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A Taxometric Agenda for Health Psychology: Personality, Health Behaviours, Illness Perceptions, Attitudes and Symptoms

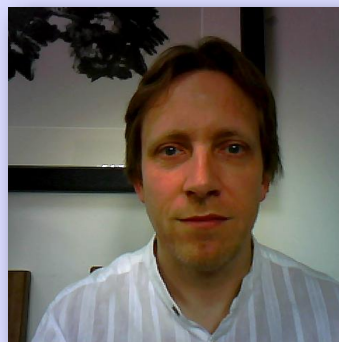
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An implicit assumption concerning many latent variables studied within health psychology, (e.g., personality, emotions, health behaviours, illness representations, symptoms), is that they are continuous/dimensional constructs. However, it is an empirical question whether or not a latent construct is truly dimensional (i.e., distributed as a continuous variable, with individuals varying quantitatively from each other) or if it is taxonic (i.e., individuals are differentiated into non-arbitrary groups or categories) (Ruscio, Haslam, Ruscio, 2006). Simply inspecting distributions, applying cluster or factor analysis will not answer this question (Waller & Meehl, 2006; Beauchaine, 2007). However, Meehl and colleagues (see Meehl, 1995; Waller & Meehl, 2006) developed a suite of statistical procedures, termed taxometrics, specifically designed to demonstrate if a latent structure is dimensional or taxonic (see Meehl, 1995). I will indicate why this question of dimensionality is not a trivial one, briefly outline the taxometric method and briefly show how it can be applied to address key questions concerning theory and interventions within health psychology.

Dimension or Taxon: A Key Scientific Question

Identifying whether constructs form distinct taxa (e.g., plants) or vary in terms of quantity (e.g., temperature) or degree (e.g., position in a status hierarchy) is a fundamental basis of science and theory building. Similarly for psychological science knowing whether a latent construct is dimensional or taxonic has important theoretical and practical/clinical implications (Ruscio et al., 2006). Explanations for dimensional models suggest multiple, additive causal factors that sum to produce quantitative variation (Ruscio et al., 2006). This implies that clinicians and researchers should utilize the full range of scores for diagnostic and research purposes (Widiger & Trull, 2007). A categorical model needs to explain the discontinuity between people and explanations may include a single causal factor (e.g., genetic or threshold models) or more complex interacting systems such as environmental influences leading to developmental bifurcation (Ruscio et al., 2006). The basic principle is that the existence of either dimensional or taxonic model requires a different theoretical account.



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The Taxometric Method

Detailed overviews of the taxometric methods are available elsewhere and the reader should refer to these for details (Beauchaine, 2007; Ruscio et al., 2006; Ruscio & Ruscio, 2004; Waller & Meehl, 2006). Basically taxometric procedures require three main steps (1) identifying valid construct indicators, (2) applying the appropriate taxometric method and (3) interpretation.

Indicators (e.g., items, scales, physiological responses etc.) are used if they can distinguish cases (termed taxons) from non-cases (termed complements). This is usually expressed in terms of a Cohen's d , with a value of 1.25 as the minimum cut off (Meehl, 1995). Good indicators require high item-total correlations and have minimum nuisance covariance (correlations among indicators in putative taxon and complement) of around .30 or less (Meehl, 1995). Indicators should pass all of these tests.

The basic taxometric technique involves the indicator variables split into input and output variables. At successive divisions along the input variable either mean differences either side of a cut (mean above minus below a cut: MAMBAC), or co-variances (Maximum Covariance: MAXCOV) or eigenvalues (Maximum Eigenvalues: MAXEIG) within a cut are computed for the remaining indicators (called output variables) (Waller &

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Meehl, 1998; Ruscio et al., 2006). These differences, covariances or eigenvalues will be at a minimum when either complement or taxon are present alone and at a maximum when the sample contains equal proportions of both. MAMBAC is used when there is a minimum of two indicators, MAXCOV or MAXEIG are used with at least three indicators. Recently taxometric procedures have been extended to incorporate factor analytic procedures known as L-Mode factor analysis (Waller & Meehl, 1998). Interpreting taxometric analysis involves inspecting the characteristic shape of the curves, when divisions are plotted on the x-axis and mean differences, covariance or eigenvalues on the y-axis. For a taxonic solution the curve will be peaked with MAMBAC and either peaked or cusped when MAXCOV/MAXEIG is used. If the structure is dimensional the curve will be either flat or concave. To aid interpretation a curve comparison fit index (CCFI) (Ruscio, 2007; Ruscio, Ruscio, & Meron, 2007; Ruscio & Marcus, 2007) can be consulted which varies between 0 and 1, with values greater than .5 indicating a taxonic solution and below .5 a dimensional solution. For any taxometric study more than one method should be used and convergence across the methods examined.

