

Categories *versus* dimensions in personality and psychopathology: a quantitative review of taxometric research

N. Haslam¹*, E. Holland¹ and P. Kuppens²

¹ Department of Psychology, University of Melbourne, Parkville, Victoria, Australia

² Faculty of Psychology and Educational Sciences, University of Leuven, Belgium

Taxometric research methods were developed by Paul Meehl and colleagues to distinguish between categorical and dimensional models of latent variables. We have conducted a comprehensive review of published taxometric research that included 177 articles, 311 distinct findings and a combined sample of 533 377 participants. Multilevel logistic regression analyses have examined the methodological and substantive variables associated with taxonic (categorical) findings. Although 38.9% of findings were taxonic, these findings were much less frequent in more recent and methodologically stronger studies, and in those reporting comparative fit indices based on simulated comparison data. When these and other possible confounds were statistically controlled, the true prevalence of taxonic findings was estimated at 14%. The domains of normal personality, mood disorders, anxiety disorders, eating disorders, externalizing disorders, and personality disorders (PDs) other than schizotypal yielded little persuasive evidence of taxa. Promising but still not definitive evidence of psychological taxa was confined to the domains of schizotypy, substance use disorders and autism. This review indicates that most latent variables of interest to psychiatrists and personality and clinical psychologists are dimensional, and that many influential taxonic findings of early taxometric research are likely to be spurious.

Received 30 April 2011; Revised 18 August 2011; Accepted 22 August 2011; First published online 23 September 2011

Key words: Categories, dimensions, personality, psychopathology, taxometrics.

Introduction

Deciding between categorical and dimensional models of latent variables is a fundamental and enduring issue in psychiatry and psychology, which taxometric analyses were designed to resolve. Developed by Paul Meehl and his colleagues, these procedures allow researchers to determine whether observed variation is underpinned by a non-arbitrary latent class, or ‘taxon’, such as a discrete psychopathology or personality type. Discovering taxa and distinguishing them from latent dimensions has broad implications for how personality and psychopathology should be conceptualized, assessed and explained.

If a latent variable is taxonic, for example, it must be conceptualized as an entity with real category boundaries that exist independent of social convention or descriptive convenience. If it is not taxonic then no boundary exists unless a manifest distinction such as a diagnostic threshold is imposed on arbitrary or

pragmatic grounds. The appropriate way to assess a taxonic variable involves assigning cases to categories at the taxon boundary, but assessing non-taxonic variables involves quantifying variation along the entirety of an underlying continuum. Taxa are likely to spring from mechanisms that Meehl (1977) referred to as ‘specific etiologies’, such as single discrete causal factors, whereas non-taxonic variables generally result from the additive effects of multiple small causal influences. Determining whether or not a latent variable is best thought of as taxonic is a crucial scientific question and not merely a matter of theoretical taste or statistical botanizing.

The taxometric method makes this determination in a distinctive way. Unlike some more familiar statistical approaches to latent variable analysis, it does not impose a particular kind of structure, as cluster analysis presumes a categorical structure or factor analysis a set of underlying dimensions, but instead tests between these alternatives. Unlike most comparable forms of data analysis, it does not follow a null hypothesis testing approach to inference or yield a single definitive statistic. Where most other analyses use a single statistical procedure, the taxometric method seeks consistency among the findings of multiple

* Address for correspondence: Professor N. Haslam, Department of Psychology, University of Melbourne, Redmond Barry Building, Parkville, VIC3010, Australia.
(Email: nhaslam@unimelb.edu.au)

mathematically independent procedures. Other analyses provide chiefly numerical output, whereas the output of taxometric analyses is largely graphical, based on the interpretation of curves. Despite these unusual features, the taxometric method has proven to be popular and versatile (Ruscio *et al.* 2006).

Taxometric analyses were first used to test Meehl's theory of schizophrenia, which proposed a taxonic genetic liability that manifests as schizotypal personality. The initial study (Golden & Meehl, 1979) supported the existence of the proposed taxon, and in the 1980s a series of articles reported taxonic findings in the domains of normal personality (self-monitoring: Gangestad & Snyder, 1985; Type A: Strube, 1989), abnormal personality (schizotypy: Erlenmeyer-Kimling *et al.* 1989) and other psychiatric phenomena (dementia: Golden, 1982; tardive dyskinesia: Golden *et al.* 1987; nuclear depression: Grove *et al.* 1987). The trickle of studies in the 1980s became a stream in the 1990s and a torrent in the new millennium.

The fundamental questions that motivated the taxometric method are still pressing. Within clinical psychology and psychiatry, the categorical/dimensional issue remains contentious as many theorists, clinicians and researchers question the merits of categorical diagnosis and classification. These doubts have reached a crescendo, playing a role in the changes underway in DSM-V (Widiger & Samuel, 2005; Helzer *et al.* 2008), which embeds dimensional judgments in psychiatric diagnosis like never before, recognizing degrees of severity and impairment in many conditions and diagnosing personality disorders (PDs) along a set of continua.

The structural question that drives taxometric research also has continuing relevance to the psychology of normal personality. Dimensional views of traits predominate (Meehl, 1992), but there is enduring interest in the possible existence of personality types (e.g. Asendorpf, 2002) or configural prototypes (Eaton *et al.* 2011). Personality psychology's status quo is thus the mirror image of psychiatry's: evidence for personality types challenges the default dimensional assumptions of trait psychologists, just as evidence that psychopathology is a matter of degree challenges categorical assumptions about psychiatric diagnosis. Taxometric research can provide a firmer empirical foundation for scientific taxonomy in both fields by testing these assumptions.

Taxometrics is not the only form of data analysis that can test between categorical and dimensional models of latent variables, and sophisticated alternatives exist (McLachlan & Peel, 2000; De Boeck *et al.* 2005; Markon & Krueger, 2006). Nevertheless, taxometric research is a particularly rich source of knowledge on latent structure within psychology and

psychiatry because its longevity means that it has built up a relatively large body of empirical findings on a wide assortment of latent variables. Reviewing those findings could help to answer basic questions about the latent structure of psychological variation. First, does existing research support the existence of any taxa in personality and psychopathology? Second, if solid evidence of taxa has been obtained, in what domains are they found? Taxa may be rarer in normal personality than in psychopathology, and rarer in PDs than in other psychiatric domains (Trull & Durrett, 2005). Whether taxa differ in prevalence across these domains and whether there is robust and replicated evidence for particular taxa are open questions.

In addition to clarifying substantive questions regarding the latent structure of personality and psychopathology, a systematic review of taxometric research might also shed light on methodological issues. First, are certain sample types (e.g. 'abnormal' clinical or forensic samples) more likely to yield taxonic findings than others (e.g. 'normal' community members)? Similarly, are taxa less frequent among children and adolescents than among adults, as might be expected if taxa differentiate developmentally? Sample size may also have implications for taxonic findings, as research using samples that fail to meet Meehl's (1995) recommended minimum *n* of 300 may have a taxonic bias because they generate less stable curves. Second, are certain kinds of data more or less likely to produce taxonic findings? Some writers have argued that self-report data can generate spurious taxonic findings (Beauchaine & Waters, 2003).

A third set of methodological questions relates to aspects of measurement in taxometric research, which relies on multiple 'indicators' of the proposed latent variable. Researchers have argued that dichotomous indicators may induce a taxonic bias (Ruscio, 2000), and that inadequate indicator validity may also impair taxometric inference (Meehl & Yonce, 1994, 1996). Research that uses indicators of limited reliability (e.g. based on single questionnaire items) or fails to report evidence of validity may yield taxonic findings at different rates than research using more valid indicators.

A final set of methodological questions involves statistical methods. Five taxometric procedures are in widespread use [latent mode (L-Mode), mean above minus below a cut (MAMBAC), maximum covariance (MAXCOV), maximum eigenvalue (MAXEIG), maximum slope (MAXSLOPE)] and some may be more likely to draw taxonic conclusions. Finding consistency among multiple procedures is a hallmark of the taxometric method, and the use of relatively few procedures can be considered one element of low methodological quality, along with small sample sizes, and dichotomous, single-item and unvalidated

indicators, that might have a bearing on taxometric research findings.

One statistical method that deserves special mention is the use of simulated comparison data. This adjunct to taxometric practice (Ruscio *et al.* 2007) involves the parallel analysis of simulated taxonic and dimensional data sets that match the distributional and correlational properties of the observed research data. If the graphical output generated from the research data more closely resembles the output of one set of simulations than the other, then the simulation procedure supports the corresponding latent structure. The comparative fit of the research data output to the two simulations can be quantified by an index, the comparison curve fit index (CCFI), where values equal to 0.5 represent equally good fit, values less than 0.5 support a dimensional finding and values greater than 0.5 support taxonicity. The CCFI offers an objective decision rule to supplement visual inspection of curves, the traditional basis for taxometric inference.

Although the simulated comparison data procedure has been controversial among some researchers (Beach *et al.* 2005a; cf. Ruscio & Marcus, 2007), Monte Carlo studies provide very strong evidence for its validity and robustness under unfavourable data conditions. In an analysis of 25 000 simulated data sets constructed to present challenges for taxometric inference (e.g. indicator skew and coarseness, modest indicator validity, 'nuisance covariance' among indicators, unequal variance of latent distributions), Ruscio & Kaczetow (2009) found that the CCFI achieved 93% accuracy in identifying taxonic and dimensional latent structures, rising to 98% when CCFI values were outside an ambiguous intermediate range (i.e. <0.4 or >0.6). In an even larger study of 100 000 data sets, Ruscio *et al.* (2010) found that a CCFI threshold of 0.5 achieved an average of 94% accuracy for MAMBAC, MAXCOV and L-Mode applied individually, and 98% when the mean CCFI of the three procedures was used. A similar study of 10 000 data sets (Ruscio *et al.* 2007) found that the CCFI strongly outperformed several previous fit indices and consistency tests. Use of simulated comparison data and the CCFI has become widespread, and it is therefore important to review whether this methodological development has had an influence on taxometric research findings.

Previous reviews of taxometric research have been qualitative and restricted to psychopathology-related constructs (Haslam, 2003, 2007), and they are now seriously outdated, the last comprehensive review (Haslam & Kim, 2002) covering less than one quarter of the taxometric articles published as of 2011. We therefore conducted a comprehensive quantitative review of all published empirical findings using

multilevel logistic regression analysis, in an effort to ascertain the prevalence of taxonic findings and the factors associated with them. Although the primary focus of the study was on substantive factors (i.e. which latent variables are taxonic), we also examined methodological factors that might contribute to taxonic findings, potentially as sources of bias.

Method

Study sample

An exhaustive literature search was conducted using previous reviews, publication databases (Google Scholar, PsycINFO, Web of Science) and journal and publisher websites (search terms included taxometric*, taxon*, MAXCOV, MAMBAC, MAXEIG). Inclusion and exclusion criteria were as follows: research had to (1) be published in peer-reviewed journal articles; (2) be officially published or 'in press' by 1 April 2011; (3) address observed substantive latent variables rather than simulated data sets or those involving an experimental manipulation (Arnau *et al.* 2001; Beauchaine & Waters, 2003; McGrath *et al.* 2009); and (4) use at least one of the accepted taxometric procedures.

