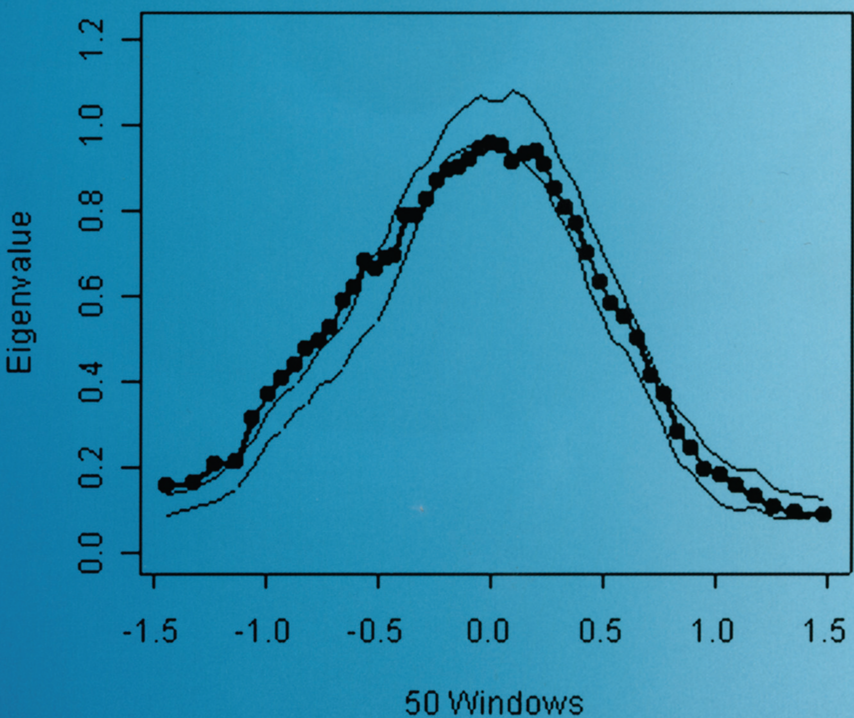
Introduction to the TAXOMETRIC METHOD

A Practical Guide



John Ruscio • Nick Haslam • Ayelet Meron Ruscio

ROUTLEDGE

INTRODUCTION TO THE TAXOMETRIC METHOD

A Practical Guide

INTRODUCTION TO THE TAXOMETRIC METHOD

A Practical Guide

John Ruscio
Elizabethtown College

Nick Haslam
University of Melbourne

Ayelet Meron Ruscio
Harvard Medical School

Routledge
Taylor & Francis Group
New York London

First published by
Lawrence Erlbaum Associates, Inc., Publishers
10 Industrial Avenue
Mahwah, New Jersey 07430

This edition published 2012 by Routledge

Routledge
Taylor & Francis Group
52 Vanderbilt Avenue
New York, NY 10017

Routledge
Taylor & Francis Group
27 Church Road, Hove
East Sussex BN3 2FA

Cover design by Kathryn Houghtaling Lacey

Library of Congress Cataloging-in-Publication Data

Ruscio, John.
Introduction to the taxometric method : a practical guide / John Ruscio, Nick Haslam, Ayelet Meron Ruscio.
p. cm.
Includes bibliographical references (p.).
ISBN 0-8058-4749-9 (alk. paper)
ISBN 0-8058-5976-4 (pbk. : alk. paper)
1. Numerical taxonomy. I. Haslam, Nick, 1963– II. Ruscio, Ayelet Meron. III. Title.
QH83.R865 2006
578.01′2—dc22 2006040044
CIP

We dedicate this book to the memory
of Paul Everett Meehl (1920–2003),
pioneer of the taxometric method,
champion of philosophical clarity
and scientific rigor, and a
continuing inspiration to each of us.

Taylor & Francis
Taylor & Francis Group
http://taylorandfrancis.com

Contents

Preface xi

I INTRODUCTION AND BACKGROUND

1 Introduction 3

Plan of the Book *4*
Conceptual Background *5*
Distinguishing Between Taxa and Dimensions *8*
Some Possible Misunderstandings About Taxa and Dimensions *9*
Conclusions *17*

2 Why Latent Structure Matters 18

Classification *19*
Diagnosis *22*
Assessment *25*
Research *27*
Causal Explanations *30*
Lay Conceptions of Important Constructs *32*
Conclusions *34*

3 The Classification Problem 35

The Classification Problem *36*
Bimodality *37*

Finite Mixture Modeling *45*
Cluster Analysis *47*
Latent Class Analysis *49*
Dimcat *50*
Searching for Multiple Boundaries *51*
The Taxometric Method *54*
Inferential Frameworks for the Taxometric Method *58*
Conclusions *61*

II TAXOMETRIC METHOD

4 Data Requirements for Taxometrics 65

Sampling Considerations *66*
Indicator Considerations *72*
Evaluating the Data by Generating Empirical Sampling Distributions *79*
Conclusions *85*

5 Taxometric Procedures I: MAXSLOPE, MAMBAC, and L-Mode 87

MAXSLOPE *89*
MAMBAC *102*
L-Mode *116*
Conclusions *121*

6 Taxometric Procedures II: MAXCOV and MAXEIG 122

The General Covariance Mixture Theorem *123*
MAXCOV *123*
MAXEIG *136*
Evaluating the Accuracy of the Base Rate Classification Technique *146*
Blending Elements of the Traditional MAXCOV and MAXEIG Procedures *148*
Conclusions *158*

