelmed by emotions.	O	O	O	O	O
147	E6	Cheerfulness	Love life.	O	O	O	O	O
148	O6	Liberalism	Tend to vote for conservative political candidates.	O	O	O	O	O
149	A6	Sympathy	Am not interested in other people's problems.	O	O	O	O	O
150	C6	Cautiousness	Make rash decisions.	O	O	O	O	O
151	N1	Anxiety	Am not easily bothered by things.	O	O	O	O	O
152	E1	Friendliness	Am hard to get to know.	O	O	O	O	O
153	O1	Imagination	Spend time reflecting on things.	O	O	O	O	O
154	A1	Trust	Think that all will be well.	O	O	O	O	O
155	C1	Self-Efficacy	Know how to get things done.	O	O	O	O	O
156	N2	Anger	Rarely get irritated.	O	O	O	O	O
157	E2	Gregariousness	Prefer to be alone.	O	O	O	O	O
158	O2	Artistic Interests	Do not like art.	O	O	O	O	O
159	A2	Morality	Cheat to get ahead.	O	O	O	O	O
160	C2	Orderliness	Often forget to put things back in their proper place.	O	O	O	O	O
161	N3	Depression	Feel desperate.	O	O	O	O	O
162	E3	Assertiveness	Wait for others to lead the way.	O	O	O	O	O
163	O3	Emotionality	Seldom get emotional.	O	O	O	O	O
164	A3	Altruism	Look down on others.	O	O	O	O	O
165	C3	Dutifulness	Break rules.	O	O	O	O	O
166	N4	Self-Consciousness	Stumble over my words.	O	O	O	O	O
167	E4	Activity Level	Like to take it easy.	O	O	O	O	O

168	O4	Adventurousness	Dislike changes.	O	O	O	O	O
169	A4	Cooperation	Love a good fight.	O	O	O	O	O
170	C4	Achievement-Striving	Set high standards for myself and others.	O	O	O	O	O
171	N5	Immoderation	Rarely overindulge.	O	O	O	O	O
172	E5	Excitement-Seeking	Act wild and crazy.	O	O	O	O	O
173	O5	Intellect	Am not interested in abstract ideas.	O	O	O	O	O
174	A5	Modesty	Think highly of myself.	O	O	O	O	O
175	C5	Self-Discipline	Find it difficult to get down to work.	O	O	O	O	O
176	N6	Vulnerability	Remain calm under pressure.	O	O	O	O	O
177	E6	Cheerfulness	Look at the bright side of life.	O	O	O	O	O
178	O6	Liberalism	Believe that too much tax money goes to support artists.	O	O	O	O	O
179	A6	Sympathy	Tend to dislike soft-hearted people.	O	O	O	O	O
180	C6	Cautiousness	Like to act on a whim.	O	O	O	O	O
181	N1	Anxiety	Am relaxed most of the time.	O	O	O	O	O
182	E1	Friendliness	Often feel uncomfortable around others.	O	O	O	O	O
183	O1	Imagination	Seldom daydream.	O	O	O	O	O
184	A1	Trust	Distrust people.	O	O	O	O	O
185	C1	Self-Efficacy	Misjudge situations.	O	O	O	O	O
186	N2	Anger	Seldom get mad.	O	O	O	O	O
187	E2	Gregariousness	Want to be left alone.	O	O	O	O	O
188	O2	Artistic Interests	Do not like poetry.	O	O	O	O	O
189	A2	Morality	Put people under pressure.	O	O	O	O	O
190	C2	Orderliness	Leave a mess in my room.	O	O	O	O	O
191	N3	Depression	Feel that my life lacks direction.	O	O	O	O	O
192	E3	Assertiveness	Keep in the background.	O	O	O	O	O
193	O3	Emotionality	Am not easily affected by my emotions.	O	O	O	O	O
194	A3	Altruism	Am indifferent to the feelings of others.	O	O	O	O	O
195	C3	Dutifulness	Break my promises.	O	O	O	O	O
196	N4	Self-Consciousness	Am not embarrassed easily.	O	O	O	O	O
197	E4	Activity Level	Like to take my time.	O	O	O	O	O
198	O4	Adventurousness	Don't like the idea of change.	O	O	O	O	O
199	A4	Cooperation	Yell at people.	O	O	O	O	O
200	C4	Achievement-Striving	Demand quality.	O	O	O	O	O
201	N5	Immoderation	Easily resist temptations.	O	O	O	O	O

202	E5	Excitement-Seeking	Willing to try anything once.	O	O	O	O	O
203	O5	Intellect	Avoid philosophical discussions.	O	O	O	O	O
204	A5	Modesty	Have a high opinion of myself.	O	O	O	O	O
205	C5	Self-Discipline	Waste my time.	O	O	O	O	O
206	N6	Vulnerability	Can handle complex problems.	O	O	O	O	O
207	E6	Cheerfulness	Laugh aloud.	O	O	O	O	O
208	O6	Liberalism	Believe laws should be strictly enforced.	O	O	O	O	O
209	A6	Sympathy	Believe in an eye for an eye.	O	O	O	O	O
210	C6	Cautiousness	Rush into things.	O	O	O	O	O
211	N1	Anxiety	Am not easily disturbed by events.	O	O	O	O	O
212	E1	Friendliness	Avoid contacts with others.	O	O	O	O	O
213	O1	Imagination	Do not have a good imagination.	O	O	O	O	O
214	A1	Trust	Suspect hidden motives in others.	O	O	O	O	O
215	C1	Self-Efficacy	Don't understand things.	O	O	O	O	O
216	N2	Anger	Am not easily annoyed.	O	O	O	O	O
217	E2	Gregariousness	Don't like crowded events.	O	O	O	O	O
218	O2	Artistic Interests	Do not enjoy going to art museums.	O	O	O	O	O
219	A2	Morality	Pretend to be concerned for others.	O	O	O	O	O
220	C2	Orderliness	Leave my belongings around.	O	O	O	O	O
221	N3	Depression	Seldom feel blue.	O	O	O	O	O
222	E3	Assertiveness	Have little to say.	O	O	O	O	O
223	O3	Emotionality	Rarely notice my emotional reactions.	O	O	O	O	O
224	A3	Altruism	Make people feel uncomfortable.	O	O	O	O	O
225	C3	Dutifulness	Get others to do my duties.	O	O	O	O	O
226	N4	Self-Consciousness	Am comfortable in unfamiliar situations.	O	O	O	O	O
227	E4	Activity Level	Like a leisurely lifestyle.	O	O	O	O	O
228	O4	Adventurousness	Am a creature of habit.	O	O	O	O	O
229	A4	Cooperation	Insult people.	O	O	O	O	O
230	C4	Achievement-Striving	Am not highly motivated to succeed.	O	O	O	O	O
231	N5	Immoderation	Am able to control my cravings.	O	O	O	O	O
232	E5	Excitement-Seeking	Seek danger.	O	O	O	O	O
233	O5	Intellect	Have difficulty understanding abstract ideas.	O	O	O	O	O
234	A5	Modesty	Know the answers to many questions.	O	O	O	O	O
235	C5	Self-Discipline	Need a push to get started.	O	O	O	O	O

236	N6	Vulnerability	Know how to cope.	O	O	O	O	O
237	E6	Cheerfulness	Amuse my friends.	O	O	O	O	O
238	O6	Liberalism	Believe that we coddle criminals too much.	O	O	O	O	O
239	A6	Sympathy	Try not to think about the needy.	O	O	O	O	O
240	C6	Cautiousness	Do crazy things.	O	O	O	O	O
241	N1	Anxiety	Don't worry about things that have already happened.	O	O	O	O	O
242	E1	Friendliness	Am not really interested in others.	O	O	O	O	O
243	O1	Imagination	Seldom get lost in thought.	O	O	O	O	O
244	A1	Trust	Am wary of others.	O	O	O	O	O
245	C1	Self-Efficacy	Have little to contribute.	O	O	O	O	O
246	N2	Anger	Keep my cool.	O	O	O	O	O
247	E2	Gregariousness	Avoid crowds.	O	O	O	O	O
248	O2	Artistic Interests	Do not like concerts.	O	O	O	O	O
249	A2	Morality	Take advantage of others.	O	O	O	O	O
250	C2	Orderliness	Am not bothered by messy people.	O	O	O	O	O
251	N3	Depression	Feel comfortable with myself.	O	O	O	O	O
252	E3	Assertiveness	Don't like to draw attention to myself.	O	O	O	O	O
253	O3	Emotionality	Experience very few emotional highs and lows.	O	O	O	O	O
254	A3	Altruism	Turn my back on others.	O	O	O	O	O
255	C3	Dutifulness	Do the opposite of what is asked.	O	O	O	O	O
256	N4	Self-Consciousness	Am not bothered by difficult social situations.	O	O	O	O	O
257	E4	Activity Level	Let things proceed at their own pace.	O	O	O	O	O
258	O4	Adventurousness	Dislike new foods.	O	O	O	O	O
259	A4	Cooperation	Get back at others.	O	O	O	O	O
260	C4	Achievement-Striving	Do just enough work to get by.	O	O	O	O	O
261	N5	Immoderation	Never spend more than I can afford.	O	O	O	O	O
262	E5	Excitement-Seeking	Would never go hang gliding or bungee jumping.	O	O	O	O	O
263	O5	Intellect	Am not interested in theoretical discussions.	O	O	O	O	O
264	A5	Modesty	Boast about my virtues.	O	O	O	O	O
265	C5	Self-Discipline	Have difficulty starting tasks.	O	O	O	O	O
266	N6	Vulnerability	Readily overcome setbacks.	O	O	O	O	O
267	E6	Cheerfulness	Am not easily amused.	O	O	O	O	O
268	O6	Liberalism	Believe that we should be tough on crime.	O	O	O	O	O
269	A6	Sympathy	Believe people should fend for themselves.	O	O	O	O	O

270	C6	Cautiousness	Act without thinking.	O	O	O	O	O
271	N1	Anxiety	Adapt easily to new situations.	O	O	O	O	O
272	E1	Friendliness	Keep others at a distance.	O	O	O	O	O
273	O1	Imagination	Have difficulty imagining things.	O	O	O	O	O
274	A1	Trust	Believe that people are essentially evil.	O	O	O	O	O
275	C1	Self-Efficacy	Don't see the consequences of things.	O	O	O	O	O
276	N2	Anger	Rarely complain.	O	O	O	O	O
277	E2	Gregariousness	Seek quiet.	O	O	O	O	O
278	O2	Artistic Interests	Do not enjoy watching dance performances.	O	O	O	O	O
279	A2	Morality	Obstruct others' plans.	O	O	O	O	O
280	C2	Orderliness	Am not bothered by disorder.	O	O	O	O	O
281	N3	Depression	Am very pleased with myself.	O	O	O	O	O
282	E3	Assertiveness	Hold back my opinions.	O	O	O	O	O
283	O3	Emotionality	Don't understand people who get emotional.	O	O	O	O	O
284	A3	Altruism	Take no time for others.	O	O	O	O	O
285	C3	Dutifulness	Misrepresent the facts.	O	O	O	O	O
286	N4	Self-Consciousness	Am able to stand up for myself.	O	O	O	O	O
287	E4	Activity Level	React slowly.	O	O	O	O	O
288	O4	Adventurousness	Am attached to conventional ways.	O	O	O	O	O
289	A4	Cooperation	Hold a grudge.	O	O	O	O	O
290	C4	Achievement-Striving	Put little time and effort into my work.	O	O	O	O	O
291	N5	Immoderation	Never splurge.	O	O	O	O	O
292	E5	Excitement-Seeking	Dislike loud music.	O	O	O	O	O
293	O5	Intellect	Avoid difficult reading material.	O	O	O	O	O
294	A5	Modesty	Make myself the center of attention.	O	O	O	O	O
295	C5	Self-Discipline	Postpone decisions.	O	O	O	O	O
296	N6	Vulnerability	Am calm even in tense situations.	O	O	O	O	O
297	E6	Cheerfulness	Seldom joke around.	O	O	O	O	O
298	O6	Liberalism	Like to stand during the national anthem.	O	O	O	O	O
299	A6	Sympathy	Can't stand weak people.	O	O	O	O	O
300	C6	Cautiousness	Often make last-minute plans.	O	O	O	O	O

Appendix B.