Each article could yield one or more pertinent empirical finding, defined as a conclusion about the latent structure of a single construct based on one or more taxometric procedures in a single sample. Different findings within one article could reflect the empirical investigation of more than one construct and/or be based on distinct samples. In this sense, when multiple taxometric procedures are used to analyse a single construct in a single sample, they contribute to a single finding. Similarly, parallel analyses of different sets of indicators of a single construct in a single sample were counted as contributing to a single finding. On these definitions, the 177 articles contained 311 findings (mean = 1.76, range 1–11).

Coding

The 177 articles were coded by the first author on multiple characteristics under the headings of publication details, sample characteristics, measurement characteristics, data analysis, results, and construct. All coding was conducted at the level of the individual finding, except for codes related to publication details (i.e. publication year, journal, number of findings), which were conducted at the article level.

Sample characteristics

For each finding, we coded sample size, whether the sample was composed of undergraduates, whether it

Table 1. Classification of constructs examined in taxometric research

Classification	Constructs
Mood disorder	Depression and its subtypes, Depression-proneness, Dysthymia, Grief, Mania, Mixed anxiety-depression
Anxiety disorder	Agoraphobia, Anxiety, Anxiety sensitivity, Aversion, Disgust sensitivity, Distress, Fear of pain, Health anxiety, Hypochondriasis, OCD and subtypes, PTSD, Separation anxiety, Worry (normal and pathological)
Eating disorder	Anorexia nervosa and subtypes, Binge eating disorder, Body dissatisfaction, Bulimia nervosa and subtypes, Dietary restraint, Drive for thinness, Eating pathology
Substance use	Alcohol abuse and dependence, Cannabis dependence, Nicotine addiction/dependence
Externalizing	Adolescent externalizing, Aggression and subtypes, Antisocial behavior, Antisocial PD, Criminal lifestyle, Criminal thinking style, Intermittent explosive disorder, Internet gambling, Psychopathic sexuality, Psychopathy, Risky sexual behavior, Sexual violence risk
Schizotypy	Pre-schizophrenic personality, Schizoidia, Schizophrenia risk, Schizotypy and subtypes
Other PD	Avoidant PD, Borderline PD, Dependent PD, Depressive PD, Narcissistic PD, Obsessive-compulsive PD, Paranoid PD
Normal personality	Alexithymia, Attachment styles, Child temperament dimensions, Extraversion/introversion, Femininity, Hypnotic susceptibility, Hypomanic temperament, Impulsivity, Infant reactivity, Jungian temperament dimensions, Narcissism, Perfectionism, Self-monitoring, Sexual orientation, Type A, Type D
Other individual difference	ADHD and subtypes, Adjudicative competence, Autism and subtypes, Dementia, Cognitive symptom exaggeration, Dissociation, Feigned neurocognitive deficit, Health complaint exaggeration, Hypersexuality, Impression management, Infrequency responding, Language impairment, Malingering, Psychosis and subtypes, Racism, Schizophrenia and subtypes, Self-deceptive positivity, Somatic complaints, Somatization, Symptom over-reporting
Miscellaneous	Biological sex, Envy/jealousy, Handedness, Marital discord, Metabolic syndrome, Nociceptive flexion reflex, Prostate cancer risk, Relationship types, Tardive dyskinesia

OCD, Obsessive-compulsive disorder; PTSD, post-traumatic stress disorder; PD, personality disorder; ADHD, attention deficit/hyperactivity disorder.

was drawn from a clinical or forensic sample, whether the sample was drawn from the general public, and whether it was composed primarily of children or adolescents (<18 years).

Measurement characteristics

We coded whether any of the data were based on self-report, ratings by observers, or interviews. With respect to indicator construction, we coded the number of indicators used in the analysis, whether any indicators were based on a single item rather than summed items, whether any indicators were dichotomous, and whether the validity of the indicators was reported in the manuscript (including quantification of indicator validities or any mention that they had satisfied a quantitative validation process).

Data analysis

Data-analytic methodology was coded in terms of the use or non-use of the MAXCOV, MAMBAC, MAXEIG, MAXSLOPE, L-Mode, and 'other' taxometric procedures. These codes were summed to produce a 'number of procedures' variable. Use of Ruscio's simulated comparison data technique was also coded.

Results

The overall conclusion for each finding was coded taxonic (1) or non-taxonic (0), based on the researchers' interpretation. Two ambiguous interpretations were coded as non-taxonic. For studies reporting CCFI values, or allowing them to be computed from an earlier fit index (fit_{RMSR}), we coded the values for each taxometric procedure that was used to generate them. For each finding with at least one CCFI reported, a mean CCFI value was computed by taking the average across procedures.

Construct

The studied constructs were classified into 10 groupings, developed to reflect broad construct domains but also to recognize narrower domains that have received substantial taxometric attention. Seven groupings were psychopathology related, one referred to normal personality and two were residual groupings. The groupings and a listing of constructs examined in the article sample are presented in Table 1.

The 'mood disorder' grouping included mood disorders, proposed subtypes of these disorders, affective phenomena related to them (grief, mania), and

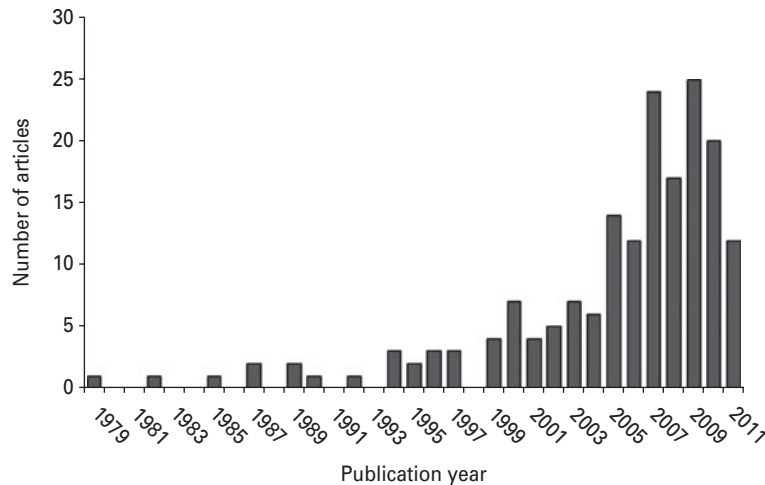


Fig. 1. Publication year of the 177 articles (incomplete year for 2011).

diatheses for them (depression-proneness). The 'anxiety disorder' grouping similarly included a mix of disorders, proposed variants, specific kinds of anxiety or aversion, and relevant diatheses (anxiety and disgust sensitivity). The 'eating disorder' grouping followed the same pattern. The 'substance use' grouping included abuse and dependence on a variety of substances. The 'externalizing' grouping contained constructs involving antisocial and under-controlled conduct, including gambling and sexual behavior. A 'schizotypy' grouping was defined narrowly given the long-standing tradition of taxometric research on this topic, and was kept separate from an 'other personality disorder' grouping, which included studies of seven recognized or proposed PDs. The 'normal personality' grouping comprised personality or temperamental traits. The 'other individual difference' grouping contained diverse psychological constructs including response styles and biases, attitudes, and pathological phenomena that have received little taxometric attention and do not readily fit under the other groupings. The final 'miscellaneous' grouping contained constructs that either were not psychological (e.g. biological sex, metabolic syndrome) or did not have the individual as the unit of analysis (e.g. emotions, relationship types).

General considerations

Individuating distinct findings within studies was occasionally challenging, as multiple parallel analyses were sometimes reported using distinct indicator sets and/or different subsamples (e.g. men *versus* women). In these circumstances, if a single construct was being examined, we coded analyses based on the entire sample and not those based on subsamples, and we

took an average value of all quantitative codes across the parallel analyses.

Coding agreement

The second author was assigned 30 randomly chosen articles containing 58 findings (18.6%), and coded them on all codes except authors and the specific CCFI values. Mean agreement across the codes was 94.8% [range 82.8% (any dichotomous indicators) to 100% (multiple codes)].

Results

The mean publication year was 2005.0 (range 1979–2011), but the rapid growth in taxometric research illustrated in Fig. 1 yields a median of 2007. Sample sizes for the 311 findings varied widely (mean = 1999.7, median = 934, range 130–80 304) and were log-transformed for later analyses. A summary of categorical finding-level codes is presented in Table 2, which indicates that most studies used clinical, forensic or undergraduate samples, used self-report data, and conducted MAMBAC and MAXCOV analyses with indicators of demonstrated validity. Methodological choices known to weaken indicator validity (i.e. single-item indicators) or bias findings towards taxonic conclusions (i.e. dichotomous indicators) were common, but taxometric procedures other than the MAMBAC, MAXCOV, MAXEIG and L-Mode were rare. On average, 2.12 distinct taxometric procedures were used in the analysis of each finding. CCFI values were reported or derivable for a substantial minority of findings.

A composite index of methodological quality was constructed from several codes in a way that subtracted points for known methodological weaknesses

Table 2. Descriptive statistics on finding-level codes ($n=311$)

	Number (%)
Sample	
Clinical/forensic sample	125 (40.2)
Undergraduate sample	115 (37.0)
Community sample	86 (27.7)
Child/adolescent sample	54 (17.4)
Data type	
Self-ratings	212 (68.2)
Interview	67 (21.5)
Other-ratings	23 (7.4)
Indicator construction	
Indicator validity demonstrated	199 (64.0)
Single-item indicators	126 (40.5)
Dichotomous indicators	62 (19.9)
Data analysis	
MAMBAC	234 (75.2)
MAXCOV	193 (62.1)
MAXEIG	124 (39.9)
L-Mode	93 (29.9)
MAXSLOPE	5 (1.6)
Other taxometric procedure	12 (3.9)
CCFI used	136 (43.7)

MAMBAC, Mean above minus below a cut; MAXCOV, maximum covariance; MAXEIG, maximum eigenvalue; L-Mode, latent mode; MAXSLOPE, maximum slope; CCFI, comparison curve fit index.

and added them for known strengths. One point was subtracted for findings based on samples of <300, using one-item indicators, or using dichotomous indicators. One point was added for findings with an above-median sample size, an above-median number of distinct taxometric procedures, and demonstrated indicator validity. The five items composing this scale yielded an index ranging from -3 to $+3$ (mean = 0.76 , S.D. = 1.56), and all items intercorrelated positively ($\alpha = 0.67$).

Table 3 summarizes the distribution of taxonic findings and the mean CCFI values for the subset of findings reporting them. CCFI values derived from different procedures were highly similar (MAMBAC = 0.37 , MAXCOV = 0.35 , MAXEIG = 0.36 , L-Mode = 0.36) and all intercorrelated strongly (mean $r = 0.64$). A large minority (38.9%) of the 311 findings were taxonic and the mean CCFI for the 136 relevant findings was 0.37 , indicating that these findings tend to be predominantly non-taxonic. Indeed, the distribution of mean CCFI values (see Fig. 2), which reveals an apparent bimodality, shows that only 20 (14.7%) findings exceeded the taxonic threshold (CCFI > 0.5). According to more conservative guidelines, 102 (75%) findings were clearly dimensional (< 0.4), 17 (12.5%)

were clearly taxonic (> 0.6), and 17 (12.5%) were ambiguous.