7 Consistency Tests 161

Performing Taxometric Procedures Multiple Times in Multiple Ways *162*
Examining Latent Parameters and Classified Cases *171*
Assessing Model Fit *185*
A Monte Carlo Study of MAXCOV Consistency Tests *195*
Conclusions *203*

8 Interpretational Issues 206

Graphing and Presentation of Taxometric Results *207*
The Influence of Indicator Skew *218*
The Influences of Indicator Validity and Within-Group Correlations *223*
Interpretational Safeguards *228*
Conclusions *239*

9 A Taxometric Checklist 241

Question 1: Is a Taxometric Analysis Scientifically Justified? *242*
Question 2: Are the Data Appropriate for Taxometric Analysis? *244*
Question 3: Has a Sufficient Variety of Procedures Been Implemented Properly? *252*
Question 4: Have the Results Been Presented and Interpreted Appropriately? *255*
Question 5: Are Implications of the Findings Clearly Articulated? *258*
Conclusions *259*

III APPLICATIONS AND FUTURE DIRECTIONS

10 Applications of the Taxometric Method 263

The Latent Structure of Psychopathology *264*
Normal Personality *273*
Other Latent Variables *276*
Overview of the Substantive Findings *277*
Implementation of the Taxometric Method *279*
Conclusions *286*

11 The Future of Taxometrics 287

Constructs in Traditional Domains Requiring Further Study *288*
New Domains for Taxometric Investigation *291*
New Research Questions to Be Addressed Using Taxometrics *297*
Methodological Issues for Further Study *304*
Conclusions *311*

Appendix A: Simulating Taxonic and Dimensional Comparison Data 312

Appendix B: Estimating Latent Parameters and Classifying Cases Using MAXCOV 321

Appendix C: Estimating the Taxon Base Rate Using MAXEIG 323

References 326

Author Index 337

Subject Index 343

Preface

In 1962, Paul Meehl published the first in a series of technical reports that introduced a new method for distinguishing categorical and continuous variables. These reports, printed with yellow covers and circulated among many researchers, came to be known as the *yellow monsters*. In this innovative line of work, Meehl and his collaborators at the University of Minnesota developed, evaluated, and refined a number of the data-analytic procedures that constitute Meehl's taxometric method. As it evolved over the next few decades, investigators began using taxometrics to study the latent structure of many constructs, especially in the areas of personality and psychopathology. Rather than following traditional disciplinary preferences or accepting authoritative pronouncements, researchers using the taxometric method performed empirical tests to determine whether the latent variables giving rise to observed data were categorical or continuous. In recent years, the volume of substantive and methodological taxometric research has been increasing at an accelerating pace.

This book gathers together the current state of the art in taxometric methodology, drawing from classic and contemporary sources to provide a comprehensive and accessible introduction to the method. Our intended audience includes researchers and students conducting taxometric studies, journal reviewers and editors evaluating such studies, and individuals who wish to make sense of these studies and incorporate taxometric results into their work. Interest in the taxometric method has spread to many countries and many disciplines as researchers have turned their attention to the importance of empirically evaluating latent structure and the data-analytic approaches for doing so. The taxometric method was developed by psychologists with expertise in clinical and quantitative psychology, but it is well suited to research in other social and behavioral sciences, physical sciences, education, biology, and beyond. At many universities, graduate-level courses involving psychological assessment or the classification of mental disorders have begun to incorporate instruction in the taxometric method; in some cases, entire courses are being developed to train students in taxometric methodology.

We cover a broad range of analytic techniques, describing in detail their logic and implementation as well as what is known about their performance from systematic study. We illustrate the application of taxometric analyses using a number of data sets and provide guidelines for the interpretation of results. Our overarching goals throughout the book are conceptual clarity, mathematical rigor, and accessibility to a wide audience that includes researchers new to the taxometric method as well as readers who are already familiar with some of the seminal work in this area. In a few places, technical material is placed in an appendix to facilitate an understanding of the important concepts without getting lost or sidetracked in details. We recommend that readers who initially bypass the appendixes revisit them once they firmly grasp the relevant issues.

This book is organized into three parts. The three chapters in Part I introduce background material essential to understanding the research problems that the taxometric method was designed to address. In chapter 1, we articulate the distinction between categorical and continuous data structures and discuss many potential misunderstandings of this distinction. In chapter 2, we review some of the reasons that it is important to study latent structure and explain how such studies can advance basic and applied science. In chapter 3, we discuss several methods that have been developed to distinguish categorical and continuous structure and describe key features that make the taxometric method an especially attractive tool for making this distinction.

The six chapters in Part II cover taxometric methodology. In chapter 4, we present the data requirements of taxometric analysis and introduce a technique for empirically evaluating the adequacy of data for planned analyses. In chapters 5 and 6, we focus on the nuts and bolts of the primary taxometric procedures. We discuss the logic of each procedure, review key implementation decisions, discuss the factors that can influence results, and illustrate how each procedure is performed through analyses of illustrative data sets. In chapter 7, we offer suggestions for choosing a set of taxometric procedures for a particular study and discuss strategies for obtaining additional evidence to examine the consistency of results. In chapter 8, we consider factors that can lead to interpretational ambiguity or misleading impressions and highlight methodological safeguards that can be used to prevent erroneous conclusions. Finally, in chapter 9, we work through a checklist of conceptual and methodological issues that we believe should be considered carefully and addressed explicitly in any taxometric investigation.

