Taxometric analyses of higher-order personality domains☆

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ABSTRACT

The "big five" taxonomy, also called the five factor model, is a framework for personality that is ubiquitous in the literature of psychology. This organization is composed of five personality domains, Neuroticism (N), Extraversion (E), Conscientiousness (C), Openness to Experience (O), and Agreeableness (A). The accepted, but largely unexamined, assumption is that these personality domains are traits with dimensional latent structures. We carried out taxometric analyses on the five core domain because there have been no comprehensive latent structural analyses of all five and because the practice of discretizing continuous "big five" data is not uncommon. Data were from three large (Ns = 857, 1280, and 9935) undergraduate and community samples that competed one of three different measures of the "big five" (BFI, NEO PI-R, or Big Five Factor Inventory). Generally, results supported dimensional latent structures for each of the five domains and were largely convergent across measures and samples. We discuss the importance of empirically validating the underlying structure of these personality traits and the implications and importance that our findings have for personality and psychopathology.

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1. Taxometric analyses of higher-order personality domains

A comprehensive model of normal and abnormal personality structure has been a quest for millennia (Barenbaum & Winter, 2008). The structure of these between-individual differences is conceptualized as either personality types that are discrete entities reflecting classes of difference in kind, or personality traits that are continuous quantities reflecting dimensions of difference in degree (Barenbaum & Winter, 2008; Pittenger, 2004). Traits are now ascendant, and the prevailing taxonomy is hierarchical with five traits at the broadest level (Funder, 2001; Matthews, Deary, & Whiteman, 2009). Research with the objective of uncovering the basic building blocks of human personality has produced convergent findings for these five traits (Digman &

Takemoto-Chock, 1981; Fiske, 1949; Goldberg, 1981; McCrae & Costa, 1985; Norman, 1963; Tupes & Christal, 1961). The "big five" organization, sometimes called the five factor model, is now the most widely accepted framework in personality psychology and has importance across the discipline (Funder, 2001).

This study will focus on the five domains of the "big five" organization. Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness to Experience are stable and believed to be present to varying degrees in all individuals (Goldberg, 1981; McCrae & Costa, 1985). Extraversion (E) is the degree of interest in external events and people. Agreeableness (A) is the degree of compassion and consideration of others. Conscientiousness (C) is the degree of dutifulness and self-discipline. Neuroticism (N) is the degree of emotional stability and impulse control. Openness to Experience (O) is the degree of complexity and breadth of mental processes. The unique combination of these domains accounts for differences in personality (Matthews et al., 2009). Their utility to predict adaptive and maladaptive outcomes are ubiquitous in the psychological literature (Funder, 2001; McAdams & Pals, 2006; Ozer & Benet-Martinez, 2006).

A shared belief has been that these domains are dimensional traits, but there are methodological and conceptual reasons to empirically

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evaluate this presumed underlying structure. Previous research indicates that there may be confusion about the difference between the observed structure and the latent structure of the five domains (Ruscio & Ruscio, 2004). The observed structure is the manifest characteristics of how a construct is measured. Typically, the five personality domains have been measured on continuous scales. It would be premature, however, to conclude that this observed structure corresponds to a trait's continuous, dimensional latent structure. Instead, the latent structures of these domains occur naturally despite how these have been measured or conceptualized (Ruscio & Ruscio, 2004). The underlying latent structures of these important personality domains remain largely unexamined.

One method of examining the latent structures of the five domains is with taxometric analyses. This approach uses multiple, non-redundant methods to simultaneously examine whether a construct is categorical or dimensional (Ruscio, Ruscio, & Carney, 2011). Results from these analyses have the potential to improve and validate research about the "big five" organization. For example, a dimensional result would suggest the need to uncover an additive process of many factors that give rise to one's personality, whereas a taxonic result would suggest an etiology that stems either a single causal agent (e.g., a gene) or the interaction of a few key casual agents (e.g., a biological vulnerability that is activated in response to a specific trauma) (Ruscio, Haslam, & Ruscio, 2006). In addition, results from taxometric analyses have important implications for assessment of personality traits. Specifically, if a construct's latent structure is dimensional, measures that assess the construct will be relatively long and will aim to assess people with all levels of the underlying trait. In contrast, if a construct is taxonic, a relatively brief measure aimed at differentiating people along the taxonic boundary would be needed (Ruscio et al., 2006).

1.1. Prior taxometric studies

Although there have been no taxometric studies of all five personality domains, two studies have examined broad personality or temperament types that are strongly related to E. For example, the "big five" trait of E has been linked to the Introversion vs. Extroversion type proposed by Jung's theory of psychological types. One study examined the relationship between the Myers-Briggs Type Indicator (MBTI; Myers & McCaulley, 1985), a measure of four Jungian types, and a "big five" measure (McCrae & Costa, 1989). The MBTI's type of Extraversion vs. Introversion had a strong negative relationship with the trait of E ($r = -0.74$) (McCrae & Costa, 1989). Inferences for E's dimensional latent structure can be made from this correlational study in combination with a taxometric analysis of a large sample's MBTI data that showed the Extroversion vs. Introversion scale to have a clear dimensional latent structure (Arnau, Green, Rosen, Gleaves, & Melancon, 2003).