Table 3 indicates that the rate of taxonic findings differed widely across the construct domains [$\chi^2_{(9)} = 56.73$, $p < 0.0001$]. Taxonic findings were relatively infrequent in the anxiety disorder, externalizing, other PD and normal personality domains, and much more common in the eating disorder, substance use, schizotypy and miscellaneous domains. Taxonic findings were also significantly more common in the broad psychopathology arena (i.e. the combination of the mood, anxiety, eating, substance use, externalizing, schizotypy, and other PD domains) than in the normal personality domain [38.7% v. 16.3% , $\chi^2_{(1)} = 8.72$, $p < 0.01$].

Rates of use of the CCFI were also highly variable across construct domains [$\chi^2_{(9)} = 68.90$, $p < 0.0001$] and the three domains with the highest rate of taxonic findings used the CCFI the least. Evidence of a further disjunction between rates of taxonic findings and CCFI evidence is revealed in Table 3. Only one of the four domains with a majority of taxonic findings has a mean CCFI consistent with predominant taxonicity.

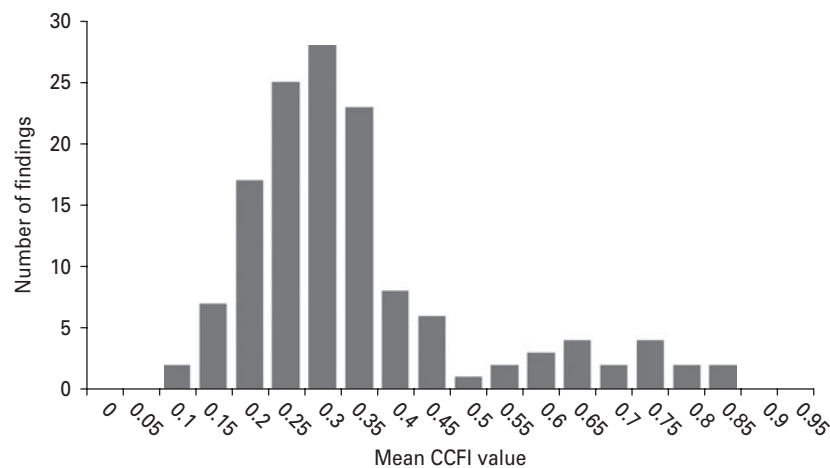
In a first attempt to assess factors related to taxonic findings, we examined associations between taxonicity and three potential predictors. The findings reported above suggest that use of the CCFI is negatively associated with taxonic findings. The relative recency of the CCFI suggests that publication year might show the same negative association. Finally, the methodological quality of studies, assessed independently of the use of the CCFI, with which it correlated positively ($r = 0.63$), might be associated with taxometric findings. Indeed, findings of analyses using the CCFI were much less likely to be taxonic (16.2%: 22 of 136) than those that did not (56.6%: 99 of 175), $\chi^2_{(1)} = 52.54$, $p < 0.0001$. More recently published findings were also less likely to be taxonic ($r = -0.36$, $p < 0.001$); 54.5% of findings published prior to the median article year were taxonic, compared to 23.2% of later findings, as were the findings of studies of higher methodological quality ($r = -0.33$, $p < 0.001$). In short, more recent, methodologically stronger research that systematically compares the fit of taxometric output to simulated taxonic and non-taxonic data sets is substantially less likely to yield taxonic findings than older and methodologically weaker research that does not.

These findings indicate that methodological and temporal factors are systematically associated with taxometric findings. However, because these predictors are related [e.g. more recent findings were methodologically stronger ($r = 0.68$) and more likely to use the CCFI ($r = 0.65$)], and other methodological and construct factors also predict findings, multivariate analyses are required to assess their unique effects.

Table 3. Distribution of taxonic findings and use of the CCFI across construct types

Grouping	Findings	Taxonic (%)	Number (%) CCFI	Mean CCFI
Mood disorder	36	13 (36.1)	12 (33.3)	0.39
Anxiety disorder	60	16 (26.7)	32 (53.3)	0.33
Eating disorder	21	13 (61.9)	4 (19.0)	0.40
Substance use	12	7 (58.3)	12 (100)	0.57
Externalizing	29	6 (20.3)	24 (82.8)	0.31
Schizotypy	29	21 (72.4)	4 (13.8)	0.37
Other PD	12	1 (8.3)	9 (75.0)	0.25
Normal personality	41	8 (19.5)	11 (26.8)	0.34
Other individual difference	49	18 (36.7)	24 (49.0)	0.41
Miscellaneous	22	18 (81.8)	4 (18.2)	0.50
Total	311	121 (38.9)	136 (43.7)	0.37

CCFI, Comparison curve fit index; PD, personality disorder.

**Fig. 2.** Distribution of mean comparison curve fit index (CCFI) values for findings reporting them ($n=136$).

The hierarchical structure of the data, with findings nested in articles, necessitates an analysis that takes these dependencies into account. We therefore used multilevel logistic regression analysis (Bryk & Raudenbush, 1992; Snijders & Bosker, 1999).

Multilevel logistic regression analyses

We first ran single-predictor two-level models with findings nested in articles. For ease of interpretation and because we are not primarily interested in within-article relationships between variables (Enders & Tofighi, 2007), binary predictors were entered uncentered, and non-binary predictors and also the level-2 predictor (publication year) were entered grand-mean centered. All analyses relied on population-average models, with random intercepts but no random slopes. The fixed effects are presented in

Table 4. At level 2 (article), publication year was negatively associated with taxonicity: more recent studies were less likely to yield taxonic findings. At level 1 (finding), several methodological predictors were significantly associated with taxonic findings. Findings based on smaller samples, fewer taxometric procedures and indicators that were dichotomous, lacking reported validity, and based on single items were more likely to be taxonic. These predictors all compose the methodological quality index, which was consequently strongly associated with non-taxonic findings. Findings in which the CCFI was reported were much less likely to yield taxonic findings, as were those based in part on the MAMBAC, MAXEIG and L-Mode procedures. The findings based in part on the MAXCOV procedure and on 'other' taxometric procedures were significantly more likely to be taxonic. Findings in the schizotypy and miscellaneous construct domains

Table 4. Findings of single-predictor multilevel logistic regression analyses predicting taxonic findings

Predictor	B (S.E.)	p
Level 2 (df = 175)		
Publication year	−0.133 (0.028)	<0.001
Level 1 (df = 309)		
Sample		
n (log-transformed)	−0.331 (0.143)	0.022
Undergraduate sample	0.053 (0.295)	0.858
Clinical/forensic sample	0.110 (0.271)	0.683
Community sample	0.148 (0.273)	0.589
Child/adolescent sample	0.176 (0.353)	0.618
Data type		
Self-ratings data	0.282 (0.289)	0.923
Other-ratings data	−0.472 (0.504)	0.350
Interview data	−0.242 (0.316)	0.444
Number of indicators	0.089 (0.056)	0.110
One-item indicators	0.669 (0.286)	0.020
Dichotomous indicators	1.061 (0.387)	0.007
Validated indicators	−0.600 (0.299)	0.045
Data analysis		
MAXCOV	0.637 (0.290)	0.029
MAMBAC	−1.601 (0.322)	<0.001
MAXEIG	−0.712 (0.291)	0.015
L-Mode	−1.870 (0.335)	<0.001
MAXSLOPE	1.755 (1.069)	0.101
Other	2.372 (0.835)	0.005
Number of procedures	−0.934 (0.189)	<0.001
Comparative fit index	−1.920 (0.303)	<0.001
Overall study quality	−0.468 (0.104)	<0.001
Construct domain		
Mood disorder	−0.126 (0.387)	0.745
Anxiety disorder	−0.670 (0.397)	0.092
Eating disorder	0.747 (0.612)	0.223
Substance abuse	0.842 (0.671)	0.211
Externalizing	−0.954 (0.450)	0.035
Schizotypy	1.729 (0.517)	0.001
Other PD	−1.714 (0.940)	0.069
Normal personality	−0.949 (0.582)	0.104
Other individual difference	−0.019 (0.378)	0.959
Miscellaneous	1.855 (0.683)	0.007

MAXCOV, Maximum covariance; MAMBAC, mean above minus below a cut; MAXEIG, maximum eigenvalue; L-Mode, latent mode; MAXSLOPE, maximum slope; PD, personality disorder; S.E., standard error; df, degrees of freedom.

were more likely to be taxonic, and those in the externalizing domain were less likely.

Many successful predictors from these single-predictor analyses were correlated. For this reason, further analyses were conducted to tease apart unique effects. With a view to reducing the number of predictors in the final analysis, the quality index was used

Table 5. Findings of final multilevel logistic regression analysis predicting taxonic findings

Predictor	B (S.E.)	p
Publication year	0.039 (0.062)	0.532
Comparative fit index	−3.446 (0.881)	<0.001
Methodological quality	0.132 (0.173)	0.447
L-Mode	−1.391 (0.538)	0.011
MAXSLOPE	2.561 (0.741)	0.001
Construct domain		
Mood disorder	−1.764 (0.903)	0.051
Anxiety disorder	−2.168 (0.884)	0.015
Eating disorder	−1.867 (0.905)	0.040
Substance abuse	0.259 (2.341)	0.912
Externalizing	−0.510 (0.893)	0.568
Schizotypy	−1.189 (0.894)	0.185
Other PD	−2.966 (1.116)	0.009
Normal personality	−4.162 (1.030)	<0.001
Other individual difference	−1.684 (0.866)	0.052

L-Mode, Latent mode; MAXSLOPE, maximum slope; PD, personality disorder.

in place of the five predictors that constituted it. When the effects of the individual taxometric procedures were tested in analyses that also included quality, year and use of the CCFI, only L-Mode [$B = -1.144$, S.E. = 0.526, $t(303) = 2.18$, $p < 0.05$] and MAXSLOPE [$B = 2.101$, S.E. = 0.875, $t(303) = 2.40$, $p < 0.05$] were significant, so only these two procedure variables were retained for the final analysis. However, the 10 construct domains were retained (represented as nine dummy variables with the 'miscellaneous' domain as the baseline), given the theoretical interest in determining which substantive domains were more likely to contain taxa.

The final analysis therefore predicted taxonic effects with publication year at level 2, and quality, CCFI, L-Mode, MAXSLOPE and nine construct domain dummies at level 1. The results, shown in Table 5, indicate that the methodological quality effects obtained in the single-predictor analyses disappear when other variables are statistically controlled, and that only use of the CCFI is significantly associated with a lower likelihood of taxonic findings. Findings based at least in part on L-Mode were significantly less likely to be taxonic and those based in part on MAXSLOPE were more likely. The construct domain effects, which represent the likelihood of taxonic findings in each domain relative to the miscellaneous domain, indicate that taxonic findings are less prevalent in the domains of normal personality, abnormal personality (other than schizotypy), eating disorders and anxiety disorders, with marginal negative effects for mood disorders and other individual differences. An analogous

model with all variables grand-mean centered (such that each fixed parameter reflects the effect relative to the average study), leads to the same conclusions. Three of these effects were moderated by publication year: taxonic findings were less likely to be obtained in more recent studies of normal personality [$B = -0.204$, $S.E. = 0.103$, $t(283) = 1.98$, $p < 0.05$], externalizing disorders [$B = -0.455$, $S.E. = 0.183$, $t(283) = 2.49$, $p < 0.05$] and schizotypy [$B = -0.351$, $S.E. = 0.104$, $t(283) = 3.39$, $p < 0.005$].