The two chapters in Part III of the book review applications of the taxometric method and promising directions for future taxometric research. In chapter 10, we report the conclusions of published taxometric investigations and assess the ways in which the taxometric method has been implemented. We offer general observations about the findings yielded by taxometric studies and note changes in the implementation of the method over time. In chapter 11, we explore questions central to the conduct of taxometric research in the years ahead, including which constructs and research domains are in particular need of taxometric investigation, how taxometric research might be most profitably conducted, and how the method might be evaluated, refined, and strengthened. We outline what we believe to be especially profitable avenues for future study, highlighting the primary challenges and promises that we foresee in this exciting, rapidly growing research area.

Although Meehl launched the taxometric method more than four decades ago, its popularity is a relatively recent phenomenon. In particular, the empirical evaluation of many important methodological issues is still in its infancy. Contributors to this literature vary widely in their willingness or reluctance to endorse specific approaches or to provide guidelines for taxometric research on the basis of what is often extremely limited information. We have made every effort to review the available options as comprehensively as possible and to describe the rationale for each alternative. We are explicit about the source of the recommendations that we offer, whether they stem from systematic study, preliminary testing, or our experience in performing and reviewing taxometric studies. We believe that it would be premature to devise a one-size-fits-all template for taxometric investigations. Instead, we advocate a more flexible approach that balances the available empirical evidence with reasoned judgments. Our goal is to improve a reader's ability to make informed decisions when conducting, reviewing, or reading taxometric studies.

Two additional features of this book are worthy of note. First, a unifying theme of our approach to taxometrics is the use of empirical sampling distributions. Specifically, to help determine whether data are acceptable for analysis as well as to help interpret results, we recommend that investigators generate and analyze categorical and continuous comparison data sets. By doing this in a way that reproduces important aspects of a unique set of research data, one can ask and answer the question, How would results differ if the data were categorical versus continuous? Although simulation studies can and should be performed to help address this question, the Monte Carlo literature on the taxometric method is sparse. Moreover, simulation studies often involve idealized data that differ in critical ways from research data, and virtually none of the choice points involved in implementing taxometric procedures has been studied systematically. To supplement these gaps in the literature, we recommend taking advantage of a "bootstrapping" approach that is increasingly popular for many types of data analysis. The basic idea is to tailor a small-scale simulation study to the conditions present in a particular investigation, including its unique configuration of data parameters and the particular way in which one or more analytic procedures will be performed. This approach combines rigor and feasibility in an informative and efficient manner. We explain how to use empirical sampling distributions in taxometric studies, emphasizing and illustrating the power of the approach at many points in the book.

A second feature is that we provide a suite of taxometric programs written in R, a powerful and freely available data-analytic package. Our programs were used to perform all of the analyses presented in this book, and they can be used to generate empirical sampling distributions. The current version of R, our programs, and a detailed manual are provided on the accompanying CD-ROM which can be found at www.routledge.com/9780805859768. Because these programs continue to evolve over time, updated versions are available on a companion Web site maintained by Lawrence Erlbaum Associates.

We are grateful to many people for their contributions to this book. We would like to thank Erlbaum senior editor Debra Reigert for her guidance in shepherding this project through the review process. Debra's keen sense for the strengths and weaknesses of the initial proposal and succes-sive drafts proved invaluable in successfully revising and improving this work. We also thank the reviewers who committed considerable time and energy to critique drafts of some or all chapters of this book: Scott Acton, Rochester Institute of Technology; Timothy Brown, Boston University; David H. Gleaves, University of Canterbury; Eric Knowles, University of Ar-kansas; Todd Little, University of Kansas; and David Marcus, University of Southern Mississippi. Their detailed comments and constructive criticism led us to rethink many issues and rework many sections of the book. Finally, we are indebted to two colleagues who scrutinized a draft of this book for clarity of presentation: Michael Suvak, Department of Psychol-ogy, Boston University; and Eric Kuhn, National Center for PTSD, Palo Alto Veterans Affairs Medical Center. Michael and Eric took this charge se-riously and provided us with extremely helpful feedback. Of course, any flaws that remain in the book despite the efforts of all these individuals to set us straight are our responsibility.

PART ONE

INTRODUCTION AND BACKGROUND

CHAPTER ONE

Introduction

A graduate student once sought refuge from his dissertation research by taking a vacation to India. Hoping to clear his mind of statistics and big-city pressures, he wound up in a houseboat on a remote lake in Kashmir, a peaceful spot for solitary reflection. For several days, he was the only Westerner in the vicinity, and he felt distinctly isolated. Then a young Mexican man arrived, another student, and took up residence on the neighboring boat. One evening, watching the sunset over the Himalayas, conversation turned to their work. Apologetically, our hero said he was conducting some obscure quantitative research on how to determine whether categories exist in psychological data sets. "Sounds like taxometrics," his new friend chimed in.

It may be an exaggeration to say that taxometrics has reached every corner of the globe or that it has become a common topic of conversation, but it is undeniable that the popularity of this analytic approach has increased substantially in recent years (Haslam & Kim, 2002). The volume of psychological research employing taxometric procedures is growing rapidly, and these procedures are becoming standard material in graduate-level statistics courses. The taxometric method is being brought to bear on an increasing range of research questions and problems, and the method is undergoing rapid evolution, evaluation, and refinement. But what *is* taxometrics?