Alpha Reliability Coefficients for the IPIP-NEO Inventories

Scale Labels		Eugene-Springfield Sample (N = 501)		Internet Sample (N=307,313)		Internet Sample (N=619,150)
IPIP-NEO	NEO PI-R	IPIP 300	IPIP 120	IPIP 300	IPIP 120	IPIP 120
Neuroticism	N	.94	.88	.95	.90	.90
Anxiety	N1	.83	.71	.86	.78	.78
Anger	N2	.88	.77	.91	.86	.87
Depression	N3	.89	.80	.91	.86	.85
Self-consciousness	N4	.80	.63	.82	.72	.70
Immoderation	N5	.77	.69	.77	.71	.69
Vulnerability	N6	.82	.70	.85	.76	.76
Extraversion	E	.92	.84	.94	.89	.89
Friendliness	E1	.87	.77	.88	.81	.81
Gregariousness	E2	.79	.60	.88	.79	.79
Assertiveness	E3	.84	.75	.85	.83	.85
Activity level	E4	.71	.68	.71	.70	.69
Excitement-seeking	E5	.77	.67	.84	.75	.73
Cheerfulness	E6	.81	.71	.82	.79	.79
Openness to Experience	O	.92	.85	.90	.82	.81
Imagination	O1	.82	.70	.84	.75	.74
Artistic interests	O2	.85	.72	.80	.74	.74
Emotionality	O3	.81	.67	.77	.66	.65
Adventurousness	O4	.77	.66	.80	.70	.70
Intellect	O5	.86	.78	.84	.74	.73
Liberalism	O6	.86	.76	.77	.64	.63
Agreeableness	A	.90	.81	.92	.85	.86
Trust	A1	.82	.70	.88	.86	.85
Morality	A2	.74	.62	.78	.74	.74
Altruism	A3	.77	.65	.82	.74	.73
Cooperation	A4	.72	.56	.77	.70	.71
Modesty	A5	.76	.63	.77	.75	.73
Sympathy	A6	.75	.68	.77	.70	.72

Note. From "Measuring Thirty Facets of the Five Factor Model with a 120-Item Public Domain Inventory: Development of the IPIP-NEO-120", by J.A. Johnson, 2014, *Journal of Research in Personality* http://dx.doi.org/10.1016/j.jrp.2014.05.003

Appendix C.

Validity of the IPIP-NEO Inventories

Scale Labels		Eugene-Springfield Sample (Ns = 420-501)						Local Sample (N=160)	
		Correlations with NEO		Correlations with BFI[1]		Correlations with MiniMarkers[1]		Correlations with Acquaintance Ratings[2]	
IPIP-NEO	NEO PI-R	IPIP 300	IPIP 120	IPIP 300	IPIP 120	IPIP 300	IPIP 120	IPIP 300	IPIP 120
Neuroticism	N	.88	.87	.47	.46	.34	.33	.52	.49
Anxiety	N1	.76	.76	.45	.44	.32	.30	.44	.40
Anger	N2	.77	.71	.41	.32	.36	.29	.55	.55
Depression	N3	.81	.76	.39	.38	.30	.28	.61	.61
Self-consciousness	N4	.73	.60	.25	.18	.10	.06	.47	.33
Immoderation	N5	.74	.65	.24	.25	.24	.21	.33	.33
Vulnerability	N6	.78	.74	.36	.36	.22	.23	.44	.43
Extraversion	E	.89	.85	.51	.49	.48	.45	.43	.42
Friendliness	E1	.76	.68	.43	.42	.42	.41	.41	.39
Gregariousness	E2	.78	.73	.36	.37	.33	.35	.42	.37
Assertiveness	E3	.81	.73	.45	.29	.46	.30	.47	.39
Activity level	E4	.72	.63	.34	.31	.31	.27	.37	.36
Excitement-seeking	E5	.67	.59	.15	.15	.12	.10	.46	.43
Cheerfulness	E6	.77	.69	.34	.28	.29	.24	.39	.42
Openness to Experience	O	.87	.84	.58	.57	.52	.49	.30	.27
Imagination	O1	.74	.69	.37	.29	.34	.29	.26	.20
Artistic interests	O2	.80	.76	.45	.45	.37	.34	.36	.36
Emotionality	O3	.71	.65	.34	.33	.33	.25	.42	.39
Adventurousness	O4	.72	.62	.40	.38	.28	.30	.28	.19
Intellect	O5	.81	.75	.43	.41	.31	.40	.24	.23
Liberalism	O6	.71	.63	.40	.36	.44	.33	.35	.34
Agreeableness	A	.83	.76	.38	.33	.35	.31	.29	.25
Trust	A1	.78	.73	.29	.31	.26	.27	.30	.28

Note. From "Measuring Thirty Facets of the Five Factor Model with a 120-Item Public Domain Inventory: Development of the IPIP-NEO-120", by J.A. Johnson, 2014, *Journal of Research in Personality* http://dx.doi.org/10.1016/j.jrp.2014.05.003

Appendix D.

Table D1.

R Packages used in Analysis of the
IPIP-NEO-300 Facets

```{r}
install.packages("rmarkdown")
install.packages("readr")
install.packages("readxl")
install.packages("mclust")
install.packages("haven")
install.packages("ggplot2")
install.packages("factoextra")
install.packages("hopkins")
install.packages("performance")
install.packages("cluster")
```

```{r}
library(readr)
library(readxl)
library(mclust)
library(haven)
library(ggplot2)
library(factoextra)
library(hopkins)
library(performance)
library(cluster)
set.seed(1969)
```

Appendix E.

Table E1.

			10 to 19	10 to 19		20 to 35	20 to 35		36 to 65	36 to 65
	Canadian	10 to 19	Female	Male	20 to 35	Female	Male	36 to 65	Female	Male
Mean	3.253	3.380	3.435	3.281	3.262	3.380	3.226	3.371	3.395	3.357
N	30	30	30	30	30	30	30	30	30	30
Std. Deviation	.360	.398	.392	.417	.367	.426	.406	.433	.458	.510
Std. Error of Mean	.066	.073	.072	.076	.067	.078	.074	.079	.084	.093
Minimum	2.610	2.763	2.808	2.494	2.610	2.408	2.391	2.513	2.454	2.225
Maximum	4.005	4.100	4.140	4.062	3.985	4.053	4.103	4.062	4.110	4.206
Range	1.395	1.337	1.332	1.568	1.375	1.645	1.712	1.549	1.656	1.981
Variance	.130	.158	.153	.173	.135	.182	.165	.188	.210	.260
Kurtosis	-.462	-1.183	-.956	-1.007	-.575	-.499	-.081	-.856	-.714	-.573
Std. Error of Kurtosis	.833	.833	.833	.833	.833	.833	.833	.833	.833	.833

Means — Profile 1 (table header)

Table E2.

			10 to 19	10 to 19		20 to 35	20 to 35		36 to 65	36 to 65
	Canadian	10 to 19	Female	Male	20 to 35	Female	Male	36 to 65	Female	Male
Mean	3.411	3.346	3.301	3.178	3.395	3.498	3.348	3.445	3.474	3.313
N	30	30	30	30	30	30	30	30	30	30
Std. Deviation	.466	.402	.377	.373	.404	.531	.531	.615	.615	.441
Std. Error of Mean	.085	.073	.069	.068	.074	.097	.097	.112	.112	.081
Minimum	2.409	2.447	2.690	2.499	2.635	2.485	2.187	2.110	2.203	2.401
Maximum	4.055	3.928	4.164	4.101	4.033	4.303	4.025	4.242	4.310	4.085
Range	1.646	1.482	1.474	1.602	1.398	1.818	1.838	2.132	2.107	1.684
Variance	.217	.161	.142	.139	.163	.282	.282	.378	.378	.194
Kurtosis	-.602	-.740	-.345	.394	-1.146	-.993	-.115	-.408	-.646	-.617
Std. Error of Kurtosis	.833	.833	.833	.833	.833	.833	.833	.833	.833	.833

Means — Profile 2 (table header)

Table E3.

			10 to 19	10 to 19		20 to 35	20 to 35		36 to 65	36 to 65
	Canadian	10 to 19	Female	Male	20 to 35	Female	Male	36 to 65	Female	Male
Mean	3.398	3.258	3.417	3.227	3.433	3.479	3.310	3.468	3.579	3.413
N	30	30	30	30	30	30	30	30	30	30
Std. Deviation	.397	.359	.416	.403	.494	.631	.441	.519	.479	.738
Std. Error of Mean	.073	.066	.076	.074	.090	.115	.081	.095	.088	.135
Minimum	2.663	2.716	2.547	2.289	2.347	2.151	2.395	2.493	2.772	1.824
Maximum	4.053	4.124	4.105	3.785	4.122	4.300	4.115	4.294	4.344	4.344
Range	1.390	1.409	1.558	1.496	1.775	2.148	1.720	1.801	1.573	2.521
Variance	.158	.129	.173	.162	.244	.399	.195	.269	.230	.544
Kurtosis	-1.178	-.206	-.916	-.360	-.426	-.469	-.717	-1.046	-1.094	-.259
Std. Error of Kurtosis	3.398	3.258	3.417	3.227	3.433	3.479	3.310	3.468	3.579	3.413

Means — Profile 3 (table header)

Appendix F.

Table F1.

Facets	Canadian Profile 1	Canadian Profile 2	Canadian Profile 3
N1_Anxiety	3.127	2.820	3.089
N2_Anger	3.188	2.668	2.965
N3_Depression	3.071	2.409	2.879
N4_SelfConsciousness	3.044	2.744	3.006
N5_Immoderation	3.378	3.150	3.380
N6_Vulnerability	2.648	2.509	2.663
E1_Friendliness	2.963	3.786	3.464
E2_Gregariousness	2.610	3.454	3.041
E3_Assertiveness	3.316	3.485	3.349
E4_ActivityLevel	2.955	3.086	2.992
E5_ExcitementSeeking	3.222	3.491	3.343
E6_Cheerfulness	3.415	3.953	3.830
O1_Imagination	4.005	3.893	4.053
O2_ArtisticInterests	3.676	4.055	4.013
O3_Emotionality	3.591	3.718	3.835
O4_Adventurousness	3.366	3.630	3.535
O5_Intellect	3.954	3.782	3.938
O6_Liberalism	2.974	3.022	3.109
A1_Trust	2.802	3.593	3.355
A2_Morality	3.483	3.747	3.684
A3_Altruism	3.501	4.034	3.988
A4_Cooperation	3.065	3.467	3.359
A5_Modesty	3.054	3.083	3.109
A6_Sympathy	3.129	3.528	3.526
C1_SelfEfficacy	3.744	3.860	3.793
C2_Orderliness	3.129	3.247	3.137
C3_Dutifulness	3.730	3.979	3.897
C4_AchievementStriving	3.585	3.741	3.675
C5_SelfDiscipline	2.858	3.262	2.931
C6_Cautiousness	3.002	3.119	3.015

Table F2.

Facets	Canadian Female Profile 1	Canadian Female Profile 2	Canadian Female Profile 3
N1_Anxiety	3.339	2.956	3.223
N2_Anger	3.267	2.723	3.020
N3_Depression	3.106	2.418	2.865
N4_SelfConsciousness	3.117	2.808	3.038
N5_Immoderation	3.487	3.157	3.405
N6_Vulnerability	2.848	2.614	2.783
E1_Friendliness	3.027	3.832	3.564
E2_Gregariousness	2.668	3.474	3.121
E3_Assertiveness	3.332	3.476	3.358
E4_ActivityLevel	3.030	3.113	3.052
E5_ExcitementSeeking	3.148	3.405	3.267
E6_Cheerfulness	3.542	4.005	3.918
O1_Imagination	3.990	3.867	4.023
O2_ArtisticInterests	3.944	4.204	4.180
O3_Emotionality	3.780	3.823	3.987
O4_Adventurousness	3.410	3.624	3.539
O5_Intellect	3.878	3.723	3.876
O6_Liberalism	3.104	3.068	3.159
A1_Trust	2.878	3.644	3.432
A2_Morality	3.620	3.860	3.821
A3_Altruism	3.660	4.123	4.121
A4_Cooperation	3.173	3.577	3.460
A5_Modesty	3.151	3.168	3.209
A6_Sympathy	3.327	3.642	3.671
C1_SelfEfficacy	3.705	3.854	3.804
C2_Orderliness	3.189	3.303	3.202
C3_Dutifulness	3.806	4.041	3.992
C4_AchievementStriving	3.699	3.788	3.793
C5_SelfDiscipline	2.897	3.282	3.009
C6_Cautiousness	2.995	3.140	3.061

Table F3.