Monte Carlo evidence (Ruscio & Kaczetow, 2009; Ruscio *et al.* 2010) indicates that the CCFI is a highly accurate method for discriminating between taxonic and dimensional data even under unfavourable measurement conditions. Our finding that use of the CCFI is associated with a markedly reduced rate of taxonic findings implies that some taxonic findings in which the index was not used may be spurious. The same may be true of studies of lower methodological quality, which were more common in early taxometric research and more likely to deliver taxonic findings. To estimate the 'true' prevalence of taxonicity in our sample of findings after controlling for these two potential sources of error, we ran a multilevel model using only the CCFI and quality index as predictors. The predictive equation, with a significant effect of CCFI ($B = -1.576$, $p < 0.001$) and a marginal effect of quality ($B = -0.201$, $p = 0.087$), was then used to estimate the probability of taxonic findings if the fit index was present (1) and quality was maximum (+3). The estimated probability (0.14) was markedly less than the proportion of taxonic findings reported in the literature (0.39). By implication, the taxometric literature substantially overstates the true frequency of taxa in its field of study.

Discussion

Our analysis of the taxometric literature has implications for taxometric methodology and for the latent structure of psychological phenomena. With regard to methodology, the analysis suggests that several factors that might plausibly influence taxometric research findings had no detectable effects. Different sample types (undergraduate, clinical, forensic, or child and adolescent) did not differ in rates of taxonic findings. The same was true of different data types (self-ratings, other-ratings and interview-based judgments) despite some concerns that self-report data may produce pseudo-taxonic findings (Beauchaine & Waters, 2003).

Other methodological factors that have been identified as potential sources of bias had systematic effects. Research using relatively small samples and few taxometric procedures was more likely to yield taxonic

findings, consistent with Meehl's (1995) view that modest samples are problematic and consistency testing essential. Use of dichotomous indicators was also associated with a higher rate of taxonic findings, as Ruscio (2000) contended, as was the use of indicator variables of questionable validity, such as those based on single items and those for which quantitative evidence of validity was not reported. Together these factors formed a reliable index of methodological quality that powerfully predicted rates of taxonic findings: methodologically stronger research tended not to find taxa. Unexpectedly, two taxometric procedures were also associated with taxonic findings, L-Mode negatively and MAXSLOPE positively. The latter effect may have limited importance because MAXSLOPE is rarely used.

Our review points to historical changes in taxometric practice. Methodological quality has improved over time, with recent findings more likely to use several distinct taxometric procedures, less likely to use small samples, and less likely to use indicators that are dichotomous, single-item, or lacking demonstrated validity. This rise in methodological quality has accompanied, and probably partly driven, a decline in taxonic findings. Clearly, the most important historical development in taxometric practice has been the analysis of simulated comparison data and use of the CCFI (Ruscio *et al.* 2007). This technique has rapidly become dominant in taxometric research, serving as an objective supplement or alternative to visual curve inspection, and our analysis found it to be a powerful predictor of structural findings. Research that did not use the technique was almost 3.5 times as likely to yield taxonic findings as research that did (56.6% *v.* 16.2%), and this effect persisted even when potentially confounding methodological and construct-related factors were statistically controlled.

The use of simulated comparison data has been controversial, and it might be argued that its negative association with taxonic findings reflects a pro-dimensional bias rather than enhanced validity. We consider this argument to be baseless. First, use of the CCFI was strongly and positively associated with methodological quality, implying that it is a positive adjunct to research that is methodologically stronger in other respects. Second, research that was methodologically stronger in uncontroversial ways (e.g. larger samples, use of more convergent data-analytic procedures) was also associated with lower rates of taxonic findings. Third, substantial Monte Carlo evidence (Ruscio *et al.* 2007, 2010; Ruscio & Kaczetow, 2009) attests to the CCFI's high accuracy, its robustness over a wide range of unfavourable measurement conditions that occur in real research settings, and its lack of significant bias either for or against taxonic

findings. For example, Ruscio *et al.*'s (2010) analysis of 100 000 simulated data sets found that the CCFI correctly identified taxonic and dimensional data with equally high accuracy.

The reorientation of taxometric research in favour of dimensional models that the simulated comparison data technique has brought about is substantial. Our findings indicate that methodologically stronger research that uses the CCFI is particularly unlikely to find taxa, whereas early, pre-CCFI taxometric research, which seemed to find many taxa, tended to be methodologically weaker. By implication, early taxometric research is likely to contain invalid taxonic findings. Our analysis estimated the rate of taxonic findings in our 177 articles to be 14% rather than the observed 39%, had the CCFI always been used in studies of high methodological quality. If this estimate is accurate, almost two-thirds of reported taxonic findings are invalid. Moreover, most of the invalid findings would be found among the 56.3% of findings (175 of 311) in which the CCFI was not used. The reported rate of taxonic findings in these studies was 56.6% (99 of 175), so if the 'true' rate of taxonicity was approximately 14% then three out of four taxonic findings generated by non-CCFI studies were probably spurious.

The way in which research using simulated comparison data and the CCFI has challenged earlier taxonic findings is well illustrated by anxiety sensitivity and antisociality (i.e. antisocial conduct, antisocial PD, criminal lifestyle and thinking styles, and psychopathy). The first seven articles on anxiety sensitivity, published between 2005 and 2007, did not use the CCFI and generated 11 exclusively taxonic findings. The next three, published from 2008 to 2011, used the CCFI and generated seven exclusively non-taxonic findings (mean CCFI = 0.34). An equally stark reversal occurred for antisociality: four early articles (1994–2005) that did not use the CCFI yielded exclusively taxonic findings whereas 17 later articles (2006–2011) that did use the CCFI yielded 18 consistently non-taxonic findings (all CCFIs < 0.40, mean = 0.28). The CCFI data-analytic strategy can therefore sharply and replicably challenge early taxonic findings.

If the 'true' rate of taxonic findings in the 177 taxometric articles is only about 14%, then taxonic latent structure is rather rare in psychology and psychiatry, instead of being common as the 39% figure would suggest. If it is further assumed that taxometric researchers have selectively examined latent variables for which taxonic structure was plausible, and have attempted to replicate findings where such structure was initially supported (e.g. the 29 findings on schizotypy), then taxa may be even rarer in the

domains of personality and psychopathology than the former figure suggests.

This conclusion regarding dimensional *versus* categorical latent variation complements the findings of a recent meta-analysis of continuous *versus* discrete observed variation (Markon *et al.* 2011). Continuous measures of psychopathology were on average 15% more reliable and 37% more valid than discrete measures, a superiority that was invariant across different construct types. The authors proposed that 'in the absence of a specific rationale for the contrary, continuous measures of psychopathology should be preferred over discrete measures *a priori*.' Our findings suggest that dimensional models of the latent structure of personality and psychopathology should similarly be preferred over categorical models *a priori*, with the proviso that if 14% of taxometric findings are validly taxonic then there may be specific rationales to the contrary in some cases. Our findings certainly do not justify blanket claims that all psychological variation is latently continuous.

The findings of this review help to identify where latent discontinuities exist. They strongly suggest, as expected, that taxa are unlikely to be found in the domains of normal personality and PDs, supporting the standard assumptions of trait theory on the one hand and much recent PD scholarship on the other (e.g. Clark, 2007). The findings also suggest that taxa are scarce within the internalizing spectrum, such as in the mood, anxiety and eating disorders, and also in the general externalizing domain. The only domains in which taxonic findings were at least somewhat prevalent were schizotypy and substance use disorders. Neither set of findings was consistently taxonic, the substance use domain was not significantly associated with taxonicity in the single-predictor analysis, and neither domain yielded taxonic findings at a significantly higher rate compared to the miscellaneous domain or to the average study in the final analysis. Nevertheless, these two domains stood out as offering at least some support for the existence of taxa. The schizotypy domain finding is perhaps unsurprising given its long record of taxonic findings, dating back to Golden & Meehl (1979). Both findings qualify the conclusion that abnormal personality and externalizing disorders tend to be latently continuous: schizotypy and substance use may be at least partial exceptions to these generalizations.

In deciding which specific latent variables may be taxonic, it seems prudent to give special weight to those taxonic findings in which the CCFI was used, given the apparent taxonic bias of research in which it was not. Fifteen such findings (excluding two from the miscellaneous domain) exceed a conservative criterion for taxonicity (CCFI > 0.6). These findings

predominantly represent the domains of substance use (seven) and other individual differences (four). The domains of mood (depression: Ruscio *et al.* 2009), anxiety (social anxiety disorder: Weeks *et al.* 2010), eating (binge-eating disorder: Hilbert *et al.* 2011) and externalizing disorders (intermittent explosive disorder: Ahmed *et al.* 2010) are represented by one finding each. These solo findings do not provide a strong basis for inferring taxa as they are either unreplicated or run contrary to many non-taxonic findings for the same construct.

The existence of substance use taxa is supported by elevated CCFI values in five studies of alcohol abuse, misuse or dependence (Walters, 2008, 2009*a*; Walters *et al.* 2009*c*; Walters & Ruscio, 2010; Green *et al.* 2011) and in two studies of nicotine dependence (Goedeker & Tiffany, 2008). Although several studies using the CCFI have yielded non-taxonic findings in this domain (alcohol abuse and dependence: Slade *et al.* 2009; Walters *et al.* 2010*a*; cannabis dependence: Denson & Earlywine, 2006; nicotine dependence: Ginestet *et al.* 2008), there is at least some replicated evidence that substance use taxa exist.

In the 'other individual differences' domain, three of the four strongly taxonic findings relate to autism and its subtypes (Ingram *et al.* 2008; Frazier *et al.* 2010). Although two of these findings came in the context of a study in which five other possible subtypes seemed to be non-taxonic (Ingram *et al.* 2008), there is now consistent support for the existence of taxa in the autism realm, including an additional study that did not use the CCFI (Munson *et al.* 2008).

In sum, after 32 years of taxometric research, the methodologically strongest evidence for the existence of taxa is in the areas of alcohol- and nicotine-related substance use and autism. Schizotypy should probably be added because a clear majority of the findings addressing it have been taxonic, although the only ones to use the CCFI have not (Rawlings *et al.* 2008). We therefore suggest that the taxometric literature clearly supports the existence of taxa only in the areas of schizotypy, autism and substance use disorders. Ideally, researchers should go beyond identifying such taxa and demonstrate that they have construct validity, such as predicted patterns of association with external variables (Hasin *et al.* 2006; Prisciandaro & Roberts, 2011), in the absence of which evidence for taxonicity can be questioned (Watson, 2003). We also acknowledge that taxometrics is just one statistical approach to the question of latent structure, and any comprehensive analysis of the existence and distribution of latent categories in personality and psychopathology must integrate its findings with those of other approaches, which may differ systematically.