Our intention in writing this book is to answer this question in a way that is conceptually clear, theoretically compelling, and—most important—practically useful. On first exposure to taxometrics, many novice researchers find it somewhat forbidding: The terminology can seem abstruse and specialized, the procedures quite different from familiar analytic approaches, the interpretation of results for complex data sets hazy, and the implications of the findings difficult to infer. This volume aims to demystify taxometric research and make it more accessible to a wider audience without sacrificing either precision or rigor. The book is not "Taxometrics for Dummies," but a clear statement of how the taxometric method can be used appropriately and fruitfully to resolve important theoretical and applied questions in the behavioral sciences. Our goal is to leave readers not only with a solid understanding of how good taxometric research may be conducted, but also with a sense for the possibilities afforded by the method and a guide for putting these possibilities into practice.

PLAN OF THE BOOK

This volume is divided into three parts. Part I, beginning with this chapter, lays out foundational issues in taxometrics, providing a rationale for the method and developing a conceptual context for later methodological material. We discuss the fundamental question that the taxometric method was designed to answer, the latent structures that are distinguished by the method, and the relevance of this structural distinction for theory, research, and practice. We then discuss the nature of the classification problem in behavioral science, review the challenges faced by classification researchers in behavioral disciplines, and introduce the taxometric method as a promising way to meet these challenges.

Part II includes an extended introduction, description, and demonstration of the taxometric method. These five chapters present an in-depth tutorial for conducting taxometric analyses, using an approach grounded in state-of-the-art empirical and simulation research. All chapters are written with an eye toward offering practical guidance on the real problems that behavioral researchers face, basing concrete suggestions on mathematical and empirical grounds when these are available and on our observations and experience when they are not. The chapters lay out the data requirements for taxometric studies, present guidelines for conducting the five most widely used taxometric procedures, and demonstrate how the findings of multiple procedures can be integrated and tested for consistency—a hallmark of the taxometric method. Special attention is given to interpreting the output of taxometric analyses, focusing on the factors that can influence the accuracy of structural inferences. The final chapter provides a comprehensive, step-by-step checklist that can be consulted to ensure that a taxometric study is properly conducted and reported. Throughout Part II, we emphasize the extent to which rigorous research provides a foundation for making informed choices when selecting or implementing taxometric procedures and consistency tests as well as when interpreting their output.

Part III concludes the book by considering what has been done, and what remains to be done, with the taxometric method. Although this volume is chiefly a guidebook for conducting new taxometric investigations, we believe that it is important for researchers to have a clear understanding of how previous studies have implemented the taxometric method and what these studies have found. Such understanding not only provides an intellectual context for future studies, but also suggests how researchers can build on existing work in more methodologically rigorous ways. To this end, we systematically review the extant taxometric literature and identify promising directions for future work.

Our review highlights the range of constructs that have received taxometric scrutiny, summarizes the investigators' conclusions about the latent structure of these constructs, and examines how taxometric practices and conventions have evolved over the past quarter century. We then focus on future priorities for taxometric research, highlighting several unresolved methodological questions, suggesting scientific applications of the method that have yet to be fully exploited, and identifying promising psychological constructs and domains that have not yet been explored in taxometric studies. We hope that this discussion gives new researchers, in particular, an inviting sense of the rich and largely untapped possibilities of taxometric investigation, motivating them to explore these possibilities for themselves and to add their contributions to the growing taxometrics literature.

CONCEPTUAL BACKGROUND

Fundamentally, taxometrics is all about the nature of variation. It begins with the simple observation that not all differences are alike. The differences between cats and dogs are not the same as the differences between hot and cold objects. The differences between gold and silver are distinct from the differences between large rocks (e.g., boulders) and small rocks (e.g., pebbles). Distinctions between branches of living organisms represent differences in quality or kind—at least when the branches represent high-level groupings such as kingdoms, phyla, classes, or orders, and sometimes less so when the branches represent low-level groupings such as genera or species—as do distinctions between chemical elements. By contrast, differences of temperature or size represent differences of quantity or degree. Some things in the world seem to fall into discrete categories. For example, an animal may be a fish or an insect, but it cannot be both a fish *and* an insect. Other things fall along a seamless dimension, differing only in their magnitude. For example, although a line can be drawn to distinguish very tall people from all other individuals, no one would view this line as anything but an arbitrary slice along an unbroken continuum of human height.

Paul Meehl (1992, 1995a), who created the taxometric method described in this book, is largely responsible for bringing this distinction between differences in kind and differences of degree to the attention of psychologists. However, even before this time, such concepts had been floating around the discipline under several other guises. Depending on the context, this distinction has been framed as one of categories versus dimensions, types versus traits, discontinuous versus continuous variation, or qualitative versus quantitative differences. Meehl instead preferred the terminology of biological classification, referring to certain sorts of categories as *taxa* (singular *taxon*) and labeling latent variables consisting of a taxon class and its remainder (the *complement* class, consisting of all individuals who do not belong to the taxon) as *taxonic*. In the broadest sense, categories that qualify as taxa are nonarbitrary, based on a distinction between category members and nonmembers that is objective (rather than subjective) and naturally occurring (rather than imposed by judgment or social convention).