Facets	Canadian Male Profile 1	Canadian Male Profile 2	Canadian Male Profile 3
N1_Anxiety	2.886	2.790	2.334
N2_Anger	2.872	2.712	2.233
N3_Depression	2.919	2.598	1.992
N4_SelfConsciousness	3.003	2.929	2.343
N5_Immoderation	3.260	3.253	2.792
N6_Vulnerability	2.476	2.551	1.916
E1_Friendliness	3.136	3.482	3.885
E2_Gregariousness	2.734	3.231	3.337
E3_Assertiveness	3.257	3.275	3.729
E4_ActivityLevel	2.829	2.897	3.189
E5_ExcitementSeeking	3.323	3.579	3.339
E6_Cheerfulness	3.533	3.742	3.951
O1_Imagination	4.078	3.825	3.940
O2_ArtisticInterests	3.611	3.600	4.095
O3_Emotionality	3.505	3.394	3.672
O4_Adventurousness	3.428	3.438	3.895
O5_Intellect	4.055	3.638	4.302
O6_Liberalism	3.055	2.957	3.188
A1_Trust	3.087	3.367	3.714
A2_Morality	3.449	3.419	3.843
A3_Altruism	3.618	3.707	4.150
A4_Cooperation	3.197	3.213	3.582
A5_Modesty	2.968	3.012	2.904
A6_Sympathy	3.211	3.239	3.596
C1_SelfEfficacy	3.777	3.684	4.212
C2_Orderliness	3.050	3.079	3.386
C3_Dutifulness	3.746	3.722	4.197
C4_AchievementStriving	3.513	3.482	4.040
C5_SelfDiscipline	2.735	2.902	3.548
C6_Cautiousness	3.063	2.970	3.521

Table F4.

Facets	Canadian 1019 Profile 1	Canadian 1019 Profile 2	Canadian 1019 Profile 3
N1_Anxiety	3.132831962	2.885912988	3.058194588
N2_Anger	3.165954767	2.716830524	2.977472751
N3_Depression	3.082897176	2.446557535	2.783030764
N4_SelfConsciousness	3.101377517	2.828736506	2.96828424
N5_Immoderation	3.295597599	3.143670217	3.318620251
N6_Vulnerability	2.732555642	2.700171775	2.762658668
E1_Friendliness	3.058531982	3.795299275	3.632634354
E2_Gregariousness	2.767731893	3.623359477	3.371080362
E3_Assertiveness	3.265843154	3.401676784	3.39069968
E4_ActivityLevel	2.929140563	3.040117475	2.956858355
E5_ExcitementSeeking	3.439357326	3.676058955	3.688627641
E6_Cheerfulness	3.530712296	3.928146666	3.944685336
O1_Imagination	4.124495966	3.756903375	4.099846015
O2_ArtisticInterests	3.734852493	3.855312384	3.953610557
O3_Emotionality	3.593113545	3.535740193	3.765161719
O4_Adventurousness	3.388012604	3.525139882	3.507440084
O5_Intellect	3.953244679	3.456329978	3.770081136
O6_Liberalism	3.067111183	2.964393456	3.091989846
A1_Trust	2.855282789	3.515574646	3.375566915
A2_Morality	3.373445702	3.589213274	3.561828468
A3_Altruism	3.574972441	3.908897019	3.95809246
A4_Cooperation	2.985478532	3.352725642	3.225338285
A5_Modesty	3.096214209	3.141401072	3.113790221
A6_Sympathy	3.174043814	3.432455299	3.495732079
C1_SelfEfficacy	3.653394929	3.65968225	3.672108505
C2_Orderliness	2.933249876	3.101100227	2.965042992
C3_Dutifulness	3.657970989	3.808798304	3.783367138
C4_AchievementStriving	3.449594563	3.520976871	3.531161543
C5_SelfDiscipline	2.715647355	3.100358495	2.814991077
C6_Cautiousness	2.912023131	2.965393232	2.854480933

Table F5.

Facets	Canadian 1019 Female Profile 1	Canadian 1019 Female Profile 2	Canadian 1019 Female Profile 3
N1_Anxiety	3.133	2.886	3.058
N2_Anger	3.166	2.717	2.977
N3_Depression	3.083	2.447	2.783
N4_SelfConsciousness	3.101	2.829	2.968
N5_Immoderation	3.296	3.144	3.319
N6_Vulnerability	2.733	2.700	2.763
E1_Friendliness	3.059	3.795	3.633
E2_Gregariousness	2.768	3.623	3.371
E3_Assertiveness	3.266	3.402	3.391
E4_ActivityLevel	2.929	3.040	2.957
E5_ExcitementSeeking	3.439	3.676	3.689
E6_Cheerfulness	3.531	3.928	3.945
O1_Imagination	4.124	3.757	4.100
O2_ArtisticInterests	3.735	3.855	3.954
O3_Emotionality	3.593	3.536	3.765
O4_Adventurousness	3.388	3.525	3.507
O5_Intellect	3.953	3.456	3.770
O6_Liberalism	3.067	2.964	3.092
A1_Trust	2.855	3.516	3.376
A2_Morality	3.373	3.589	3.562
A3_Altruism	3.575	3.909	3.958
A4_Cooperation	2.985	3.353	3.225
A5_Modesty	3.096	3.141	3.114
A6_Sympathy	3.174	3.432	3.496
C1_SelfEfficacy	3.653	3.660	3.672
C2_Orderliness	2.933	3.101	2.965
C3_Dutifulness	3.658	3.809	3.783
C4_AchievementStriving	3.450	3.521	3.531
C5_SelfDiscipline	2.716	3.100	2.815
C6_Cautiousness	2.912	2.965	2.854

Table F6.

Facets	Canadian 1019 Male Profile 1	Canadian 1019 Male Profile 2	Canadian 1019 Male Profile 3
N1_Anxiety	2.868	2.615	2.785
N2_Anger	2.948	2.539	2.774
N3_Depression	2.979	2.289	2.628
N4_SelfConsciousness	3.035	2.748	2.881
N5_Immoderation	3.141	3.132	3.198
N6_Vulnerability	2.499	2.536	2.494
E1_Friendliness	3.059	3.698	3.587
E2_Gregariousness	2.721	3.599	3.280
E3_Assertiveness	3.198	3.347	3.360
E4_ActivityLevel	2.822	3.038	2.865
E5_ExcitementSeeking	3.458	3.767	3.712
E6_Cheerfulness	3.459	3.785	3.848
O1_Imagination	4.101	3.585	4.062
O2_ArtisticInterests	3.434	3.365	3.667
O3_Emotionality	3.420	3.245	3.500
O4_Adventurousness	3.345	3.467	3.486
O5_Intellect	4.008	3.307	3.854
O6_Liberalism	2.982	2.887	3.069
A1_Trust	2.910	3.436	3.347
A2_Morality	3.274	3.381	3.405
A3_Altruism	3.483	3.710	3.789
A4_Cooperation	2.956	3.156	3.155
A5_Modesty	3.029	3.040	2.976
A6_Sympathy	3.044	3.165	3.334
C1_SelfEfficacy	3.692	3.665	3.687
C2_Orderliness	2.914	3.080	2.921
C3_Dutifulness	3.606	3.671	3.713
C4_AchievementStriving	3.349	3.500	3.415
C5_SelfDiscipline	2.661	3.119	2.767
C6_Cautiousness	2.941	2.936	2.882

Table F7.

Facets	Canadian 2035 Profile 1	Canadian 2035 Profile 2	Canadian 2035 Profile 3
N1_Anxiety	3.124	2.803	3.104
N2_Anger	3.159	2.610	2.927
N3_Depression	3.047	2.347	2.882
N4_SelfConsciousness	3.079	2.741	3.030
N5_Immoderation	3.406	3.153	3.409
N6_Vulnerability	2.664	2.444	2.635
E1_Friendliness	2.944	3.757	3.376
E2_Gregariousness	2.610	3.370	2.941
E3_Assertiveness	3.311	3.483	3.317
E4_ActivityLevel	2.919	3.102	2.961
E5_ExcitementSeeking	3.137	3.393	3.244
E6_Cheerfulness	3.431	3.955	3.783
O1_Imagination	3.985	3.888	4.033
O2_ArtisticInterests	3.639	4.122	4.020
O3_Emotionality	3.610	3.754	3.832
O4_Adventurousness	3.332	3.663	3.532
O5_Intellect	3.985	3.877	4.003
O6_Liberalism	3.014	3.101	3.169
A1_Trust	2.802	3.631	3.320
A2_Morality	3.551	3.825	3.708
A3_Altruism	3.494	4.078	3.957
A4_Cooperation	3.125	3.557	3.411
A5_Modesty	2.989	3.072	3.071
A6_Sympathy	3.148	3.560	3.508
C1_SelfEfficacy	3.788	3.942	3.827
C2_Orderliness	3.211	3.346	3.197
C3_Dutifulness	3.773	4.060	3.918
C4_AchievementStriving	3.652	3.833	3.703
C5_SelfDiscipline	2.840	3.312	2.911
C6_Cautiousness	3.082	3.211	3.106

Table F8.

Facets	Canadian 2035 Female Profile 1	Canadian 2035 Female Profile 2	Canadian 2035 Female Profile 3
N1_Anxiety	3.341	2.650	2.984
N2_Anger	3.018	2.398	2.695
N3_Depression	3.038	2.155	2.622
N4_SelfConsciousness	3.040	2.606	2.927
N5_Immoderation	3.401	2.923	3.258
N6_Vulnerability	2.698	2.151	2.485
E1_Friendliness	3.088	3.858	3.638
E2_Gregariousness	2.408	3.156	2.822
E3_Assertiveness	3.273	3.551	3.368
E4_ActivityLevel	3.094	3.212	3.174
E5_ExcitementSeeking	2.645	2.876	2.692
E6_Cheerfulness	3.445	3.935	3.879
O1_Imagination	3.783	3.678	3.822
O2_ArtisticInterests	4.018	4.289	4.237
O3_Emotionality	3.893	3.885	3.977
O4_Adventurousness	3.447	3.776	3.575
O5_Intellect	3.802	3.974	3.965
O6_Liberalism	3.008	3.116	3.114
A1_Trust	3.107	3.831	3.697
A2_Morality	3.850	4.060	4.128
A3_Altruism	3.884	4.256	4.241
A4_Cooperation	3.496	3.811	3.833
A5_Modesty	3.313	3.152	3.355
A6_Sympathy	3.589	3.825	3.826
C1_SelfEfficacy	3.847	4.132	4.042
C2_Orderliness	3.524	3.569	3.486
C3_Dutifulness	4.053	4.300	4.303
C4_AchievementStriving	3.874	4.075	4.001
C5_SelfDiscipline	3.145	3.660	3.438
C6_Cautiousness	3.266	3.517	3.366

Table F9.

Facets	Canadian 2035 Male Profile 1	Canadian 2035 Male Profile 2	Canadian 2035 Male Profile 3
N1_Anxiety	2.847	2.497	2.780
N2_Anger	2.892	2.410	2.652
N3_Depression	2.942	2.187	2.719
N4_SelfConsciousness	2.958	2.576	2.920
N5_Immoderation	3.290	3.033	3.274
N6_Vulnerability	2.391	2.208	2.395
E1_Friendliness	3.017	3.738	3.325
E2_Gregariousness	2.628	3.379	2.925
E3_Assertiveness	3.293	3.518	3.331
E4_ActivityLevel	2.829	3.086	2.868
E5_ExcitementSeeking	3.231	3.477	3.380
E6_Cheerfulness	3.437	3.840	3.719
O1_Imagination	4.048	3.772	4.068
O2_ArtisticInterests	3.536	3.847	3.856
O3_Emotionality	3.458	3.478	3.585
O4_Adventurousness	3.404	3.678	3.571
O5_Intellect	4.103	3.888	4.115
O6_Liberalism	3.030	2.994	3.143
A1_Trust	2.947	3.590	3.330
A2_Morality	3.467	3.691	3.531
A3_Altruism	3.530	3.934	3.797
A4_Cooperation	3.173	3.442	3.354
A5_Modesty	2.888	2.984	2.918
A6_Sympathy	3.120	3.387	3.338
C1_SelfEfficacy	3.863	3.982	3.852
C2_Orderliness	3.135	3.323	3.123
C3_Dutifulness	3.768	4.025	3.827
C4_AchievementStriving	3.601	3.812	3.635
C5_SelfDiscipline	2.783	3.351	2.858
C6_Cautiousness	3.170	3.301	3.109

Table F10.

Facets	Canadian 3665 Profile 1	Canadian 3665 Profile 2	Canadian 3665 Profile 3
N1_Anxiety	3.158	2.598	2.955
N2_Anger	2.957	2.410	2.705
N3_Depression	2.895	2.181	2.661
N4_SelfConsciousness	2.924	2.541	3.045
N5_Immoderation	3.208	2.871	3.367
N6_Vulnerability	2.574	2.110	2.493
E1_Friendliness	3.175	3.761	3.579
E2_Gregariousness	2.513	3.133	2.697
E3_Assertiveness	3.350	3.584	3.274
E4_ActivityLevel	3.076	3.198	3.094
E5_ExcitementSeeking	2.727	2.951	2.702
E6_Cheerfulness	3.470	3.847	3.857
O1_Imagination	3.826	3.691	3.939
O2_ArtisticInterests	3.921	4.182	4.141
O3_Emotionality	3.814	3.788	3.861
O4_Adventurousness	3.516	3.779	3.475
O5_Intellect	3.976	4.048	3.969
O6_Liberalism	3.044	3.129	3.064
A1_Trust	3.201	3.753	3.708
A2_Morality	3.830	3.956	4.102
A3_Altruism	3.851	4.156	4.178
A4_Cooperation	3.503	3.709	3.835
A5_Modesty	3.170	3.098	3.383
A6_Sympathy	3.544	3.736	3.733
C1_SelfEfficacy	3.922	4.141	4.007
C2_Orderliness	3.494	3.545	3.373
C3_Dutifulness	4.062	4.242	4.294
C4_AchievementStriving	3.889	4.053	3.912
C5_SelfDiscipline	3.190	3.628	3.271
C6_Cautiousness	3.352	3.539	3.372

Table F11.