Conclusions

Taxometrics was launched as a rigorous method for 'solving' (Meehl, 1995) a fundamental question in the study of personality and psychopathology. Three decades of research allow us to review its answers. The collected evidence of this review is that latent categories are very scarce in normal and abnormal personality and infrequent but not absent in the broad arena of psychopathology. Taxa are most likely few and far between in the domains of internalizing and externalizing disorders, with the partial exception of substance use conditions. They may also occur in additional forms of psychopathology, notably schizotypy and autism. Other taxa may exist, but taxometric evidence for them is preliminary and runs against the strongly dimensional tide of recent research. Early taxometric research findings performed a valuable role in raising the issue of latent structure and giving credence to the possibility of psychological taxa, but their findings may often have been spurious. Taxometric research supports the conclusion that most psychological variation is dimensional, with a few potentially important exceptions.

Declaration of Interest

None.

References (* used in review)

- *Ahmed AO, Green BA, McCloskey MS, Berman ME (2010). Latent structure of intermittent explosive disorder in an epidemiological sample. *Journal of Psychiatric Research* **44**, 663–672.
- *Ambrosini PJ, Bennett DS, Cleland CM, Haslam N (2003). Taxonicity of adolescent melancholia: a categorical or dimensional construct? *Journal of Psychiatric Research* **36**, 247–256.
- *Arnau RC, Green BA, Rosen DH, Gleaves DH, Melancon JG (2003). Are Jungian preferences really categorical? An empirical investigation using taxometric analysis. *Personality and Individual Differences* **34**, 233–251.
- Arnau RC, Thompson RL, Cook C (2001). Do different response formats change the latent structure of responses? An empirical investigation using taxometric analysis. *Educational and Psychological Measurement* **61**, 23–44.
- *Arntz A, Bernstein D, Gielen D, van Nieuwenhuijzen M, Penders K, Haslam N, Ruscio J (2009). Taxometric evidence for the dimensional structure of cluster-C, paranoid and borderline personality disorders. *Journal of Personality Disorders* **23**, 606–628.
- Asendorpf J (2002). Editorial: The puzzle of personality types. *European Journal of Personality* **16**, S1–S5.
- *Asmundson GJG, Collimore KC, Bernstein A, Zvolensky MJ, Hadjistavropoulos HD (2007). Is the latent

- structure of fear of pain continuous or discontinuous among pain patients? Taxometric analysis of the pain anxiety symptoms scale. *Journal of Pain* 8, 387–395.
- *Asmundson GJG, Hadjistavropoulos HD, Bernstein A, Zvolensky MJ (2009). Latent structure of fear of pain: an empirical test among a sample of community dwelling older adults. *European Journal of Pain* 13, 419–425.
- *Asmundson GJG, Weeks JW, Carleton RN, Thibodeau MA, Fetzner MG (2011). Revisiting the latent structure of the anxiety sensitivity construct: more evidence of dimensionality. *Journal of Anxiety Disorders* 25, 138–147.
- *Baldwin G, Shean GD (2006). A taxometric study of the Center for Epidemiological Studies depression scale. *Genetic, Social and General Psychology Monographs* 132, 101–128.
- *Beach SRH, Amir N (2003). Is depression taxonic, dimensional, or both? *Journal of Abnormal Psychology* 112, 228–236.
- Beach SRH, Amir N, Bau J (2005a). Can sample specific simulations help detect low base rate taxonicity? *Psychological Assessment* 17, 446–461.
- *Beach SRH, Fincham FD, Amir N, Leonard KE (2005b). The taxometrics of marriage: is marital discord categorical? *Journal of Family Psychology* 19, 276–285.
- Beauchaine TP, Waters E (2003). Pseudotaxonicity in MAMBAC and MAXCOV analyses of rating-scale data: turning continua into classes by manipulating observers' expectations. *Psychological Methods* 8, 3–15.
- *Bernstein A, Zvolensky MJ, Feldner MT, Lewis SF, Leen-Feldner EW (2005). Anxiety sensitivity taxonicity: a concurrent test of cognitive vulnerability for post-traumatic stress symptomatology among young adults. *Cognitive Behaviour Therapy* 34, 229–241.
- *Bernstein A, Zvolensky MJ, Kotov R, Arrindell WA, Taylor S, Sandin B, Cox BJ, Stewart SH, Bouvard M, Cardenas SJ, Eifert GH, Schmidt NB (2006). Taxonicity of anxiety sensitivity: a multi-national analysis. *Journal of Anxiety Disorders* 20, 1–22.
- *Bernstein A, Zvolensky MJ, Norton PJ, Schmidt NB, Taylor S, Forsyth JP, Lewis SF, Feldner MT, Leen-Feldner EW, Stewart SH, Cox B (2007). Taxometric and factor analytic models of anxiety sensitivity: integrating approaches to latent structural research. *Psychological Assessment* 19, 74–87.
- *Bernstein A, Zvolensky MJ, Stewart S, Comeau N (2007). Taxometric and factor analytic models of anxiety sensitivity among youth: exploring the latent structure of anxiety psychopathology vulnerability. *Behavior Therapy* 38, 269–283.
- *Bernstein A, Zvolensky MJ, Stewart SH, Comeau MN, Leen-Feldner EW (2006). Anxiety sensitivity taxonicity across gender among youth. *Behaviour Research and Therapy* 44, 679–698.
- *Bernstein A, Zvolensky MJ, Weems C, Stickle T, Leen-Feldner EW (2005). Taxonicity of anxiety sensitivity: an empirical test among youth. *Behaviour Research and Therapy* 43, 1131–1155.
- *Blanchard JJ, Gangestad SW, Brown SA, Horan WP (2000). Hedonic capacity and schizotypy revisited: a taxometric analysis of social anhedonia. *Journal of Abnormal Psychology* 109, 87–95.
- *Blanchard JJ, Horan WP, Collins LM (2005). Examining the latent structure of negative symptoms: is there a distinct subtype of negative symptom schizophrenia? *Schizophrenia Research* 77, 151–165.
- *Braverman J, LaBrie RA, Shaffer HJ (2011). A taxometric analysis of actual internet sports gambling behavior. *Psychological Assessment* 23, 234–244.
- *Broman-Fulks JJ, Deacon BJ, Olatunji BO, Bondy CL, Abramowitz JS, Tolin DF (2010). Categorical or dimensional: a reanalysis of the anxiety sensitivity. *Behavior Therapy* 41, 154–171.
- *Broman-Fulks JJ, Green BA, Berman ME, Olatunji BO, Arnau RC, Deacon BJ, Sawchuk CN (2008). The latent structure of anxiety sensitivity – revisited. *Assessment* 15, 188–203.
- *Broman-Fulks JJ, Hill RW, Green BA (2008). Is perfectionism categorical or dimensional? A taxometric analysis. *Journal of Personality Assessment* 90, 481–490.
- *Broman-Fulks JJ, Ruggiero KJ, Green BA, Kilpatrick DG, Danielson KM, Resnick HS, Saunders BE (2006). Taxometric investigation of PTSD: data from two nationally representative samples. *Behavior Therapy* 37, 364–380.
- *Broman-Fulks JJ, Ruggiero KJ, Green BA, Smith DW, Hanson RF, Kilpatrick DG, Saunders BE (2009). The latent structure of posttraumatic stress disorder among adolescents. *Journal of Traumatic Stress* 22, 146–152.
- Bryk AS, Raudenbush SW (1992). *Hierarchical Linear Models for Social and Behavioral Research: Applications and Data Analysis Methods*. Sage Publications: Newbury Park, CA.
- Clark LA (2007). Assessment and diagnosis of personality disorder: perennial issues and an emerging reconceptualization. *Annual Review of Psychology* 58, 227–257.
- *Crome E, Baillie A, Slade T, Ruscio AM (2010). Social phobia: further evidence of dimensional structure. *Australian and New Zealand Journal of Psychiatry* 44, 1012–1020.
- *Cuesta MJ, Ugarte MD, Goicoa T, Eraso S, Peralta V (2007). A taxometric analysis of schizophrenia symptoms. *Psychiatry Research* 150, 245–253.
- *Daneluzzo E, Stratta P, Di Tommaso S, Pacifico R, Riccardi I, Rossi A (2009). Dimensional, non-taxonic latent structure of psychotic symptoms in a student sample. *Social Psychiatry and Psychiatric Epidemiology* 44, 911–916.
- De Boeck P, Wilson M, Acton GS (2005). A conceptual and psychometric framework for distinguishing categories and dimensions. *Psychological Review* 112, 129–158.
- *Denson TF, Earleywine M (2006). Pothead or pot smoker? A taxometric investigation of cannabis dependence. *Substance Abuse Treatment, Prevention, and Policy* 1, 22.
- *Denson TF, Iyer R, Lickel B (2010). Racist or racism? Taxometric support for a dimensional latent structure of explicit prejudice. *Group Processes and Intergroup Relations* 13, 113–128.