Defining *taxon* more explicitly than this has proved to be rather difficult, although the concept is intuitively quite easily grasped. We later provide a mathematical definition of the taxon concept when we introduce the structural models that the taxometric method is designed to distinguish empirically. At present, however, we offer a more conceptual list of the central properties of a taxon:

1. A taxon is a latent structure. By *latent structure* we mean the fundamental nature of a construct that exists regardless of how people choose to conceptualize or measure it. *Manifest structure*, in contrast, refers to characteristics associated with observable features of the construct that depend, in part, on our theoretical assumptions and measurement decisions. An analogy with classical test theory may help to clarify this distinction. The expression $X = T + E$ represents an observed score X as the sum of a true score T plus error E. The observed score is manifest in the sense that one can directly examine this quantity. The true score is latent in the sense that it cannot be directly observed. The existence of a latent variable is inferred based on the relationships among manifest variables and invoked to explain certain patterns of relationships. For example, factor analysis is based on the premise that when a number of conceptually related items are correlated with one another, one can postulate the existence of one or more latent factors that influence scores on each manifest

item. Thus, a latent taxon is not simply a cluster of superficially similar cases. Rather, it is a grouping of cases that share an underlying commonality, a set of "deep" properties that accounts for the group's observable similarities. What makes something a cat is not its outwardly perceptible properties: A dog groomed to look like a cat and trained to purr does not thereby become a cat.

2. A taxon is a *category* with a *boundary*. It is a (latent) class that has a finite membership. In principle, the individuals belonging to a taxon could be counted. In contrast, latent dimensions do not define distinct groups of members. Instead, every individual has some degree of each dimensional property, some position along each continuum. In the animal kingdom, for example, there is not continuous variation in levels of catness. Rather, a finite set of animals are cats and the large remainder of animals are not. A taxonic *boundary* is a metaphorical notion rather than a literal line of demarcation, but it captures the fact that there is some sort of break or discontinuity between members of a taxon and its complement. Those on one side of the boundary are categorically different from those on the other side, even if in some respects they resemble one another. Some small dogs can look more like cats than like Great Danes, but they nevertheless belong with the latter, growling at the former across a deep taxonomic gulf.

3. A taxon's boundary is *nonarbitrary* or *objective*. Not all categories with boundaries are taxa. When a boundary is simply imposed on a continuum by a human classificatory decision, social convention, or naming practice, it does not constitute a true taxon. This does not mean that the boundary is necessarily unjustified or frivolous—it may, in fact, be pragmatically useful. For example, low-income individuals and premature infants probably do not belong to naturally occurring taxa, but instead fall below thresholds that have been superimposed on dimensions to facilitate social services, public health, and medical decision making. If, in contrast, a boundary represents an objective or naturally occurring discontinuity at the latent level, it is considered to demarcate a taxon. The boundary between cats and dogs, once again, is no social or linguistic artifact, but a fact about the world.

4. A taxon is (reasonably) *enduring*. This property of a taxon is perhaps more incidental than the others. However, we might hesitate to refer to a class of things (particularly a class of people) as a taxon if its membership was very unstable. Of course, the time frame by which stability should be judged varies across taxa. For example, a taxon corresponding to a personality characteristic would be expected to persist for years, rather than mere days, whereas a taxon such as influenza infection (which is qualitatively different from other viral infections that cause respiratory illnesses such as the common cold) is stable only over much briefer spans of time.

Although a taxon need not be perfectly stable, within an appropriate time frame, it should be relatively traitlike rather than fleeting.

DISTINGUISHING BETWEEN TAXA AND DIMENSIONS

The properties listed earlier help to clarify our intuitive understanding of taxa and dimensions. *Cat* is a taxon because there is a countable number of entities in the world that belong to this latent class; because there is an objective, naturally occurring category boundary between cats and noncats; and because—horror movies aside—cats do not typically transmogrify into other things. *Pet*, in contrast, is not a taxon because the boundary between pets and nonpets is based on social conventions that can vary widely across places and times so that the set of things that might be called *pets* is not a unitary latent class. Similarly, tall person is not a taxon because there is no latent class of lofty people who are categorically different from others. With no discoverable, objective boundary that cleaves the height continuum at the latent level, human height is best conceived as a dimensional construct.

With any luck, you will now be convinced that there is a meaningful conceptual distinction between taxa and dimensions. However, Meehl and his colleagues (e.g., Grove, 2004; Grove & Meehl, 1993; Meehl, 1973, 1995a; Meehl & Golden, 1982; Meehl & Yonce, 1994, 1996; Waller & Meehl, 1998) did not simply want to draw an abstract, armchair distinction between these two types of constructs. Instead, they wanted to establish that this distinction was fundamental to the study of differences between people, and that it had a host of practical and theoretical implications (to be discussed in chap. 2). Most important, they proposed that this distinction can be drawn empirically. Often, they argued, it is not obvious whether certain differences between people are taxonic. This is because differences can only be observed at the manifest level, where the opinions of theorists and laypeople and the assumptions of classification systems may lead taxonic boundaries to be drawn where none exists or may fail to recognize boundaries that do exist. Not satisfied with leaving questions of taxonicity to theoretical arguments and disciplinary preferences, Meehl and colleagues set about developing a rigorous approach that would empirically test for the existence of a taxon. They referred to their innovative methodology as the *taxometric method*. Thus, the aim of a taxometric analysis is to determine whether a latent construct is taxonic or dimensional through the rigorous use of appropriate data-analytic procedures.

These taxometric procedures, and the taxometric method as a whole, ultimately rest on a realist philosophy of science. They presume that, to a substantial extent, the latent structure of individual differences (such as personality features and psychopathological syndromes) exists independently of human efforts to classify and describe them. Taxa are not artifacts of particular discovery procedures brought into existence by the research methods. Neither are taxa mere social constructions, fabricated out of social or linguistic conventions. Because taxa are objective and discoverable, the best way to search for their existence is to employ a variety of appropriate procedures designed to detect latent boundaries. The confidence with which one can infer the existence of a taxon depends on the consistency with which multiple sources of information clearly point to its existence. When the results of different analytic procedures converge in a manner that would be extremely unlikely if no taxon existed, the independent existence of a taxon is inferred. This use of multiple procedures—dubbed "consistency testing"—is central to the taxometric method, and it receives special attention in chapter 7.