Taxometrics: An Agenda for Health Psychology Research

There are numerous important roles for taxometrics within health psychology and these are detailed below.

Personality, Diagnosis and Prognosis: Can personality traits be used as diagnostic and prognostic constructs, with definable cutoff scores? Type-D personality has become defined as one such categorical risk factor in cardiovascular disease (Denollet, 1998). However, the cut-offs for Type D are arbitrary (see Ferguson et al., 2009). Apart from the dangers of treating a continuous measure as if it were taxonic, a major danger of using arbitrary cut-offs in this context is misdiagnosis of cases as non-cases and visa-versa. The taxometrics of Type D have recently been reported and show that it is in fact dimensional and not taxonic (Ferguson et al., 2009). As such, there are concerns about using Type D as a categorical risk factor, based on arbitrary cut-offs when in fact it is dimensional. However, it is appropriate to draw distinctions within a dimensional construct as long as these are systematic and empirically justifiable (Ruscio et al., 2006) via identifying inflection points (Kessler, 2002) or the cross-over points for sensitivity and specificity (Ferguson, 2009).

Fortunately taxometric analyses have been applied to many traits regularly used in health psychology

and a large number are dimensional: (1) alexithymia (Parker, Keefer, Taylor & Bagby, 2008), (2) health anxiety (Ferguson 2009), (3) Type-D (Ferguson et al., 2009), adult attachment styles, impulsivity (see Ruscio et al., 2006), whereas a number are taxonic including Type A, self-monitoring, and impression management (see Ruscio et al., 2006 for a review).

Health Behaviours, illness representations and symptoms: Indices of unhealthy behaviour (e.g., summing the extent to which people smoke, drink alcohol, take drugs, have a poor diet; Kendzor et al., 2008) or the extent to which people report emotions associated with health behaviours (Kiviniemi, Voss-Humke & Seifert, 2007) are often summed to form a single continuum. However, it may be that these types of index are taxonic; that is a group exists, who have unusually strong positive emotions associated with negative health behaviours. If indeed these types of measure are taxonic this has profound implications for the type of theoretical models that might be used to explain unhealthy behaviours and in developing interventions. If a taxon is uncovered for example, it would be useful to assign people to taxon and complement (see Ruscio, 2009), and explore: (1) if the taxonic group membership is stable over time (is trait like), (2) if there are differential predictors, and (3) models that suggest developmental bifurcation. It would also suggest that this group would require focused interventions and indicate (based on cutoff and base rate information from the taxometric procedure) who to target the intervention at. As such, the status of health behaviours as a focus of intervention and a predictor would change.

Similar arguments can be applied to other widely used latent constructs in health psychology. For example, illness representations are treated as continuous and taxometric methods could be applied to explore if any of the 'dimensions' of illness representations are taxonic and if this is the case across different illnesses. Similarly for symptom reporting is there a taxonic group that represents people who tend to over-report symptoms? Indeed Ferguson et al (2009) have suggested such a possibility in terms of developing taxometric approaches within psychosomatic medicine to examine if levels of abnormal illness behaviour and symptom reporting (e.g., Chronic Fatigue Syndrome) form a distinguishable diagnostic category. Taxometric methods are now starting to be applied in the field of attitudes research and similar approaches could be taken with respect to attitudes research in health psychology (e.g., Denson, Iyer & Livkel, 2009). Finally, it should be noted that taxometrics can be applied to all types of data including physiological recording: For example,



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are there different groups of physiological responders to stress?

In conclusion a taxometric approach to health psychology research and practice would help to delineate the nature of many key constructs used and help further refine and develop theory and practice. ■

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