- *Dollaghan CA (2004). Taxometric analyses of specific language impairment in 3- and 4-year-old children. *Journal of Speech, Language and Hearing* **47**, 464–475.
- *Dragovic M, Milenkovic S, Hammond G (2008). The distribution of hand preference is discrete: a taxometric examination. *British Journal of Psychology* **99**, 445–459.
- Eaton NR, Krueger RF, South SC, Simms LJ, Clark LA (2011). Contrasting prototypes and dimensions in the classification of personality pathology: evidence that dimensions, but not prototypes, are robust. *Psychological Medicine* **41**, 1151–1163.
- *Edens JF, Marcus DK, Lilienfeld SO, Poythress NJ (2006). Psychopathic, not psychopath: taxometric evidence for the dimensional structure of psychopathy. *Journal of Abnormal Psychology* **115**, 131–144.
- *Edens JF, Marcus DK, Morey LC (2009). Paranoid personality has a dimensional latent structure: taxometric analyses of community and clinical samples. *Journal of Abnormal Psychology* **118**, 545–553.
- *Edens JF, Marcus DK, Ruiz MA (2008). Taxometric analyses of borderline personality features in a large-scale male and female offender sample. *Journal of Abnormal Psychology* **117**, 705–711.
- *Edens JF, Marcus DK, Vaughn MG (2011). Exploring the taxometric status of psychopathy among youthful offenders: is there a juvenile psychopath taxon? *Law and Human Behavior* **35**, 13–24.
- Enders CK, Tofighi D (2007). Centering predictor variables in cross-sectional multilevel models: a new look at an old issue. *Psychological Methods* **12**, 121–138.
- *Erlenmeyer-Kimling L, Golden RR, Cornblatt BA (1989). A taxometric analysis of cognitive and neuromotor variables in children at risk for schizophrenia. *Journal of Abnormal Psychology* **98**, 203–208.
- *Ferguson E (2009). A taxometric analysis of health anxiety. *Psychological Medicine* **39**, 277–285.
- *Ferguson E, Williams L, O'Connor R, Howard S, Hughes B, Johnston DW, Allan JL, O'Connor DB, Lewis CA, Grealy MA, O'Carroll RE (2009). A taxometric analysis of type-D personality. *Psychosomatic Medicine* **71**, 981–986.
- *Forbes D, Haslam N, Williams B, Creamer M (2005). Testing the latent structure of PTSD: a taxometric study of combat veterans. *Journal of Traumatic Stress* **18**, 647–656.
- *Fossati A, Beauchaine TP, Grazioli F, Carretta I, Cortinovis F, Maffei C (2005). A latent structure analysis of Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Narcissistic Personality Disorder criteria. *Comprehensive Psychiatry* **46**, 361–367.
- *Fossati A, Raine A, Borroni S, Maffei C (2007). Taxonic structure of schizotypal personality in nonclinical subjects: issues of replicability and age consistency. *Psychiatry Research* **152**, 103–112.
- *Foster JD, Campbell WK (2007). Are there such things as 'narcissists' in social psychology? A taxometric analysis of the Narcissistic Personality Inventory. *Personality and Individual Differences* **43**, 1321–1332.
- *Fraleigh RC, Spieker SJ (2003). Are infant attachment patterns continuously or categorically distributed? A taxometric analysis of strange situation behavior. *Developmental Psychology* **39**, 387–404.
- *Franklin CL, Strong DR, Greene RL (2002). A taxometric analysis of the MMPI-2 depression scales. *Journal of Personality Assessment* **79**, 110–121.
- *Frazier TW, Youngstrom EA, Naugle RI (2007). The latent structure of attention-deficit/hyperactivity disorder in a clinic-referred sample. *Neuropsychology* **21**, 45–64.
- *Frazier TW, Youngstrom EA, Naugle RI, Haggerty KA, Busch RM (2007). The latent structure of cognitive symptom exaggeration on the Victoria Symptom Validity Test. *Archives of Clinical Neuropsychology* **22**, 197–211.
- *Frazier TW, Youngstrom EA, Sinclair L, Kubu CS, Law P, Rezaei A, Constantino JN, Eng C (2010). Autism spectrum disorders as a qualitatively distinct category from typical behavior in a large, clinically ascertained sample. *Assessment* **17**, 308–320.
- *Gangestad SW, Bailey JM, Martin NG (2000). Taxometric analyses of sexual orientation and gender identity. *Journal of Personality and Social Psychology* **78**, 1109–1121.
- *Gangestad SW, Snyder M (1985). 'To carve nature at its joints': on the existence of discrete classes in personality. *Psychological Review* **92**, 317–349.
- *Gibb BE, Alloy LB, Abramson LY, Beevers CG, Miller IW (2004). Cognitive vulnerability to depression: a taxometric analysis. *Journal of Abnormal Psychology* **113**, 81–89.
- *Ginestet CE, Mitchell K, Wellman N (2008). Taxometric investigation of the latent structure of nicotine dependence: an epidemiological sample. *Nicotine and Tobacco Research* **10**, 833–841.
- *Gleaves DH, Lowe MR, Green BA, Cororve MB, Williams TL (2000). Do anorexia and bulimia nervosa occur on a continuum? A taxometric analysis. *Behavior Therapy* **31**, 195–219.
- *Gleaves DH, Lowe MR, Snow AC, Green BA, Murphy-Eberenz KP (2000). Continuity and discontinuity models of bulimia nervosa: a taxometric investigation. *Journal of Abnormal Psychology* **109**, 56–68.
- *Goedeker KC, Tiffany ST (2008). On the nature of nicotine addiction: a taxometric analysis. *Journal of Abnormal Psychology* **117**, 896–909.
- *Golden RR (1982). A taxometric model for the detection of a conjectured latent taxon. *Multivariate Behavioral Research* **17**, 389–416.
- *Golden RR, Campbell M, Perry R (1987). A taxometric method for diagnosis of tardive dyskinesia. *Journal of Psychiatric Research* **21**, 233–241.
- *Golden RR, Meehl PE (1979). Detection of the schizoid taxon with MMPI indicators. *Journal of Abnormal Psychology* **88**, 217–233.
- *Green BA, Ahmed AO, Marcus DK, Walters GD (2011). The latent structure of alcohol use pathology in an epidemiological sample. *Journal of Psychiatric Research* **45**, 225–233.
- *Grove WM, Andreasen NC, Young M, Endicott J, Keller MB, Hirschfeld RMA, Reich T (1987). Isolation and characterization of a nuclear depressive syndrome. *Psychological Medicine* **17**, 471–484.
- *Guay J, Ruscio J, Hare R, Knight RA (2007). A taxometric study of the latent structure of psychopathy: evidence for dimensionality. *Journal of Abnormal Psychology* **116**, 701–716.

- *Hankin BL, Fraley RC, Lahey BB, Waldman ID (2005). Is depression best viewed as a continuum or discrete category? A taxometric analysis of childhood and adolescent depression in a population-based sample. *Journal of Abnormal Psychology* **114**, 96–110.
- *Harris GT, Rice ME, Hilton NZ, Lalumiere ML, Quinsey VL (2007). Coercive and precocious sexuality as a fundamental aspect of psychopathy. *Journal of Personality Disorders* **21**, 1–27.
- *Harris GT, Rice ME, Quinsey VL (1994). Psychopathy as a taxon: evidence that psychopaths are a discrete class. *Journal of Consulting and Clinical Psychology* **62**, 387–397.
- Hasin DS, Liu X, Alderson D, Grant BF (2006). DSM-IV alcohol dependence: a categorical or dimensional phenotype? *Psychological Medicine* **36**, 1695–1705.
- *Haslam N (1994). Categories of social relationship. *Cognition* **53**, 59–90.
- *Haslam N (1997). Evidence that male sexual orientation is a matter of degree. *Journal of Personality and Social Psychology* **73**, 862–870.
- *Haslam N (1999). Taxometric and related methods in relationships research. *Personal Relationships* **6**, 519–534.
- Haslam N (2003). The dimensional view of personality disorders: a review of the taxometric evidence. *Clinical Psychology Review* **23**, 75–93.
- Haslam N (2007). Do categories or dimensions underlie mental disorders? An update on the taxometric evidence. *Current Psychiatry Reviews* **3**, 172–177.
- *Haslam N, Beck AT (1994). Subtyping major depression: a taxometric analysis. *Journal of Abnormal Psychology* **103**, 686–692.
- *Haslam N, Bornstein BH (1996). Envy and jealousy as discrete emotions: a taxometric analysis. *Motivation and Emotion* **20**, 255–272.
- Haslam N, Kim H (2002). Categories and continua: a review of taxometric research. *Genetic, Social and General Psychology Monographs* **128**, 271–320.
- *Haslam N, Williams B, Prior M, Haslam R, Graetz B, Sawyer M (2006). Testing the latent structure of ADHD: a taxometric analysis. *Australian and New Zealand Journal of Psychiatry* **40**, 639–647.
- *Haslam N, Williams BJ, Kyrios M, McKay D, Taylor S (2005). Subtyping obsessive-compulsive disorder: a taxometric analysis. *Behavior Therapy* **36**, 381–391.
- Helzer JE, Kraemer HC, Krueger RF (eds) (2008). *Dimensional Approaches in Diagnostic Classification: Refining the Research Agenda for DSM-V*. American Psychiatric Association: Washington, DC.
- *Hilbert A, Pike KM, Wilfley DE, Fairburn CG, Dohm F, Striegel-Moore RH (2011). Clarifying boundaries of binge eating disorder and psychiatric comorbidity: a latent structure analysis. *Behaviour Research and Therapy* **49**, 202–211.
- *Holland JM, Neimeyer RA, Boelen PA, Prigerson HG (2009). The underlying structure of grief: a taxometric investigation of prolonged and normal reactions to loss. *Journal of Psychopathology and Behavioral Assessment* **31**, 190–201.
- *Holland JM, Schutte KK, Brennan PL, Moos RH (2010). The structure of late-life depressive symptoms across a 20-year span: a taxometric investigation. *Psychology and Aging* **25**, 142–156.
- *Holm-Denoma JM, Richey JA, Joiner TA (2010). The latent structure of dietary restraint, body dissatisfaction, and drive for thinness: a series of taxometric analyses. *Psychological Assessment* **22**, 788–797.
- *Horan WP, Blanchard JJ, Gangestad SW, Kwapil TR (2004). The psychometric detection of schizotypy: do putative schizotypy indicators identify the same latent class? *Journal of Abnormal Psychology* **113**, 339–357.
- *Ingram DG (2009). Is the metabolic syndrome a discrete diagnostic category or the end of a continuum? Taxometric evidence for dimensionality in the National Health and Nutrition Examination Survey 1999–2004. *Annals of Epidemiology* **19**, 143–147.
- *Ingram DG, Kattan MW (2010). Risk grouping versus risk continuum in patients with clinically localized prostate cancer: a taxometric test. *Journal of Urology* **184**, 1937–1941.
- *Ingram DG, Takahashi TN, Miles JH (2008). Defining autism subgroups: a taxometric solution. *Journal of Autism and Developmental Disorders* **38**, 950–960.
- *Kollman DM, Brown TA, Liverant GI, Hofmann SG (2006). A taxometric investigation of the latent structure of social anxiety disorder in outpatients with anxiety and mood disorders. *Depression and Anxiety* **23**, 190–199.
- *Korfine L, Lenzenweger MF (1995). The taxonicity of schizotypy: a replication. *Journal of Abnormal Psychology* **104**, 26–31.
- *Kotov R, Schmidt NB, Lerew DR, Joiner TE, Ialongo NS (2005). Latent structure of anxiety: taxometric exploration. *Psychological Assessment* **17**, 369–374.
- *Lenzenweger MF (1999). Deeper into the schizotypy taxon: on the robust nature of maximum covariance analysis. *Journal of Abnormal Psychology* **108**, 182–187.
- *Lenzenweger MF, Korfine L (1992). Confirming the latent structure and base rate of schizotypy: a taxometric analysis. *Journal of Abnormal Psychology* **101**, 567–571.
- *Lenzenweger MF, McLachlan G, Rubin DB (2007). Resolving the latent structure of schizophrenia endophenotypes using expectation-maximization-based finite mixture modeling. *Journal of Abnormal Psychology* **116**, 16–29.
- *Linscott RJ (2007). The latent structure and coincidence of hypohedonia and schizotypy and their validity as indices of psychometric risk for schizophrenia. *Journal of Personality Disorders* **21**, 225–242.
- *Linscott RJ, Marie D, Arnott KL, Clarke BL (2006). Over-representation of Maori New Zealanders among adolescents in a schizotypy taxon. *Schizophrenia Research* **84**, 289–296.
- *Longley SL, Broman-Fulks JJ, Calamari JE, Noyes R, Wade M, Orlando CM (2010). A taxometric study of hypochondriasis symptoms. *Behavior Therapy* **41**, 505–514.
- *Marcus DK, Barry TD (2011). Does attention-deficit/hyperactivity disorder have a dimensional latent structure? A taxometric analysis. *Journal of Abnormal Psychology* **120**, 427–442.
- *Marcus DK, Fulton JJ, Turchik JA (2011). Is risky sexual behavior continuous or categorical? A taxometric analysis