Although the taxometric method is grounded in a realist view of taxa, it is not realist in a crude or unsophisticated way. The taxometric approach does not dictate that classification systems must include all taxa and only taxa. In practice, taxonomies are ultimately cognitive and cultural products that serve our practical purposes: They do not necessarily exist in nature independent of the people who develop them. Taxonomies do not have to mirror nature; if a taxon exists, our taxonomies are not obliged to recognize it. However, taxometric researchers argue that matching our classification systems to empirically established taxa—in Plato's words, "carving nature at the joints"—will often be pragmatically as well as theoretically useful. Taxonic boundaries represent real distinctions independent of theory or fiat that are likely to have important implications for basic and applied science. If the things being classified—such as mental disorders—come in categorically different kinds, then it is possible that what is true for one kind (e.g., its causes, risk factors, developmental course, prognosis, optimal treatment) may not be true for another. Consequently, the realist view of latent structure that motivates taxometric research suggests that classification efforts should take seriously any taxa that are discovered.

SOME POSSIBLE MISUNDERSTANDINGS ABOUT TAXA AND DIMENSIONS

The previous sections have attempted to clarify the meaning of a taxon and to describe how a realist view of latent structure motivated the development of the taxometric method. It is also important at this early stage to dispel some common misconceptions about taxa and dimensions.

Misconception 1: A Taxon Should Be Readily Observable

When the taxon concept is first explained to some people, they wonder why an elaborate data-analytic apparatus would be needed to detect a taxon. Shouldn't the existence of a taxon be obvious, so that we could easily see that one group of people is different in kind from others? This misunderstanding is addressed in chapter 3, but a few remarks are relevant here. The basic point is that manifest structure is often an unreliable guide to latent structure. That is, the apparent structure of differences observed between people does not necessarily correspond to the structure that actually exists at the latent level. This can work in two directions. Sometimes, on the basis of observable features, a group of people might appear to form a tight and unified cluster, when in fact there is no discrete boundary that distinguishes them from others. However, sometimes no categories can be detected amid manifest variation, even when taxa do underlie this variation. This is especially likely where the difference between taxon and complement is subtle, imprecisely conceptualized, or poorly measured.

The latter issue is particularly relevant within the behavioral sciences. Given the intrinsic difficulty of measuring many psychological, sociological, educational, and related constructs and the relatively primitive state of assessment in many areas of these disciplines, we cannot always be confident that taxonic differences between people would be readily observable. Even where taxa do exist, current measurement tools may be unable to distinguish taxon members from complement members with high validity. For example, research indicates that effect sizes in psychology are often quite modest and studies are often underpowered (Cohen, 1962; Maxwell, 2004; Sedlmeier & Gigerenzer, 1989), suggesting that psychological taxa will rarely advertise themselves in ways that are obvious to the naked eye (Gangestad & Snyder, 1985). Therefore, it is vital to remember that manifest and latent levels of description are distinct, and that powerful quantitative tools may be needed to derive an understanding of latent structure from observable data.

Misconception 2: If a Latent Variable Is Taxonic, It Will Not Show Any Continuous Variation (and If It Does, Then It Is Not Taxonic)

This misunderstanding comes in several forms. At times it simply reflects a failure to distinguish between the manifest and latent levels of analysis. A latent variable that is taxonic can show continuous variation when it is assessed to yield manifest scores. For example, biological sex is taxonic, but manifest *indicators* or correlates of sex (e.g., masculine vs. feminine interest patterns, voice pitch, height) often evidence continuous variation. The fact that the manifest indicators of a construct can vary along a continuum does not, however, mean that the construct is underpinned by one or more latent dimensions. Similarly, the fact that a construct is taxonic does not mean that indicators must vary in a strictly categorical fashion.

A related form of this misunderstanding is that if a construct is taxonic, there should be no dimensional variation within either the taxon or its complement. In fact both meaningful and nonmeaningful variation is possible within latent classes. Nonmeaningful (manifest-level) dimensional variation may be introduced within classes in at least two ways. First, there is apt to be variation within the taxon simply as a function of random measurement error. That is, because the manifest indicators do not perfectly capture membership in the latent classes, all taxon members will not receive the same value or score, but will differ by degree in a nonsystematic fashion. Second, in addition to the unavoidable problem of measurement error, there may be systematic dimensional variation among taxon members if manifest indicators of the taxon covary for artifactual reasons. For example, indicators of a taxon might all be drawn from self-report questionnaires that share some common method variance (e.g., all may be influenced by a response bias involving the exaggeration of clinical symptoms). As a result, there might be systematic variation among taxon members due to individual differences in response bias.

It is important, however, to highlight one more possible source of dimensional variation within taxa: There may be *real* dimensional variation within a taxon or complement that is due neither to measurement error nor measurement artifacts. A certain mental disorder might be taxonic, for example, but cases within the taxon might vary systematically along one or more dimensions, such as degree of severity. Clinical features that differentiate members of the taxon from members of the complement might also reliably distinguish taxon members from one another. This sort of meaningful (latent-level) dimensional variation could occur within the taxon alone, within the complement alone, or within both latent classes (J. Ruscio & Ruscio, 2002, 2004a). Such variation may appear to be a "nuisance" from a statistical point of view (hence the widespread use of the terms *nuisance covariance* or *nuisance correlations* in the taxometric literature; we use the more familiar *within-group correlations* throughout this book), but it may nonetheless be an entirely valid component of latent structure. Indeed, because many behavioral constructs are complex and multidetermined, it is conceivable that many may have complex latent structures—a possibility that we explore further later.