This contrasts with the findings from a taxometric study of behavioral inhibition (BI), an early precursor for low E (i.e., introversion) (Caspi, Roberts, & Shiner, 2005; Kagan, Reznick, Clarke, Snidman, & Garcia-Coll, 1984; Nigg, 2000; Woodward, Lenzenweger, Kagan, Snidman, & Arcus, 2000). A child with high levels of BI tends to be shy and fearful of novel situations; this tendency is likely subsumed by the sociability aspect of E (Nigg, 2000). The strong negative relationship of BI with E ($r = -0.58$ to -0.66) is supported by studies using self-report data from children (Muris & Dietvorst, 2006; Muris et al., 2009; van der Linden, Vreeke, & Muris, 2013). A previous taxometric analysis of observational data from several hundred infants yielded a distinct category of those who exhibited high levels of BI (Woodward et al., 2000). These conflicting findings about latent constructs strongly related to E suggest that its assumed dimensional structure should be examined more fully.

The taxometric studies of the Extraversion vs. Introversion and the BI types share the strength of large sample sizes, but also share some notable methodological weaknesses. These include the use of indicators with response formats that are dichotomous, rather than continuous, and publication before the development of the comparison curve fit index (CCFI; Ruscio, Ruscio, & Meron, 2007), the only empirical index of a latent structure. Thus, as suggested by Haslam, Holland, and Kuppens (2012), past taxometric analyses using outdated methodological approaches—particularly those with categorical findings—should be interpreted cautiously. Furthermore, no taxometric study to date has examined the other major personality traits. An additional investigation into the latent structures of all five personality domains is warranted.

1.2. Discretizing continua

A taxometric study of the latent structure of the five domains has implications for research from an array of psychological specialties and related disciplines. Traditionally, correlational techniques that use continuous data from unselected samples have been employed to examine these personality domains (Revelle, 2007). A not uncommon and more controversial approach has been the use of quasi-experimental techniques that divide continuous data into discrete groups or categories (i.e., discretizing continua into high scores and low scores) with either a median split or an extreme groups approach (MacCallum, Zhang, Preacher, & Rucker, 2002; Preacher, Rucker, MacCallum, & Nicewander, 2005; Robins, Tracy, & Sherman, 2007). If the artificial categories do not reflect the actual nature of the latent trait being studied, the statistical results will be distorted and may hinder scientific progress (MacCallum et al., 2002; Preacher et al., 2005). The median split has been used on continuous measures of the five domains for a variety of topics that include, but are not limited to, health, athletic and job performance, substance use, and emotional expression (Binboğa, Tok, Catikkas, Guven, & Dane, 2013; Erlanger & Tsytsarev, 2012; Hochwälder, 2009; Peterson, Morey, & Higgins, 2005; Petrides, 2010; West, Rhoden, Robinson, Castle, & St Clair Gibson, 2016). This use of the median split has been criticized for the loss of statistical power and information about particular trait differences, the appearance of spurious significant main effects or interactions, the possibility of overlooking nonlinear effects, and difficulty comparing findings across studies (Altman & Royston, 2006; MacCallum et al., 2002; Royston, Altman, & Sauerbrei, 2006).

Group comparisons using measure of the five domains also have been made with extreme group designs. Some examples of the topics that have been covered are physiological reactivity, attentional biases, and stress or threat perception (Abbasi, 2016; Farmer et al., 2013; Jerant et al., 2012; Koelega, 1992; Meira, Fairbrother, & Perez, 2015; Sawada et al., 2016; Tamir, Robinson, & Soldberg, 2006). The extreme groups approach (EGA) splits pretest data from continuous measures into two or more groups, and only participants from the extreme ends of the score distribution are selected. Power to detect effects is increased because the variance within trait groups is reduced relative to the variance between trait groups. The EGA has been criticized because the effect size is inflated and the results do not generalize to the population. In addition, nonlinear effects cannot be detected and reliability is reduced because there is not a full distribution of scores (Preacher, 2015; Preacher et al., 2005).

Findings for a dimensional or categorical latent structure for each personality domain will suggest whether the median split and EGA methods are justified. To make continuous score distributions discrete is defensible only when the latent structure of a variable is categorical and the selected boundary/threshold validly classifies cases into groups (MacCallum et al., 2002; Preacher, 2015). Existing studies that discretize continuous data from measures of the five personality domains will be far less informative if these constructs are dimensional.