- of the Sexual Risk Survey. *Psychological Assessment* **23**, 282–286.
- ***Marcus DK, John S, Edens JF** (2004). A taxometric analysis of psychopathy. *Journal of Abnormal Psychology* **113**, 626–635.
- ***Marcus DK, Lilienfeld SO, Edens JF, Poythress NG** (2006). Is antisocial personality disorder continuous or categorical? A taxometric analysis. *Psychological Medicine* **36**, 1571–1581.
- ***Marcus DK, Poythress NG, Edens JF, Lilienfeld SO** (2010). Adjudicative competence: evidence that impairment in 'rational understanding' is taxonic. *Psychological Assessment* **22**, 716–722.
- ***Marcus DK, Ruscio J, Lilienfeld SO, Hughes KT** (2008). Converging evidence for the latent structure of antisocial personality disorder: consistency of taxometric and latent class analyses. *Criminal Justice and Behavior* **35**, 284–293.
- Markon KE, Chmielewski M, Miller CJ** (2011). The reliability and validity of discrete and continuous measures of psychopathology: a quantitative review. *Psychological Bulletin* **137**, 856–879.
- Markon KE, Krueger RF** (2006). Information-theoretic latent distribution modelling: distinguishing discrete and continuous latent variable models. *Psychological Methods* **11**, 228–243.
- ***Mattila AK, Keefer KV, Taylor GJ, Joukamaa M, Jula A, Parker JDA, Bagby RM** (2010). Taxometric analysis of alexithymia in a general population sample from Finland. *Personality and Individual Differences* **49**, 216–221.
- McGrath RE, Neubauer J, Meyer GJ, Tung K** (2009). Instructional set and the structure of responses to rating scales. *Personality and Individual Differences* **46**, 116–122.
- McLachlan G, Peel D** (2000). *Finite Mixture Models*. Wiley: New York.
- Meehl PE** (1977). Specific etiology and other forms of strong influence: some quantitative meanings. *Journal of Medicine and Philosophy* **2**, 33–53.
- Meehl PE** (1992). Factors and taxa, traits and types, difference of degree and differences in kind. *Journal of Personality* **60**, 117–174.
- Meehl PE** (1995). Bootstraps taxometrics: solving the classification problem in psychopathology. *American Psychologist* **50**, 266–275.
- Meehl PE, Yonce LJ** (1994). Taxometric analysis: I. Detecting taxonicity with two quantitative indicators using means above and below a sliding cut (MAMBAC procedure). *Psychological Reports* **74**, 1059–1274.
- Meehl PE, Yonce LJ** (1996). Taxometric analysis: II. Detecting taxonicity using covariance of two quantitative indicators in successive intervals of a third indicator (MAXCOV procedure). *Psychological Reports* **78**, 1091–1227.
- ***Meyer T, Keller F** (2001). Exploring the latent structure of the Perceptual Aberration, Magical Ideation and Physical Anhedonia Scales in a German sample: a partial replication. *Journal of Personality Disorders* **15**, 521–535.
- ***Meyer T, Keller F** (2003). Is there evidence for a latent class called 'hypomanic temperament'? *Journal of Affective Disorders* **75**, 259–267.
- ***Munson J, Dawson G, Sterling L, Beauchaine T, Zhou A, Koehler E, Lord C, Rogers S, Sigman M, Estes A, Abbott R** (2008). Evidence for latent classes of IQ in young children with autism spectrum disorder. *American Journal of Mental Retardation* **113**, 439–452.
- ***Murrie DC, Marcus DK, Douglas KS, Lee Z, Salekin RT, Vincent G** (2007). Youth with psychopathy features are not a discrete class: a taxometric analysis. *Journal of Child Psychology and Psychiatry* **48**, 714–723.
- ***Oakman JM, Woody EZ** (1996). A taxometric analysis of hypnotic susceptibility. *Journal of Personality and Social Psychology* **71**, 980–991.
- ***Okumura Y, Sakamoto S, Ono Y** (2009). Latent structure of depression in a Japanese population sample: taxometric procedures. *Australian and New Zealand Journal of Psychiatry* **43**, 666–673.
- ***Okumura Y, Sakamoto S, Tomoda A, Kijima N** (2009). Latent structure of self-reported depression in undergraduates: using taxometric procedures and information-theoretic latent variable modelling. *Personality and Individual Differences* **46**, 166–171.
- ***Olatunji BO, Broman-Fulks JJ** (2007). A taxometric study of the latent structure of disgust sensitivity: converging evidence for dimensionality. *Psychological Assessment* **19**, 437–448.
- ***Olatunji BO, Broman-Fulks JJ** (2009). Latent structure of aversion: taxometric exploration. *Journal of Anxiety Disorders* **23**, 87–92.
- ***Olatunji BO, Broman-Fulks JJ, Bergman SM, Green BA, Zlomke KR** (2010). A taxometric investigation of the latent structure of worry: dimensionality and associations with depression, anxiety, and stress. *Behavior Therapy* **41**, 212–228.
- ***Olatunji BO, Williams B, Haslam N, Abramowitz JS, Tolin DF** (2008). The latent structure of obsessive-compulsive symptoms: a taxometric study. *Depression and Anxiety* **25**, 956–968.
- ***Parker JDA, Keefer KV, Taylor GJ, Bagby RM** (2008). Latent structure of the alexithymia construct: a taxometric investigation. *Psychological Assessment* **20**, 385–396.
- ***Prisciandaro JJ, Roberts JE** (2005). A taxometric investigation of unipolar depression in the National Comorbidity Survey. *Journal of Abnormal Psychology* **114**, 718–728.
- ***Prisciandaro JJ, Roberts JE** (2011). Evidence for the continuous latent structure of mania in the Epidemiological Catchment Area from multiple latent structure and construct validation methodologies. *Psychological Medicine* **41**, 575–588.
- ***Rawlings D, Williams B, Haslam N, Claridge G** (2008). Taxometric analysis supports a dimensional latent structure for schizotypy. *Personality and Individual Differences* **44**, 1640–1651.
- ***Rhudy JL, Green BA, Arnau RC, France CR** (2008). Taxometric analysis of biceps femoris EMG following electrocutaneous stimulation over the sural nerve: determining the latent structure of the nociceptive flexion reflex (NFR). *International Journal of Psychophysiology* **69**, 18–26.
- ***Richey JA, Schmidt NB, Lonigan CJ, Philips BM, Catanzaro SJ, Laurent J, Gerhardstein RR, Kotov R** (2009). The latent structure of child depression: a taxometric

- analysis. *Journal of Child Psychiatry and Psychology* **50**, 1147–1155.
- ***Roisman GI, Fraley RC, Belsky J** (2007). A taxometric study of the adult attachment interview. *Developmental Psychology* **43**, 675–686.
- ***Rothschild L, Cleland C, Haslam N, Zimmerman M** (2003). Taxometric analysis of borderline personality disorder. *Journal of Abnormal Psychology* **112**, 657–666.
- ***Ruscio AM** (2010). The latent structure of social anxiety disorder: consequences of shifting to a dimensional diagnosis. *Journal of Abnormal Psychology* **119**, 662–671.
- ***Ruscio AM, Borkovec TD, Ruscio JP** (2001). A taxometric investigation of the latent structure of worry. *Journal of Abnormal Psychology* **110**, 413–422.
- ***Ruscio AM, Ruscio J** (2002). The latent structure of analogue depression: should the BDI be used to classify groups? *Psychological Assessment* **14**, 135–145.
- ***Ruscio AM, Ruscio J, Keane TM** (2002). The latent structure of post-traumatic stress disorder: a taxometric investigation of reactions to extreme stress. *Journal of Abnormal Psychology* **111**, 290–301.
- Ruscio J** (2000). Taxometric analysis with dichotomous indicators: the modified MAXCOV procedure and a case-removal consistency test. *Psychological Reports* **87**, 929–939.
- ***Ruscio J, Brown TA, Ruscio AM** (2009). A taxometric investigation of DSM-IV major depression in a large outpatient sample: interpretable structural results depend on the mode of assessment. *Assessment* **16**, 127–144.
- Ruscio J, Haslam N, Ruscio AM** (2006). *Introduction to the Taxometric Method: A Practical Guide*. Lawrence Erlbaum Associates: Mahwah, NJ.
- Ruscio J, Kaczetow W** (2009). Differentiating categories and dimensions: evaluating the robustness of taxometric analyses. *Multivariate Behavioral Research* **44**, 259–280.
- Ruscio J, Marcus DK** (2007). Detecting small taxa using simulated comparison data: a reanalysis of Beach, Amir, and Bau's (2005) data. *Psychological Assessment* **19**, 241–246.
- ***Ruscio J, Ruscio AM** (2000). Informing the continuity controversy: a taxometric analysis of depression. *Journal of Abnormal Psychology* **109**, 473–487.
- ***Ruscio J, Ruscio AM, Keane TM** (2004). Using taxometric analysis to distinguish a small latent taxon from a latent dimension with positively skewed indicators: the case of involuntary defeat syndrome. *Journal of Abnormal Psychology* **113**, 145–154.
- Ruscio J, Ruscio AM, Meron M** (2007). Applying the bootstrap to taxometric analysis: generating empirical sampling distributions to help interpret results. *Multivariate Behavioral Research* **42**, 349–386.
- ***Ruscio J, Walters GD** (2009). Using comparison data to differentiate categorical and dimensional data by examining factor score distributions: resolving the mode problem. *Psychological Assessment* **21**, 578–594.
- ***Ruscio J, Walters GD, Marcus DK, Kaczetow W** (2010). Comparing the relative fit of categorical and dimensional latent variable models using consistency tests. *Psychological Assessment* **22**, 5–21.
- ***Ruscio J, Zimmerman M, McGlinchey JB, Chelminski I, Young D** (2007). Diagnosing major depressive disorder XI: a taxometric investigation of the structure underlying DSM-IV symptoms. *Journal of Nervous and Mental Disease* **195**, 10–19.
- ***Schmidt NB, Kotov R, Bernstein A, Zvolensky MJ, Joiner TE, Lewinsohn PM** (2007). Mixed anxiety depression: taxometric exploration of the validity of a diagnostic category in youth. *Journal of Affective Disorders* **98**, 83–89.
- ***Schmidt NB, Kotov R, Lerew DR, Joiner TE, Ialongo NS** (2005). Evaluating latent discontinuity in cognitive vulnerability to panic: a taxometric investigation. *Cognitive Therapy and Research* **29**, 673–690.
- ***Silove D, Slade T, Marnane C, Wagner R, Brooks R, Manicavasagar V** (2007). Separation anxiety in adulthood: dimensional or categorical? *Comprehensive Psychiatry* **48**, 546–553.
- ***Skilling TA, Harris GT, Rice MT, Quinsey VL** (2001). Identifying persistently antisocial offenders using the Hare Psychopathy Checklist and DSM antisocial personality disorder criteria. *Psychological Assessment* **14**, 27–38.
- ***Skilling TA, Quinsey VL, Craig WM** (2001). Evidence of a taxon underlying serious antisocial behavior in boys. *Criminal Justice and Behavior* **28**, 450–470.
- ***Slade T** (2007). Taxometric investigation of depression: evidence of consistent latent structure across clinical and community samples. *Australian and New Zealand Journal of Psychiatry* **41**, 403–410.
- ***Slade T, Andrews G** (2005). Latent structure of depression in a community sample: a taxometric analysis. *Psychological Medicine* **35**, 489–497.
- ***Slade T, Grisham JR** (2009). A taxometric investigation of agoraphobia in a clinical and community sample. *Journal of Anxiety Disorders* **23**, 799–805.
- ***Slade T, Grove R, Teeson M** (2009). A taxometric study of alcohol abuse and dependence in a general population sample: evidence of dimensional latent structure and implications for DSM-V. *Addiction* **104**, 742–751.
- Snijders TAB, Bosker RJ** (1999). *Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling*. Sage: London.
- ***Solomon A, Ruscio J, Seeley JR, Lewinsohn PM** (2006). A taxometric investigation of unipolar depression in a large community sample. *Psychological Medicine* **36**, 973–985.
- ***Strong DR, Brown RA, Kahler CW, Lloyd-Richardson EE, Niaura R** (2004). Depression proneness in treatment-seeking smokers: a taxometric analysis. *Personality and Individual Differences* **36**, 1155–1170.
- ***Strong DR, Glassmire DM, Frederick RI, Greene RL** (2006). Evaluating the latent structure of the MMPI-2 F(p) scale in a forensic sample: a taxometric analysis. *Psychological Assessment* **18**, 250–261.
- ***Strong DR, Greene RL, Hoppe C, Johnston T, Olesen N** (1999). Taxometric analysis of impression management and self-deception on the MMPI-2 in child-custody litigants. *Journal of Personality Assessment* **73**, 1–18.
- ***Strong DR, Greene RL, Kordinak ST** (2002). Taxometric analysis of impression management and self-deception in college student and personnel evaluation settings. *Journal of Personality Assessment* **78**, 161–175.