In short, there may be dimensional variation within a taxon and/or complement, and its existence in no way detracts from the inherent taxonicity of the construct. A latent variable is taxonic if it contains a nonarbitrary difference in kind, regardless of whether this difference coexists with differences of degree. Although teasing apart the various potential causes of within-group indicator covariance can be an intriguing research question, one would first need to establish the existence of taxa before this question can meaningfully be raised or addressed.

Misconception 3: A Taxon Cannot Be Further Subdivided

Perhaps in part because of the previous misunderstanding—the supposition that no variation or heterogeneity is possible within taxa—people sometimes imagine that a taxon only exists at a single level. In this view, when a taxon is found, there is no point seeking lower order taxa that may be nested within it. By implication, investigations of latent structure can stop when a taxon is detected. To see why this belief may be mistaken, consider the classification of living organisms. *Mammal* is a taxon because the distinction between mammals and nonmammals meets the criteria for a categorical boundary described earlier. Within the mammal taxon, primates and rodents represent lower order taxa. The primate taxon can be divided further into the *homo* and *australopithecus* genera, with *homo* divided into species including *homo habilis* and *homo sapiens*. Thus, taxa can be nested within one another at multiple levels.

Such nesting may be less pronounced in the domains of personality or psychopathology, yet it may still exist. There is nothing to logically prevent a subtype of a taxonic mental disorder from also being taxonic. For example, schizophrenia may represent a taxon within which *paranoid type* and *catatonic type* represent nested taxa. Similarly, a personality diathesis might be taxonic, as might be the less prevalent condition for which it confers vulnerability. Conversely, if a relatively broad latent variable such as a disorder or diathesis proves to be nontaxonic, it is still possible that a narrower or less inclusive variable is taxonic. For example, a rare taxonic variant (e.g., psychotic depression) of a more common dimensional condition (e.g., major depression) might occur, although one might hesitate to call it a *subtype* if no higher order taxonic type exists. In short, detecting (or even failing to detect) a taxon may represent only the beginning of the process of mapping out the full latent structure of a construct (J. Ruscio & Ruscio, 2004a).

It is important to emphasize that this point about the potential nestedness of taxa goes double for the complement class. A taxometric analysis might reveal a qualitative boundary separating a taxon from its complement, but this does not mean that the complement is unitary or indivisible. The complement contains all cases that do not belong in the taxon, and it may well be the case that this remainder comprises a heterogeneous mix of latent classes and dimensions.

Misconception 4: Taxa Cannot Exist Because People Differ in So Many Ways That They Are Unlikely to Form Homogeneous Groups

This potential misconception builds on the previous two and incorporates an additional misunderstanding. Some researchers bristle at the notion that a taxon may exist because they misconstrue this as suggesting that one dichotomous latent variable exhaustively accounts for all individual differences between and within groups. In fact, even when a taxon exists, individuals belonging to the same latent class can differ from one another in several ways. As noted earlier, these individuals may vary along one or more latent dimensions, and a taxon or complement may be further divided into subtypes.

An additional point counters this misconception: Members of the same group can differ from one another on any number of characteristics *other* than the one whose structure is being considered. For example, people who possess XX sex chromosomes are biologically female, whereas those who possess XY chromosomes are biologically male. Setting aside the small proportion of individuals who possess other configurations of sex chromosomes, it would be silly to insist that there is no taxonic boundary in human biological sex because men and women differ greatly from one another (within and between groups) on many features other than biological sex. Individual differences among members of a latent class do not refute the existence of a genuine taxonic boundary, nor do they lessen the scientific utility of drawing a taxonic distinction between existing groups.

Misconception 5: A Taxon Is a "Natural Kind"

One common way to define a taxon has been to refer to it as a *natural kind*. This concept has been examined at great length by philosophers (e.g., Kripke, 1980). Their usual analysis holds that certain kinds of things in the world—the standard examples being chemical elements or compounds, and biological taxa—exist "in nature," independent of human classifications and naming conventions. Such natural kinds have sharp boundaries: A substance either is or is not water, and a furry animal with stripes either is or is not a tiger. Up to this point, the definition of *natural kind* would seem to match the properties of a taxon perfectly. Both concepts represent latent categories that are nonarbitrary, discovered rather than constructed, and discrete. However, the concept of natural kind typically contains two additional features that are more restrictive. First, a natural kind in the domain of living things is usually understood to be biologically based, akin to a species. Second, membership in a natural kind is usually taken to require the possession of a shared essence. What makes a substance water is having the molecular structure H_2O, and what makes a creature a tiger is having tiger DNA. Such hidden essences are necessary properties of the entities belonging to the natural kind and are causally responsible for their observable features.

These latter two properties of a natural kind—being biologically based and species-like, and having an essence—are not necessary for a category to qualify as a taxon in the taxometric sense. There is no reason that a taxon could not have an entirely environmental or learned basis, arising, for instance, through a process of social shaping or adaptation to an ecological niche. In an important article that every budding taxometric researcher should read, Meehl (1992) drew attention to such *environment-mold taxa*, using as one example the political taxon *Trotskyist*. Members of this now rare group share a tightly organized set of ideological tenets that categorically distinguish them from individuals with other beliefs, although these group differences do not arise from a biological foundation. Meehl made comparable observations about the taxonicity of certain occupational groups.