Facets	Canadian 3665 Female Profile 1	Canadian 3665 Female Profile 2	Canadian 3665 Female Profile 3
N1_Anxiety	3.177	2.699	3.260
N2_Anger	2.845	2.404	3.070
N3_Depression	2.898	2.263	2.812
N4_SelfConsciousness	2.991	2.711	3.019
N5_Immoderation	3.316	2.948	3.583
N6_Vulnerability	2.576	2.203	2.772
E1_Friendliness	3.199	3.746	3.838
E2_Gregariousness	2.454	3.005	3.026
E3_Assertiveness	3.294	3.467	3.403
E4_ActivityLevel	3.090	3.166	3.300
E5_ExcitementSeeking	2.620	2.789	2.786
E6_Cheerfulness	3.570	3.918	3.923
O1_Imagination	3.747	3.712	3.977
O2_ArtisticInterests	4.082	4.289	4.215
O3_Emotionality	3.894	3.897	4.092
O4_Adventurousness	3.486	3.714	3.534
O5_Intellect	3.891	4.018	3.805
O6_Liberalism	3.071	3.155	2.982
A1_Trust	3.273	3.812	3.698
A2_Morality	3.917	4.091	4.185
A3_Altruism	3.962	4.249	4.338
A4_Cooperation	3.598	3.850	3.805
A5_Modesty	3.307	3.228	3.420
A6_Sympathy	3.661	3.845	3.809
C1_SelfEfficacy	3.900	4.098	4.065
C2_Orderliness	3.515	3.520	3.507
C3_Dutifulness	4.110	4.310	4.344
C4_AchievementStriving	3.889	4.039	4.066
C5_SelfDiscipline	3.203	3.568	3.520
C6_Cautiousness	3.327	3.500	3.214

Table F12.

Facets	Canadian 3665 Male Profile 1	Canadian 3665 Male Profile 2	Canadian 3665 Male Profile 3
N1_Anxiety	3.049	2.289	2.674
N2_Anger	2.974	2.073	2.669
N3_Depression	2.895	1.899	2.445
N4_SelfConsciousness	2.925	2.259	2.732
N5_Immoderation	3.058	2.530	3.109
N6_Vulnerability	2.512	1.824	2.225
E1_Friendliness	3.075	3.927	3.416
E2_Gregariousness	2.401	3.421	2.776
E3_Assertiveness	3.339	3.776	3.420
E4_ActivityLevel	2.984	3.352	2.992
E5_ExcitementSeeking	2.749	3.069	3.035
E6_Cheerfulness	3.334	3.797	3.679
O1_Imagination	3.914	3.530	3.954
O2_ArtisticInterests	3.676	4.050	3.927
O3_Emotionality	3.654	3.511	3.609
O4_Adventurousness	3.434	3.829	3.666
O5_Intellect	4.085	4.020	4.206
O6_Liberalism	2.978	2.909	3.196
A1_Trust	3.165	3.809	3.539
A2_Morality	3.754	3.892	3.755
A3_Altruism	3.697	4.120	3.878
A4_Cooperation	3.480	3.695	3.497
A5_Modesty	3.047	2.983	3.048
A6_Sympathy	3.376	3.557	3.529
C1_SelfEfficacy	3.949	4.273	4.014
C2_Orderliness	3.435	3.719	3.275
C3_Dutifulness	4.048	4.344	4.040
C4_AchievementStriving	3.842	4.180	3.818
C5_SelfDiscipline	3.098	3.924	3.163
C6_Cautiousness	3.470	3.835	3.408

Appendix G.

Table G1.

Summary: Canadian Data
Gaussian finite mixture model fitted by EM algorithm
Mclust VEE (ellipsoidal; equal shape and orientation) model with 3 components:

log-likelihood	n	df	BIC	ICL
-373582.7	16383	559	-752589.9	-760681.4

Clustering table:

1	2	3
3547	9912	2924

Mixing probabilities:

1	2	3
0.23	0.55	0.22

Table G2.

Summary: Canadian Data—Female
Gaussian finite mixture model fitted by EM algorithm

Mclust VEE (ellipsoidal, equal shape and orientation) model with 3 components:

log-likelihood	n	df	BIC	ICL
-294886.51	3197	559	-595076.6	-601292.2

Clustering table:

1	2	3
8076	1748	3373

Mixing probabilities:

0.612	0.132	0.256

Table G3.

Summary: Canadian Data—Male
Gaussian finite mixture model fitted by EM algorithm

Mclust VEE (ellipsoidal, equal shape and orientation) model with 3 components:

log-likelihood	n	df	BIC	ICL
-182173.4	8000	559	-369370.6	-372735.1

Clustering table:

1	2	3
4337	2333	1330

Mixing probabilities:

0.542	0.292	0.166

Table G4.

Summary: 10 to 19-years-old
Gaussian finite mixture model fitted by EM algorithm

Mclust VEE (ellipsoidal, equal shape and orientation) model with 3 components:

log-likelihood	n	df	BIC	ICL
-175417.2	7893	559	-355850.8	-359342.3

Clustering table:

1	2	3
4746	1402	1745

Mixing probabilities:

0.559	0.185	0.255

Table G5.

Summary: 10 to 19-years-old—Female
Gaussian finite mixture model fitted by EM algorithm

Mclust VEE (ellipsoidal, equal shape and orientation) model with 3 components:

log-likelihood	n	df	BIC	ICL
-103517.8	4786	559	-211772.3	-213636.4

Clustering table:

1	2	3
449	1440	2897

Mixing probabilities:

1	2	3
0.12	0.31	0.57

Table G6.

Summary: 10 to 19-years-old—Male
Gaussian finite mixture model fitted by EM algorithm

Mclust VEE (ellipsoidal, equal shape and orientation) model with 3 components:

log-likelihood	n	df	BIC	ICL
-69370.72	3107	559	-143236.6	-144617

Clustering table:

1	2	3
1657	525	925

Mixing probabilities:

1	2	3
0.50	0.18	0.32

Table G7.

Summary: 20 to 35-years-old
Gaussian finite mixture model fitted by EM algorithm

Mclust VEE (ellipsoidal; equal shape and orientation) model with 3 components:

log-likelihood	n	df	BIC	ICL
-240914.7	10651	559	-487013.2	-491678.4

Clustering table:

1	2	3
1073	6523	3055

Mixing Probabilities:

1	2	3
0.13	0.57	0.30

Table G8.

Summary: 20 to 35-years-old—Female
Gaussian finite mixture model fitted by EM algorithm

Mclust VEE (ellipsoidal; equal shape and orientation) model with 3 components:

log-likelihood	n	df	BIC	ICL
-45871.99	2073	559	-96012.92	-97074.55

Clustering table:

1	2	3
390	1178	505

Mixing probabilities:

1	2	3
0.23	0.52	0.25

Table G9.

Summary: 20 to 35-years-old—Male
Gaussian finite mixture model fitted by EM algorithm
Mclust VEE (ellipsoidal; equal shape and orientation) model with 3 components:

log-likelihood	n	df	BIC	ICL
-97544.02	4325	559	-199768.1	-201823.4

Clustering table:

1	2	3
985	767	2573

Mixing probabilities:

1	2	3
0.27	0.19	0.54

Table G10.

Summary: 36 to 65-years-old				
Gaussian finite mixture model fitted by EM algorithm				
Mclust VEE (ellipsoidal, equal shape and orientation) model with 3 components:				
log-likelihood	n	df	BIC	ICL
-72357.24	3226	559	-149230.6	-150744.8
Clustering table:				
1	2	3		
386	1091	1749		
Mixing Probabilities:				
1	2	3		
0.13	0.36	0.51		

Table G11.

Summary: 36 to 65-years-old—Female				
Gaussian finite mixture model fitted by EM algorithm				
Mclust VEE (ellipsoidal; equal shape and orientation) model with 3 components:				
log-likelihood	n	df	BIC	ICL
-45908.32	2073	559	-96085.59	-97009.47
Clustering table:				
1	2	3		
736	980	357		
Mixing probabilities:				
1	2	3		
0.36	0.44	0.20		

Table G12.

Summary: 36 to 65—Male				
Gaussian finite mixture model fitted by EM algorithm				
Mclust VEE (ellipsoidal; equal shape and orientation) model with 3 components:				
log-likelihood	n	df	BIC	ICL
-25426.28	1153	559	-54793.57	-55275.34
Clustering table:				
1	2	3		
554	393	206		
Mixing probabilities:				
1	2	3		
0.46	0.36	0.19		

Appendix H.

Figure H1.

Latent Profiles
Canadian & US Data—Ages 10 to 99
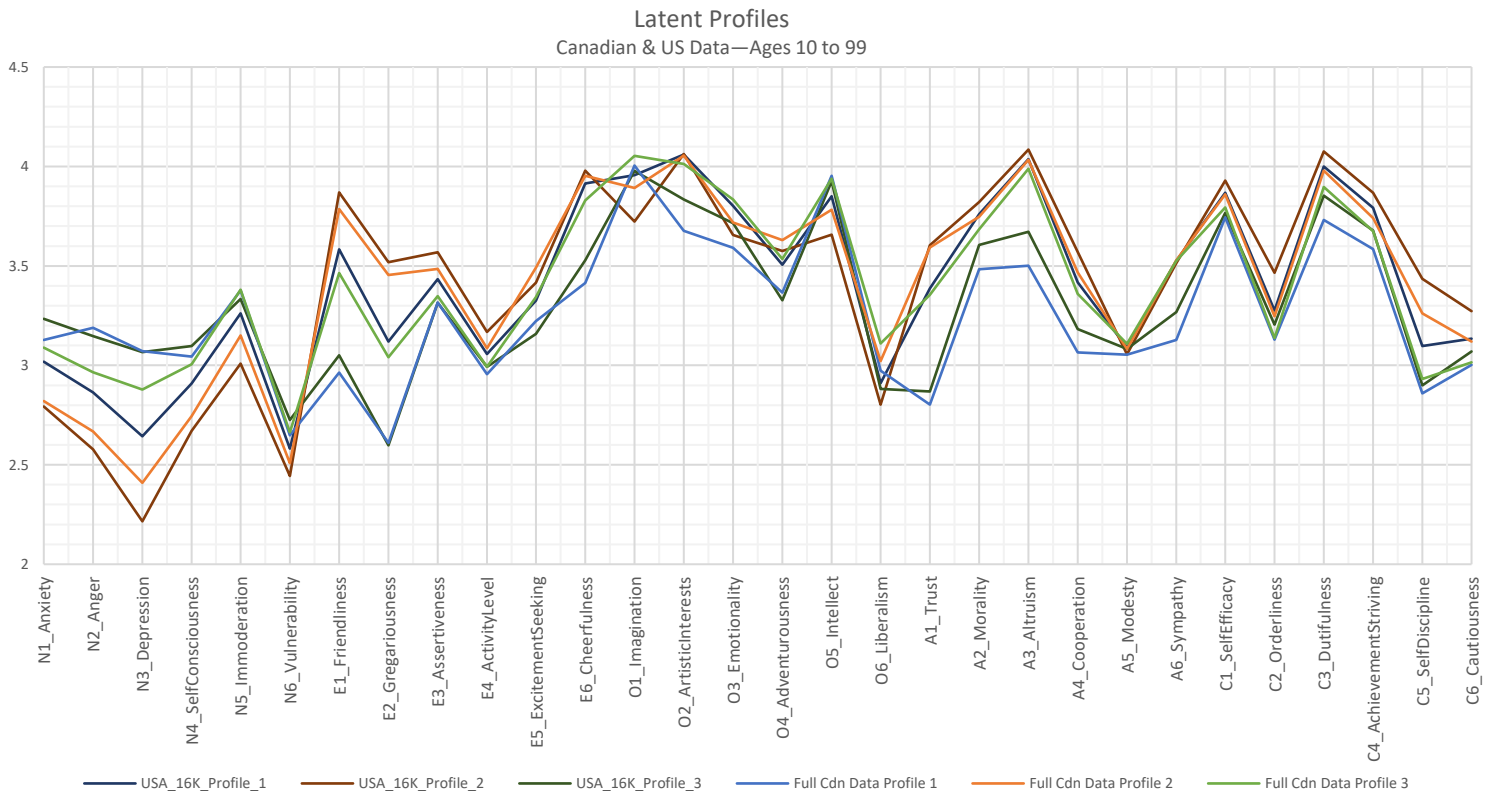
Appendix I.