- ***Strong DR, Greene RL, Schinka JA** (2000). A taxometric analysis of the MMPI-2 Infrequency scales [F and F(p)] in clinical settings. *Psychological Assessment* **12**, 166–173.
- ***Strube MJ** (1989). Evidence for the type in type A behavior: a taxometric analysis. *Journal of Personality and Social Psychology* **56**, 972–987.
- ***Thomas ML, Locke DEC** (2010). Psychometric properties of the MMPI-2-RF Somatic Complaints (RC1) scale. *Psychological Assessment* **22**, 492–503.
- Trull TJ, Durrett CA** (2005). Categorical and dimensional models of personality disorder. *Annual Review of Clinical Psychology* **1**, 355–380.
- ***Trull TJ, Widiger TA, Guthrie P** (1990). Categorical versus dimensional status of borderline personality disorder. *Journal of Abnormal Psychology* **99**, 40–48.
- ***Tylka TL, Subich LM** (2003). Revisiting the latent structure of eating disorders: taxometric analyses with nonbehavioral indicators. *Journal of Counseling Psychology* **50**, 276–286.
- ***Tyrka A, Cannon TD, Haslam N, Mednick SA, Schulsinger F, Schulsinger H, Parnas J** (1995). The latent structure of schizotypy: I. Premorbid indicators of a taxon of individuals at risk for schizophrenia-spectrum disorders. *Journal of Abnormal Psychology* **104**, 173–183.
- ***van Kampen D** (1999). Genetic and environmental influences on pre-schizophrenic personality: MAXCOV-HITMAX and LISREL analyses. *European Journal of Personality* **13**, 63–80.
- ***Vasey MW, Kotov R, Frick PJ, Loney BR** (2005). The latent structure of psychopathy in youth: a taxometric investigation. *Journal of Abnormal Child Psychology* **33**, 411–429.
- ***Waelde LC, Silvern L, Fairbank JA** (2005). A taxometric investigation of dissociation in Vietnam veterans. *Journal of Traumatic Stress* **18**, 359–369.
- ***Waller NG, Putnam FW, Carlson EB** (1996). Types of dissociation and dissociative types: a taxometric analysis of dissociative experiences. *Psychological Methods* **3**, 300–321.
- ***Waller NG, Ross CA** (1997). The prevalence and biometric structure of pathological dissociation in the general population: taxometric and behavior genetic findings. *Journal of Abnormal Psychology* **106**, 499–510.
- ***Walters GD** (2007). The latent structure of the criminal lifestyle: a taxometric analysis of the lifestyle criminality screening form and psychological inventory of criminal thinking styles. *Criminal Justice and Behavior* **34**, 1623–1637.
- ***Walters GD** (2008). The latent structure of alcohol use disorders: a taxometric analysis of structured interview data obtained from male federal prison inmates. *Alcohol and Alcoholism* **43**, 326–333.
- ***Walters GD** (2009a). Taxometric analysis of alcohol dependence in male prisoners: measuring latent structure with indicators from DSM-IV. *Addiction Research and Theory* **17**, 372–380.
- ***Walters GD** (2009b). Latent structure of a two-dimensional model of antisocial personality disorder: construct validation and taxometric analysis. *Journal of Personality Disorders* **23**, 647–660.
- ***Walters GD** (2010). Dementia: continuum or distinct entity? *Psychology and Aging* **25**, 534–544.
- ***Walters GD** (2011). The latent structure of life-course-persistent antisocial behaviour: is Moffitt's developmental taxonomy a true taxonomy? *Journal of Consulting and Clinical Psychology* **79**, 96–105.
- ***Walters GD** (2011). Childhood temperament: dimensions or types? *Personality and Individual Differences* **50**, 1168–1173.
- ***Walters GD, Berry DTR, Lanyon RI, Murphy MP** (2009a). Are exaggerated health complaints continuous or categorical? A taxometric analysis of the Health Problem Overstatement Scale. *Psychological Assessment* **21**, 219–226.
- ***Walters GD, Berry DTR, Rogers R, Payne JW, Granacher RP** (2009b). Feigned neurocognitive deficit: taxon or dimension? *Journal of Clinical and Experimental Neuropsychology* **31**, 584–593.
- ***Walters GD, Brinkley CA, Magaletta PR, Diamond PM** (2008). Taxometric analysis of the Levenson Self-Report Psychopathy scale. *Journal of Personality Assessment* **90**, 491–498.
- ***Walters GD, Diamond PM, Magaletta PR** (2010a). What is the latent structure of alcohol use disorders? A taxometric analysis of the Personality Assessment Inventory Alcohol Problems Scale in male and female prison inmates. *Psychology of Addictive Behaviors* **24**, 26–37.
- ***Walters GD, Diamond PM, Magaletta PR, Geyer MD, Duncan SA** (2007). Taxometric analysis of the antisocial features scale of the Personality Assessment Inventory in federal prison inmates. *Assessment* **14**, 351–360.
- ***Walters GD, Duncan SA, Mitchell-Perez K** (2007). The latent structure of psychopathy: a taxometric investigation of the Psychopathy Checklist-Revised in a heterogeneous sample of male prison inmates. *Assessment* **14**, 270–278.
- ***Walters GD, Gray NS, Jackson RL, Sewell KW, Rogers R, Taylor J, Snowden RJ** (2007). A taxometric analysis of the Psychopathy Checklist: Screening Version (PCL:SV): further evidence of dimensionality. *Psychological Assessment* **19**, 330–339.
- ***Walters GD, Hennig CL, Negola TD, Fricke LA** (2009c). The latent structure of alcohol dependence in female federal prisoners. *Addiction Research and Theory* **17**, 525–537.
- ***Walters GD, Knight RA, Langstrom N** (2011). Is hypersexuality dimensional? Evidence for the DSM-5 from general population and clinical samples. *Archives of Sexual Behavior*. Published online 3 February 2011. doi: 10.1007/s10508-010-9719-8.
- ***Walters GD, Knight RA, Thornton D** (2009d). The latent structure of sexual violence risk: a taxometric analysis of widely used sex offender actuarial risk measures. *Criminal Justice and Behavior* **36**, 290–306.
- ***Walters GD, Marcus DK, Edens JF, Knight RA, Sanford GM** (2011). In search of the psychopathic sexuality taxon: indicator size does matter. *Behavioral Sciences and the Law* **29**, 23–39.
- ***Walters GD, McCoy K** (2007). Taxometric analysis of the Psychological Inventory of Criminal Thinking Styles in incarcerated offenders and college students. *Criminal Justice and Behavior* **34**, 781–793.
- ***Walters GD, Rogers R, Berry DTR, Miller HA, Duncan SA, McCusker PJ, Payne JW, Granacher RP** (2008).

- Malingering as a categorical or dimensional construct: the latent structure of feigned psychopathology as measured by the SIRS and MMPI-2. *Psychological Assessment* **20**, 238–247.
- *Walters GD, Ronen T, Rosenbaum M (2010b). The latent structure of childhood aggression: a taxometric study of self-reported and teacher-rated aggression in Israeli schoolchildren. *Psychological Assessment* **22**, 628–637.
- *Walters GD, Ruscio J (2009). To sum or not to sum: taxometric analysis with ordered categorical assessment items. *Psychological Assessment* **21**, 99–111.
- *Walters GD, Ruscio J (2010). Where do we draw the line? Assigning cases to subsamples for MAMBAC, MAXCOV, and MAXEIG taxometric analyses. *Assessment* **17**, 321–333.
- Watson D (2003). Investigating the construct validity of the dissociative taxon: stability analyses of normal and pathological dissociation. *Journal of Abnormal Psychology* **112**, 298–305.
- *Weeks JW, Carleton RN, Asmundson GJG, McCabe RE, Anthony MM (2010). ‘Social anxiety disorder carved at its joints’: evidence for the taxonicity of social anxiety disorder. *Journal of Anxiety Disorders* **24**, 734–742.
- *Weeks JW, Norton PJ, Heimberg RG (2009). Exploring the latent structure of two cognitive components of social anxiety: taxometric analysis of fears of negative and positive evaluation. *Depression and Anxiety* **26**, E40–E48.
- *Whisman MA, Beach SRH, Snyder DK (2008). Is marital discord taxonic and can taxonic status be assessed reliably? Results from a national, representative sample of married couples. *Journal of Consulting and Clinical Psychology* **76**, 745–755.
- *Whisman MA, Pinto A (1997). Hopelessness depression in depressed inpatient adolescents. *Cognitive Therapy and Research* **21**, 345–358.
- Widiger TA, Samuel DB (2005). Diagnostic categories or dimensions? A question for the Diagnostic and Statistical Manual of Mental Disorders – Fifth Edition. *Journal of Abnormal Psychology* **114**, 494–504.
- *Williamson DA, Womble LG, Smeets MAM, Netemeyer RG, Thaw J, Kutlesic V, Gleaves DH (2002). The latent structure of eating disorder symptoms: a factor analytic and taxometric investigation. *American Journal of Psychiatry* **159**, 412–418.
- *Woodward SA, Lenzenweger MF, Kagan J, Snidman N, Arcus D (2000). Taxonic structure of infant reactivity: evidence from a taxometric perspective. *Psychological Science* **11**, 296–301.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.