Descriptive statistics for each facet of the IPIP-NEO-300 questionnaire.

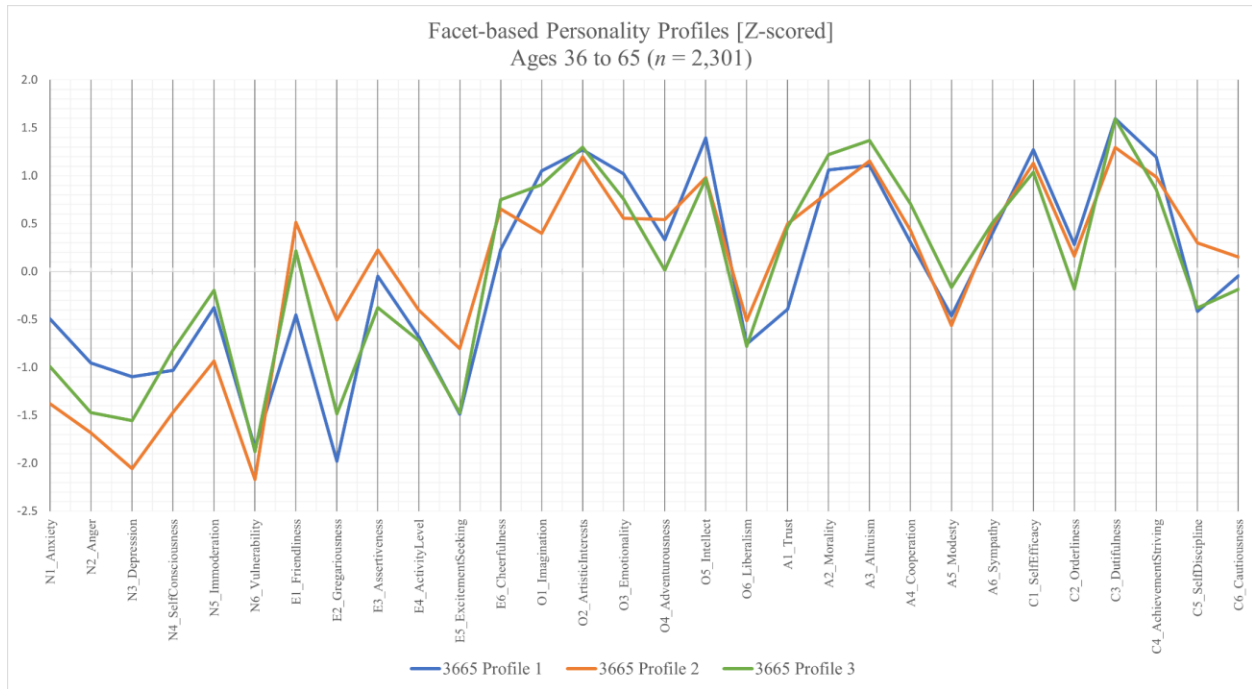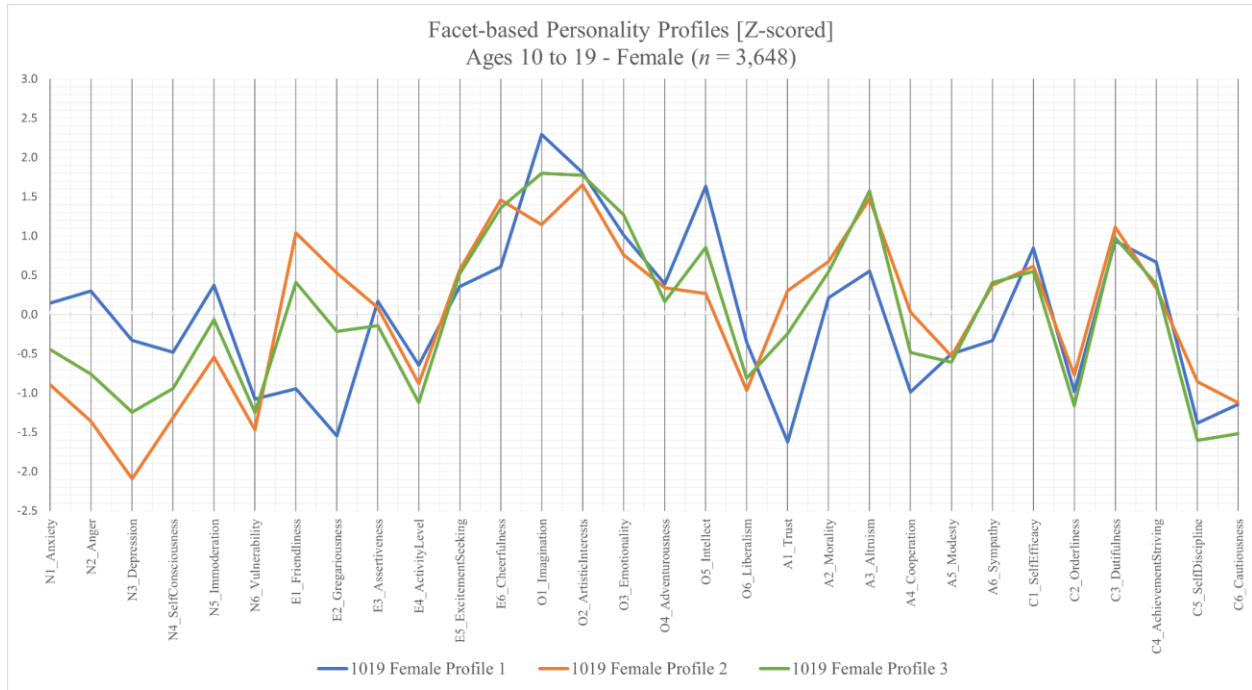|	Mean	Std. Deviation	Skewness	Kurtosis	N
N1_Anxiety	3.016	0.791	-0.021	-0.505	16365
N2_Anger	2.912	0.907	0.059	-0.706	16365
N3_Depression	2.771	0.955	0.258	-0.754	16365
N4_Self-Consciousness	2.935	0.766	0.047	-0.502	16365
N5_Immoderation	3.312	0.706	-0.083	-0.335	16365
N6_Vulnerability	2.616	0.752	0.232	-0.293	16365
E1_Friendliness	3.482	0.791	-0.394	-0.309	16365
E2_Gregariousness	3.097	0.873	-0.142	-0.640	16365
E3_Assertiveness	3.384	0.753	-0.284	-0.304	16365
E4_Activity Level	3.014	0.559	0.067	0.114	16365
E5_Excitement Seeking	3.368	0.820	-0.209	-0.583	16365
E6_Cheerfulness	3.803	0.698	-0.655	0.238	16365
O1_Imagination	3.999	0.681	-0.647	0.056	16365
O2_Artistic Interests	3.975	0.691	-0.739	0.194	16365
O3_Emotionality	3.764	0.670	-0.451	-0.117	16365
O4_Adventurousness	3.537	0.658	-0.216	-0.315	16365
O5_Intellect	3.895	0.713	-0.544	-0.188	16365
O6_Liberalism	3.063	0.638	0.080	0.011	16365
A1_Trust	3.341	0.766	-0.437	-0.154	16365
A2_Morality	3.672	0.667	-0.563	0.124	16365
A3_Altruism	3.928	0.633	-0.796	0.847	16365
A4_Cooperation	3.346	0.712	-0.323	-0.255	16365
A5_Modesty	3.093	0.703	-0.145	-0.313	16365
A6_Sympathy	3.466	0.680	-0.404	0.086	16365
C1_Self Efficacy	3.805	0.596	-0.509	0.312	16365
C2_Orderliness	3.168	0.791	0.015	-0.484	16365
C3_Dutifulness	3.896	0.608	-0.611	0.308	16365
C4_Achievement Striving	3.681	0.687	-0.411	-0.143	16365
C5_Self Discipline	3.017	0.811	0.094	-0.578	16365
C6_Cautiousness	3.043	0.755	0.020	-0.504	16365

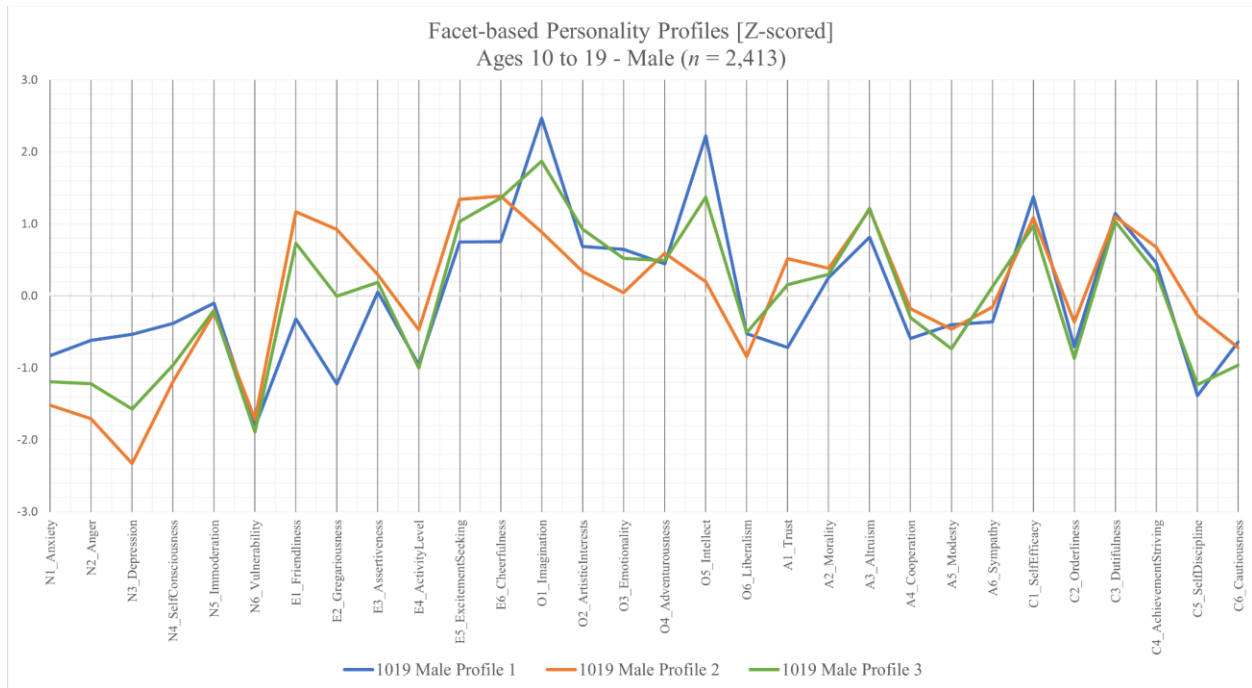# Appendix J.

Figure J1 – 10 to 19-years-old

Facet-based Personality Profiles [Z-scored]
Ages 10 to 19 (n = 6,061)
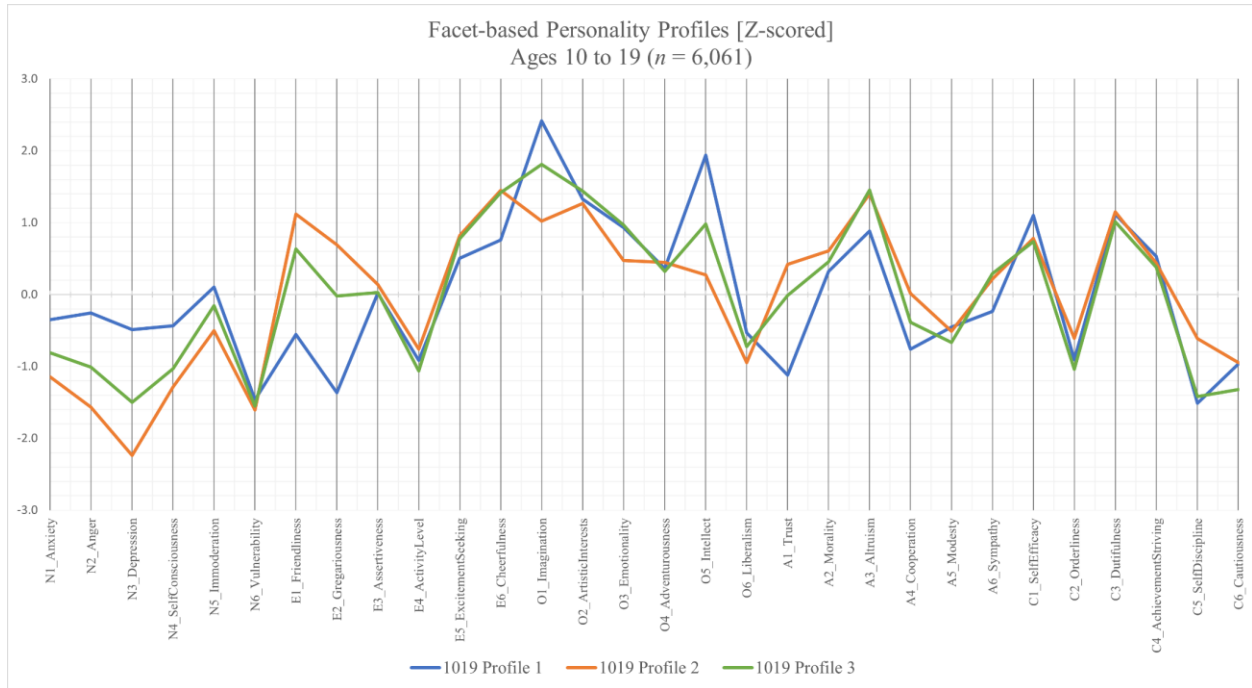
Figure J2 – 20 to 35-years-old

Facet-based Personality Profiles [Z-scored]
Ages 20 to 35 (n = 8,003)
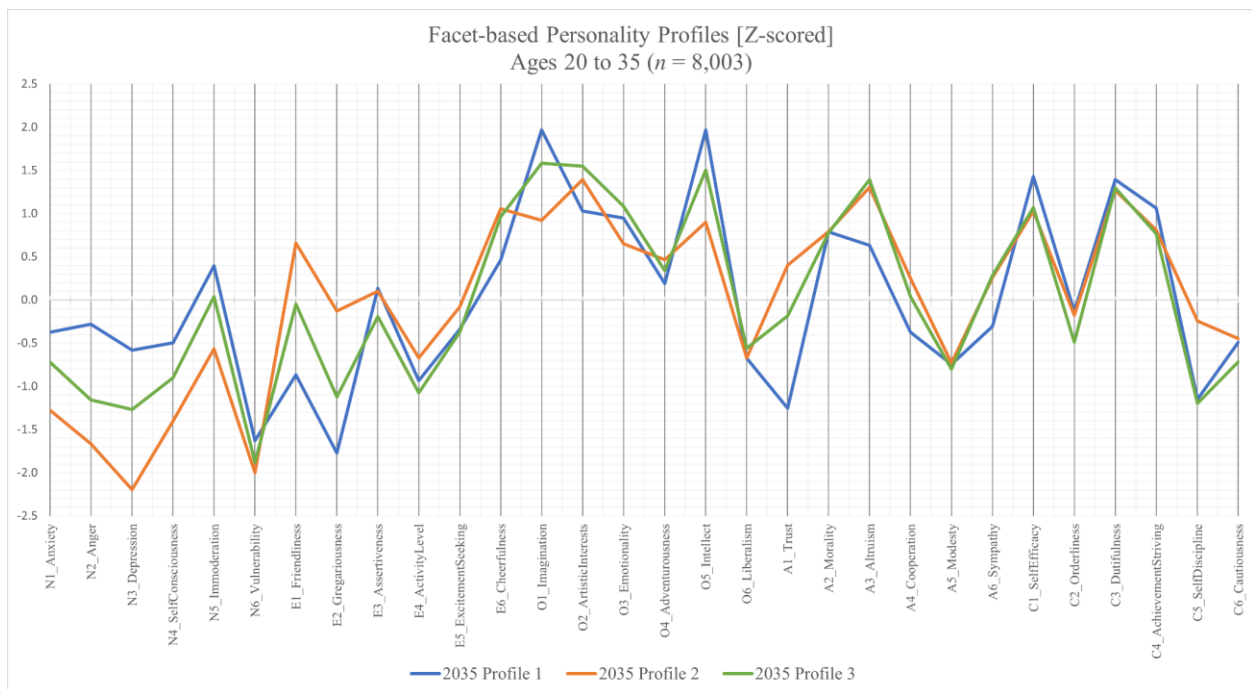
Figure J3 – 36 to 65-years-old

Facet-based Personality Profiles [Z-scored]
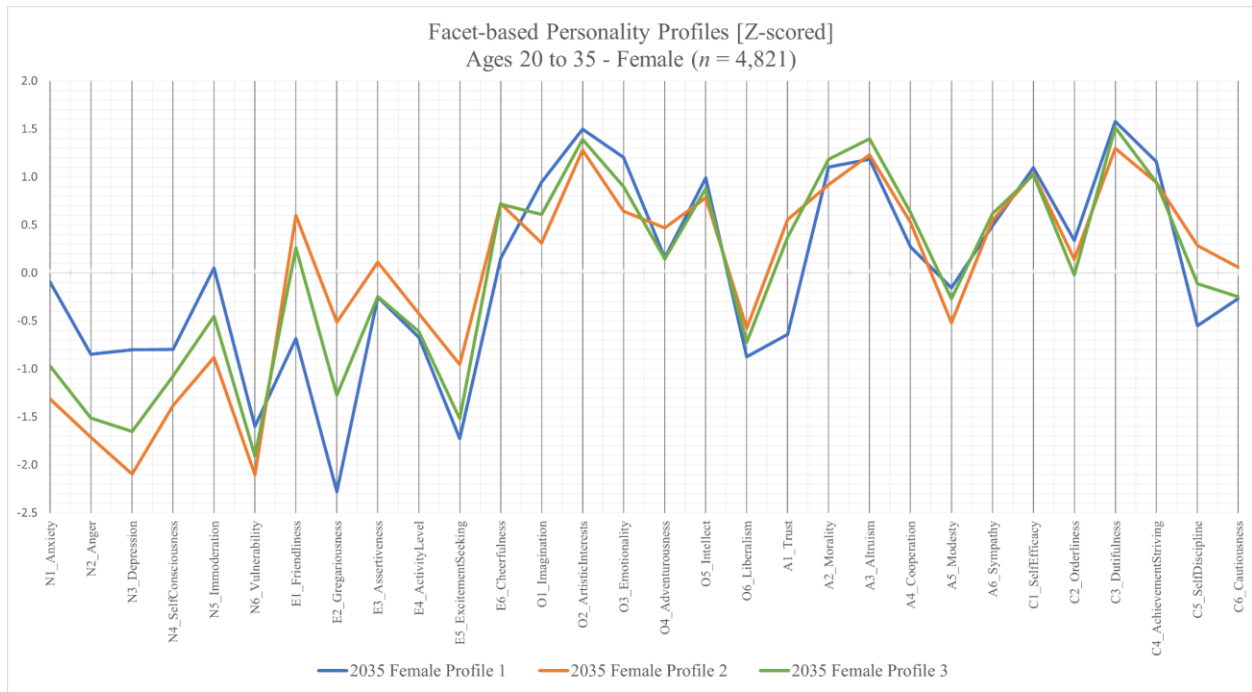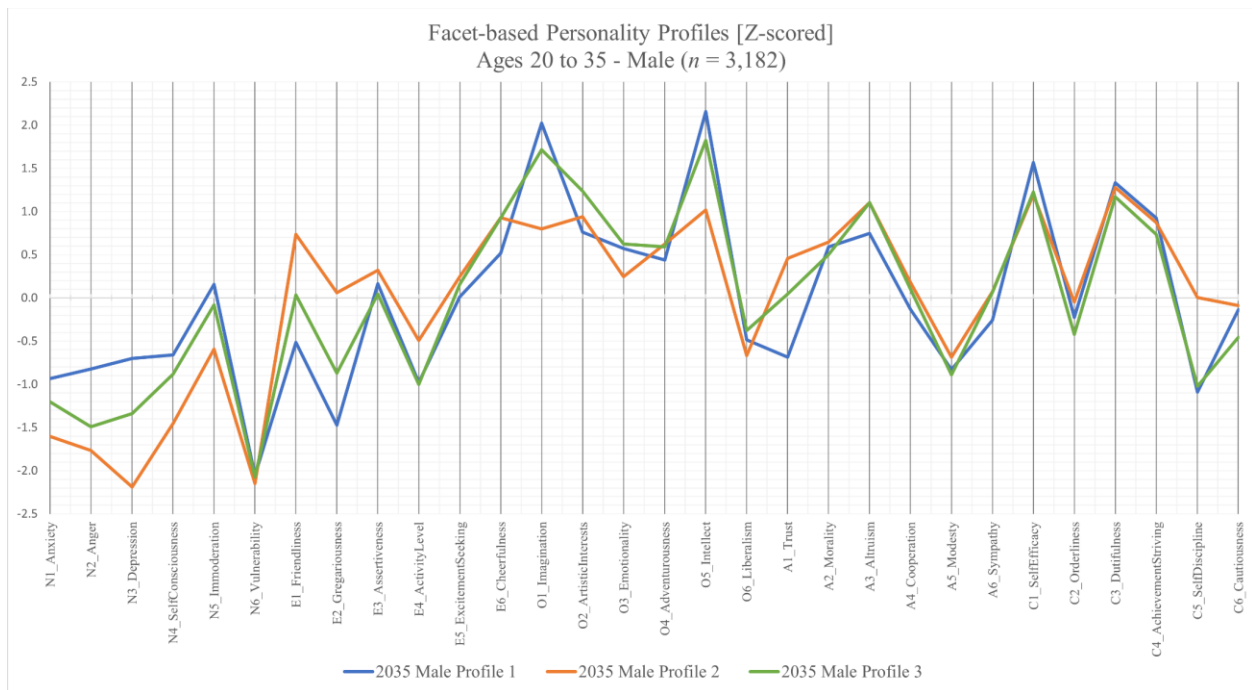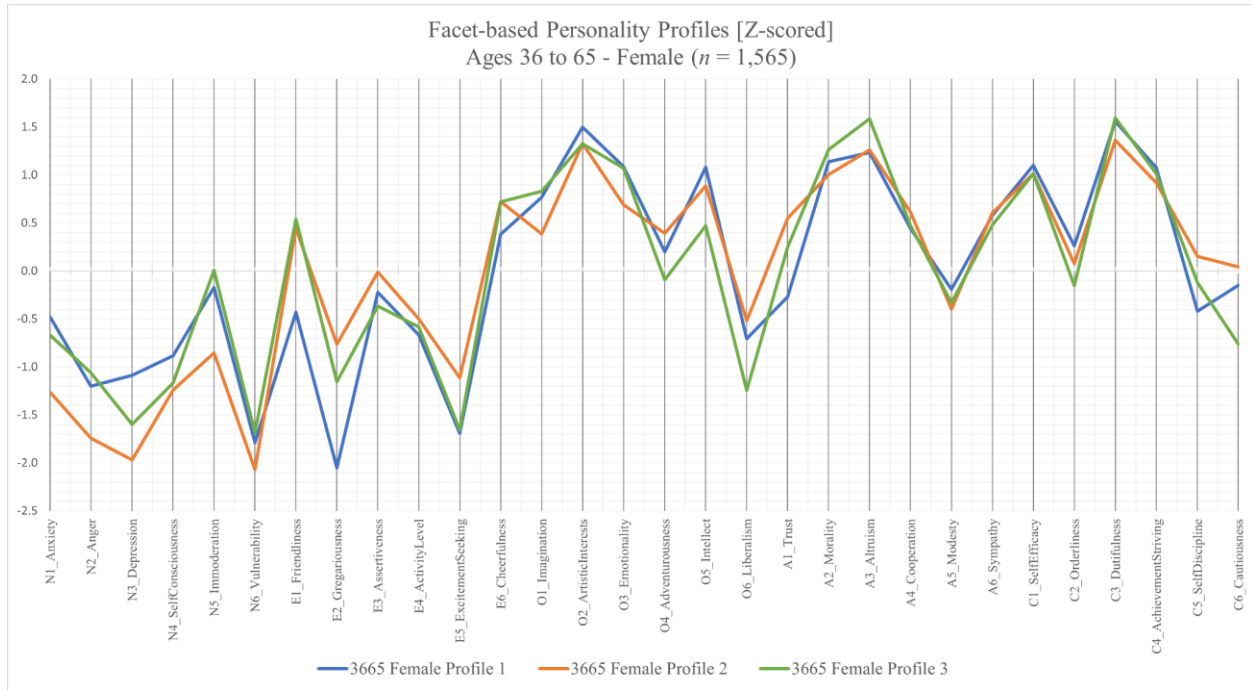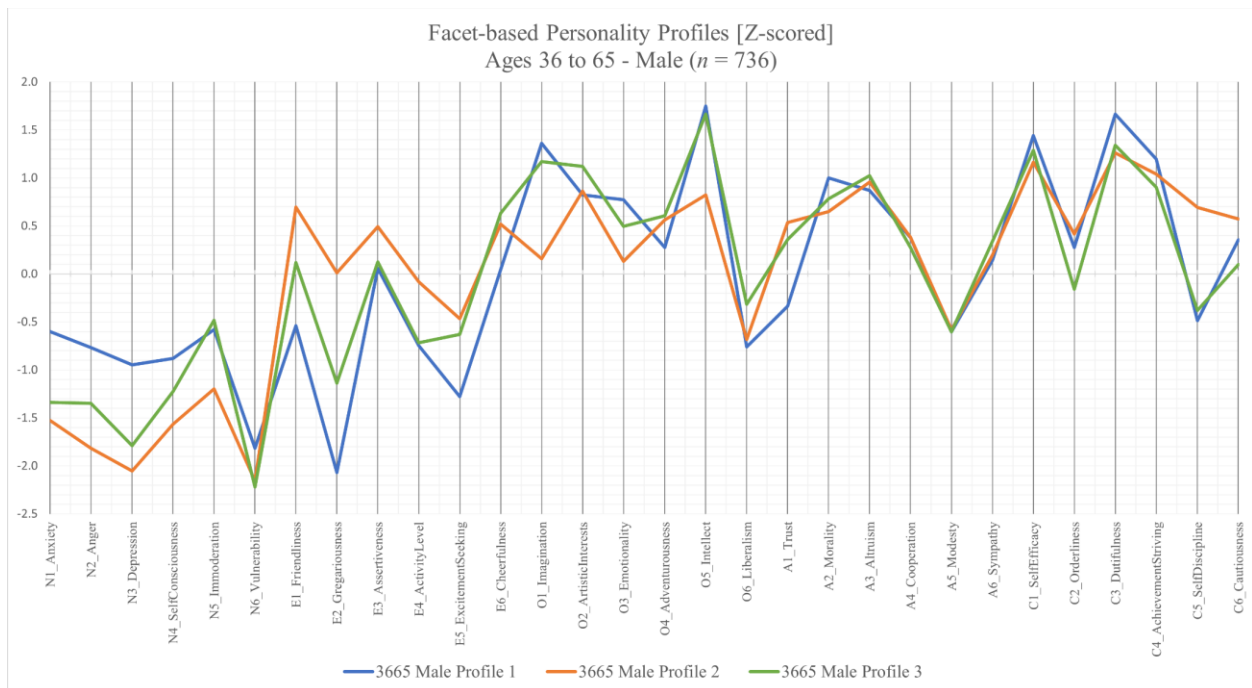Ages 36 to 65 (n = 2,301)

Figure J4 – 10 to 19-years-old Female

Figure J5 – 10 to 19-years-old Male

Figure J6 – 20 to 35-years-old Female

Figure J7 – 20 to 35-years-old Male

Figure J8 – 36 to 65-years-old Female

Figure J9 – 36 to 65-years-old Male

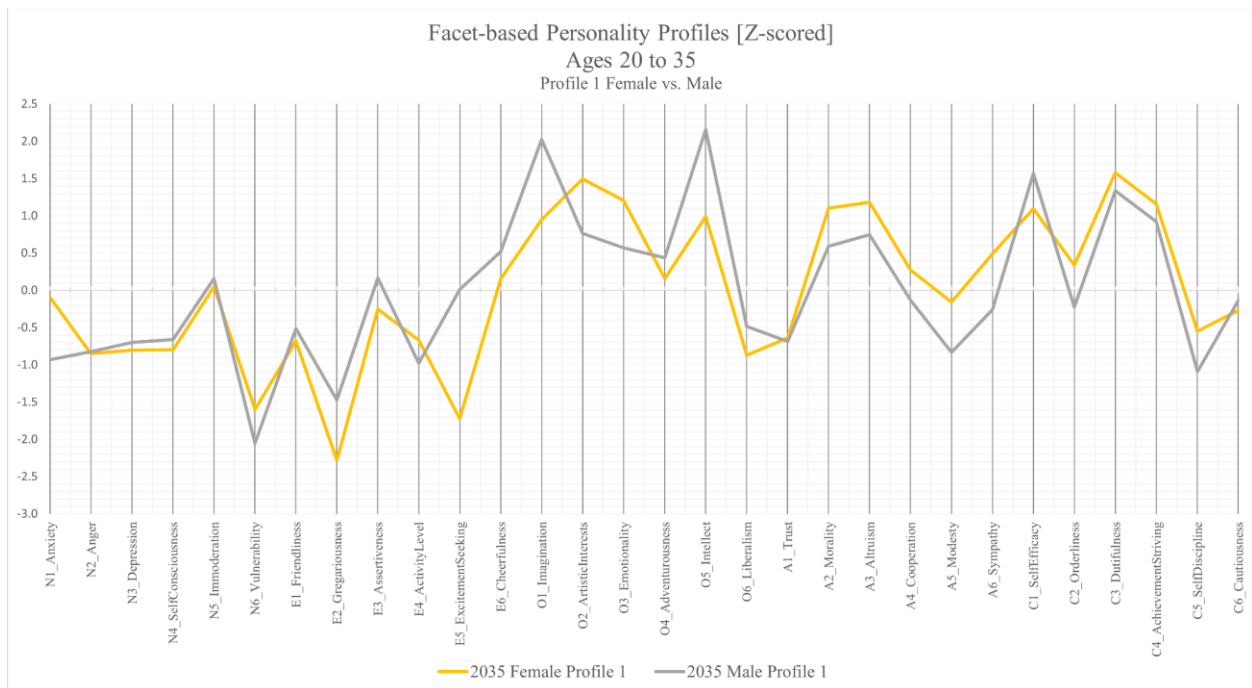**Figure J10 – 10 to 19-years-old Female vs. Male Comparison – Profile 1**
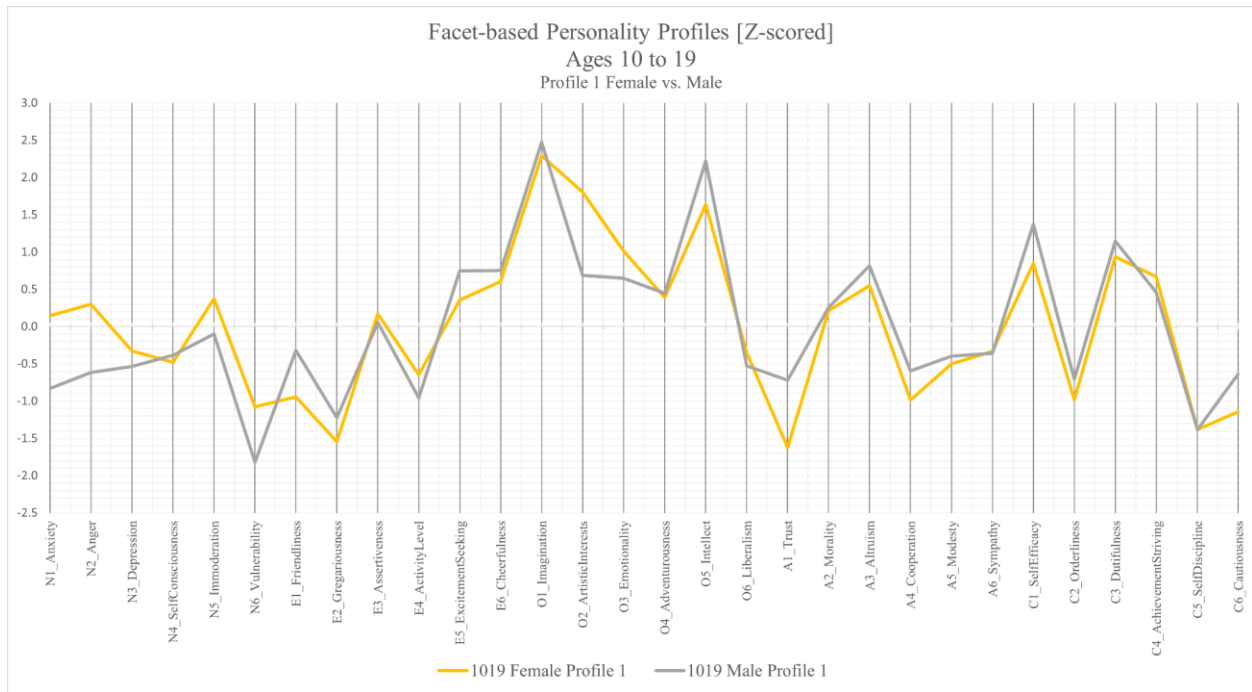
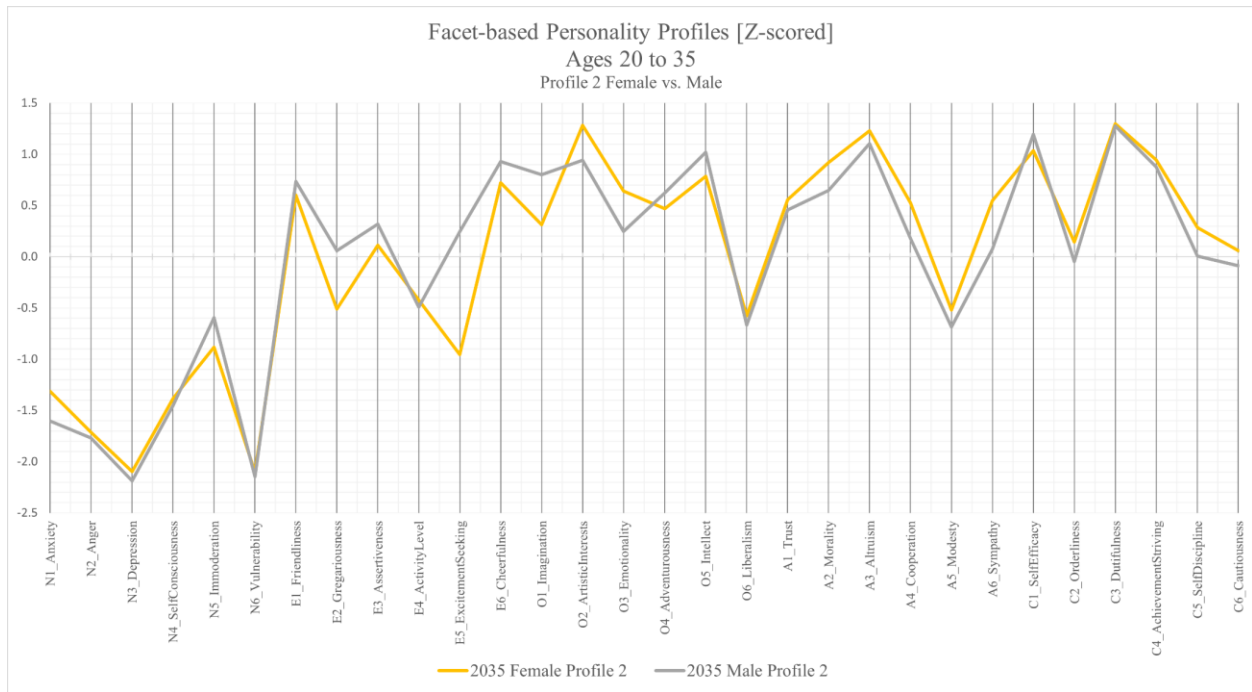**Figure J11 – 10 to 19-years-old Female vs. Male Comparison – Profile 2**
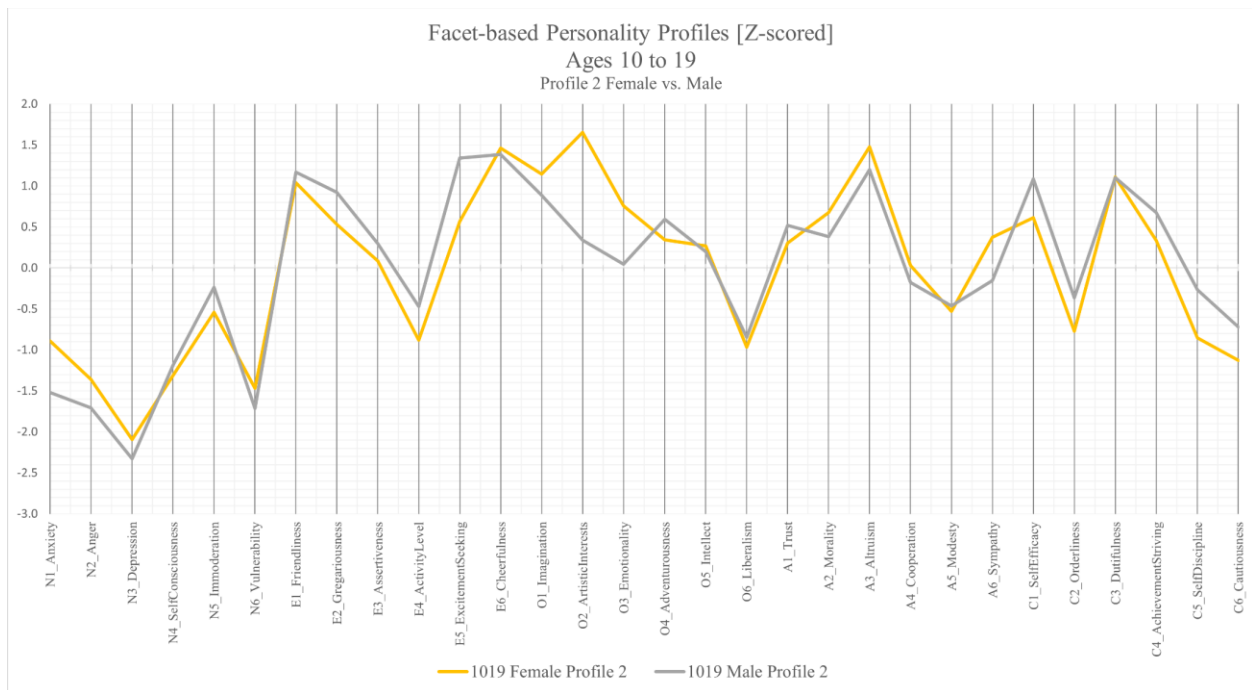
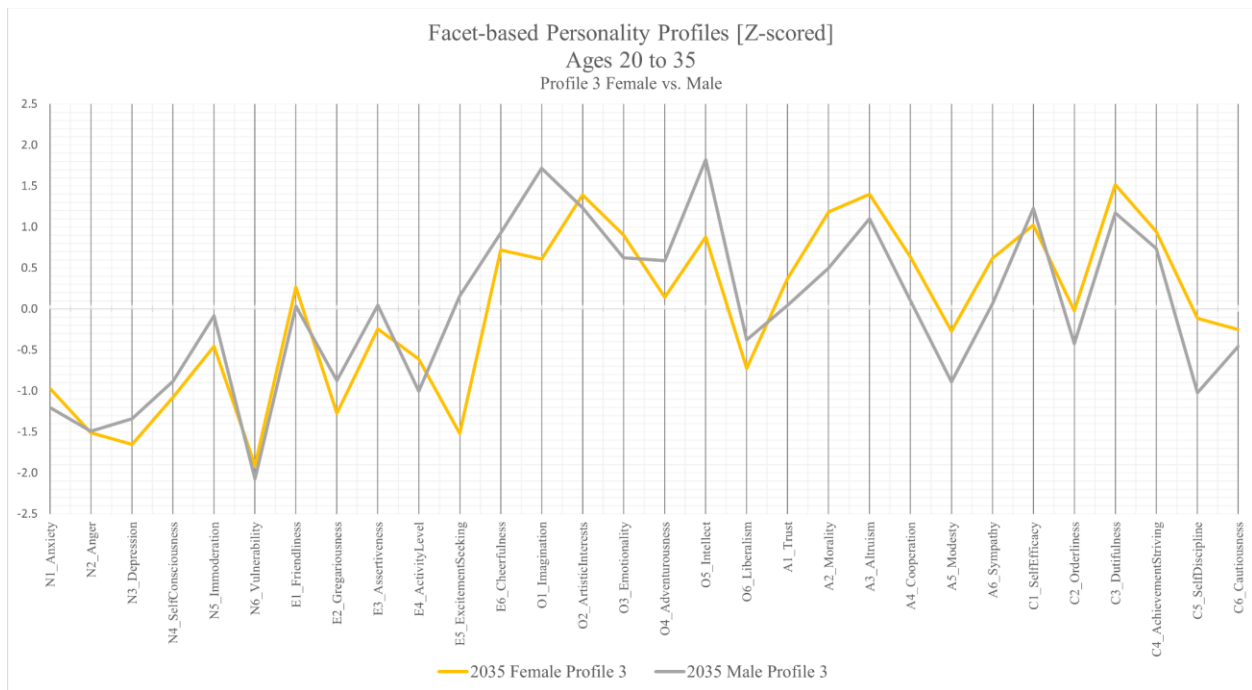**Figure J12 – 10 to 19-years-old Female vs. Male Comparison – Profile 3**
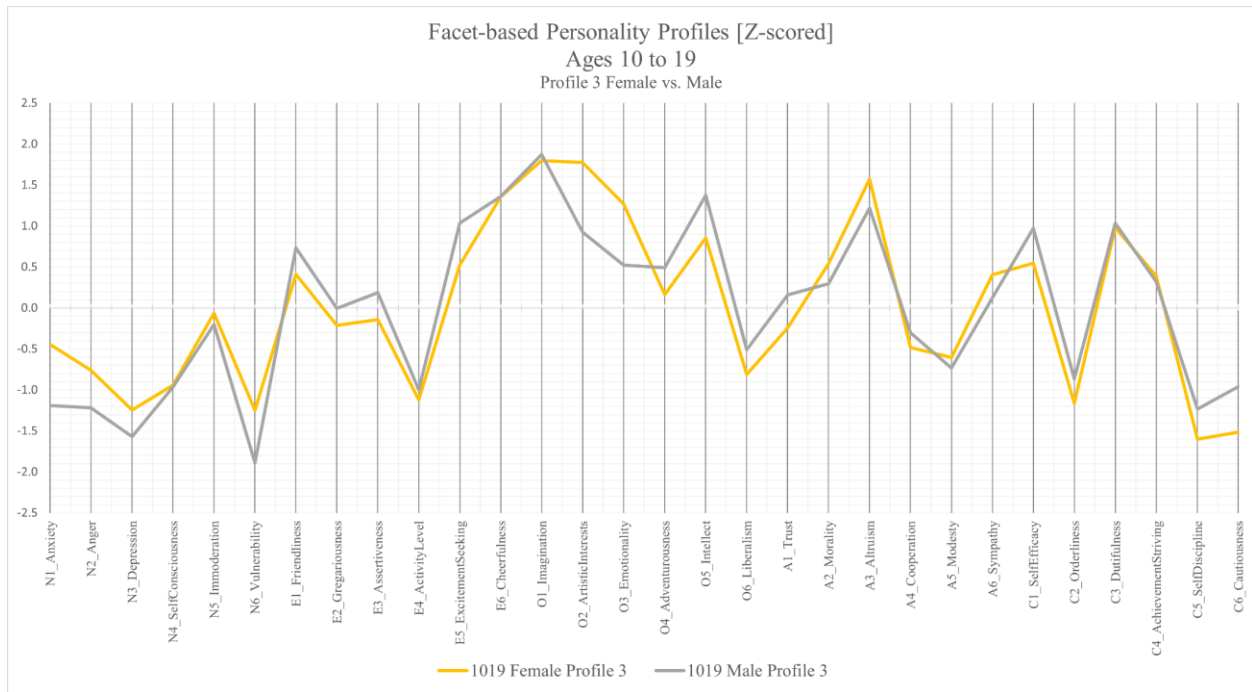
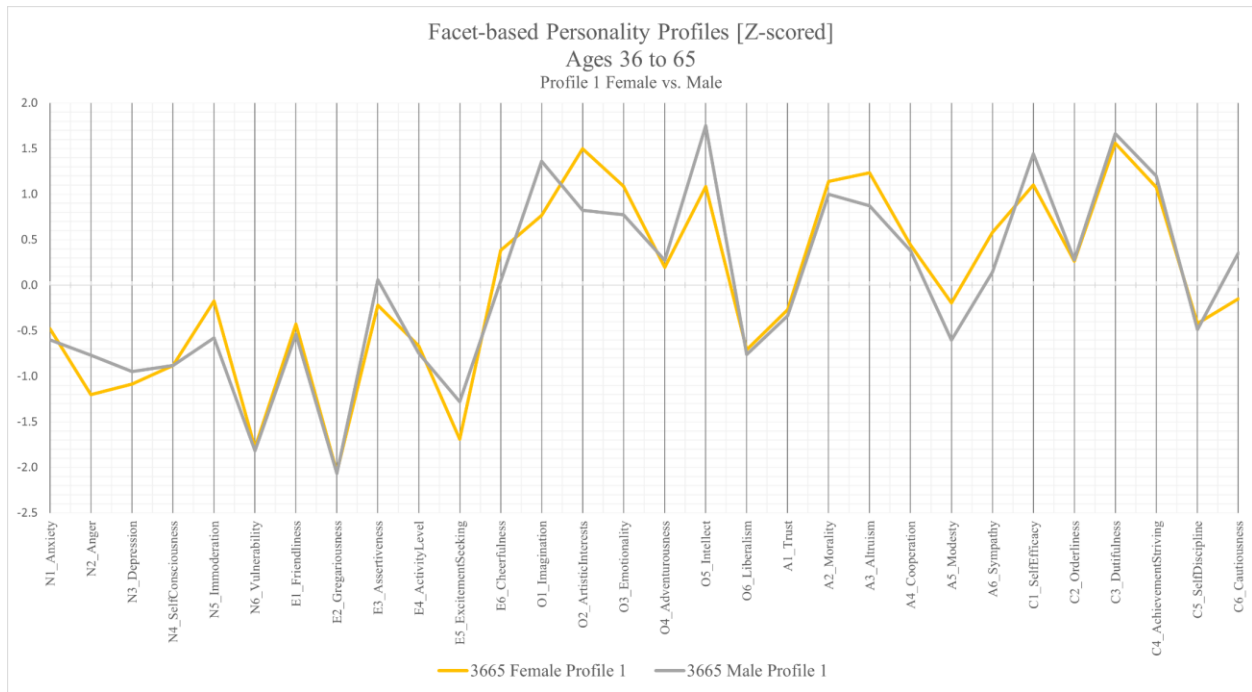**Figure J13 – 20 to 35-years-old Female vs. Male Comparison – Profile 1**

Figure J14 – 20 to 35-years-old Female vs. Male Comparison – Profile 2
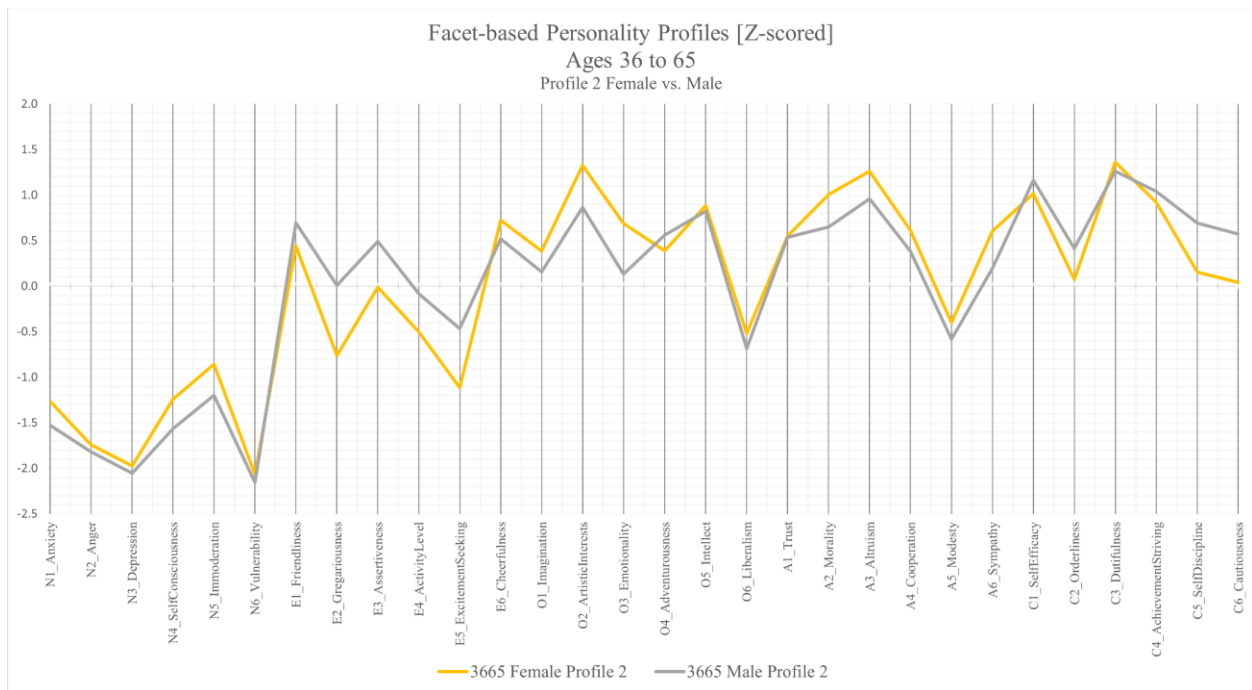

Figure J15 – 20 to 35-years-old Female vs. Male Comparison – Profile 3

Figure J16 – 36 to 65-years-old Female vs. Male Comparison – Profile 1

Figure J17 – 36 to 65-years-old Female vs. Male Comparison – Profile 2

Figure J18 – 36 to 65-years-old Female vs. Male Comparison – Profile 3