Similarly, it is not necessary to suppose that all members of a taxon must share an underlying causal essence. An essentialist view, according to which all taxon members have a single, necessary property that is causally responsible for its observed features, may be defensible in some instances (e.g., a neurological disorder that is caused by a single major gene). However, there is little reason to believe that such specific etiologies are typical of personality or psychopathology taxa. For many such taxa, the causal basis for taxon membership more plausibly corresponds to a nonessentialist view, in which taxon membership springs from multiple, interacting, and probabilistic causal factors (e.g., threshold and epigenetic effects), and members do not share any single defining characteristic. In summary, we believe that it is generally unwise to equate *taxon* with *natural kind* when the latter is understood in the normal essentialist sense.

These distinctions between the concepts of *taxon* and *natural kind* may strike some readers as conceptual hair-splitting, but we believe they lead to some important implications. In particular, the concept of taxon is broader than the concept of natural kind: All natural kinds are taxa, but not all taxa are natural kinds. In addition, when a taxon is found, one should not prejudge the issue of causation by automatically inferring that it has a biological basis or an underlying essence.

Misconception 6: If a Latent Variable Is Not Taxonic, Any Categorical Distinction Imposed on It Is Completely Arbitrary

We have repeatedly stated that a taxon possesses a nonarbitrary categorical boundary—a boundary that is not simply imposed by artifact, preference, or convention. Does this imply that categorical distinctions that are imposed on nontaxonic latent variables are arbitrary? In one sense it does, but in another important sense it does not. Such a distinction will be arbitrary in the sense that it does not correspond to an objective boundary. However, this distinction is not necessarily arbitrary in the sense of being unsystematic, careless, or unjustified. That is, categorical distinctions can sometimes be drawn on latent dimensions in ways that are well justified and pragmatically useful, even if no taxonic boundary exists (e.g., a child has to be a set height to ride a roller coaster).

It may at times make sense to derive a categorical diagnosis or dichotomous decision on the basis of scores on latent continua. This is how essential hypertension and obesity are diagnosed, for instance. Although we know of no true taxonic boundaries along the continua of blood pressure or body mass, it may nonetheless be practically important to identify individuals who exceed critical levels on these continua. If cutoffs must be drawn on dimensions for such practical purposes, there are surely better and worse ways for these cutoffs to be defined. It would be foolish, for example, to impose a cutoff on the basis of a median split, leading 50% of the population to be diagnosed with hypertension or obesity. In contrast, cutoffs could be defined in ways that are sensible, meaningful, and empirically optimized—nonarbitrary in our second sense. Actuarial data might be used to locate a point on each continuum at which (a) the health consequences of the high blood pressure or high body weight reach a threshold of clinical severity, (b) these health consequences begin to rapidly worsen (i.e., an "inflection point"; Kessler, 2002a), (c) the cost/benefit ratio of a treatment becomes satisfactory, or (d) false positive identifications (mistakenly inferring an elevated health risk where none exists) and false negative identifications (missing an elevated health risk that is present) are optimally balanced (Kraemer, Noda, & O'Hara, 2004). Although the optimal point of demarcation would likely vary according to the practical purpose at hand, the population being classified, and other relevant factors, the location of such a point would not be entirely arbitrary in any pejorative sense. Thus, there is a place for well-reasoned, empirically grounded, pragmatically useful categories in the behavioral sciences, even in the absence of taxa.

Misconception 7: A Dimensional Solution Is Not Worthy of Further Attention

One subtle but persistent practice in the taxometrics literature is the tendency to dismiss dimensional findings as less interesting, less important, or even less valid than the discovery of a taxon. This perspective is reflected in the terminology of the literature, which often refers to *nontaxonic* rather than *dimensional* findings. The apparent preference for taxonic over dimensional results may be explained by any of a number of factors, including the framing of taxometric procedures as *taxon search procedures* that achieve success only when taxa are detected; the greater ease with which taxa can be incorporated into existing categorical classification systems; or the conceptualization of dimensional structure as a kind of null hypothesis that can be rejected, but not accepted, on the basis of taxometric results.

In contrast with these views, our own perspective is that dimensional structure can be legitimately inferred from taxometric analysis, provided that the available data are shown to be capable of distinguishing taxonic from dimensional structures (see chap. 4). Under such conditions, a dimensional solution provides a meaningful and useful statement about latent structure that can serve as a springboard for important follow-up investigation. Just as a taxon may be divisible into lower order taxa, a dimensional construct may consist of multiple dimensions, some of which may subsume or be subsumed by dimensions at higher or lower orders within the broader nested construct. Although the specific analytic procedures that are used to search for hierarchically arranged types versus subtypes and higher order versus lower order factors may differ, the exploration and delineation of the full latent structural model is equally important for both structures. Moreover, investigations into the nature, causes, and correlates of a dimensional construct are arguably as valuable as those that seek to better understand a taxonic construct. Our view of the taxometric method as a tool for distinguishing taxonic from dimensional structure, rather than exclusively a taxonic search procedure, influences the manner in which we discuss taxometric results and the implications that we draw for their potential impact on theory, research, and practice. In short, we believe the proper attitude to take in taxometric research is an empirical one, rather than holding a preference for or bias toward taxonic findings.

CONCLUSIONS

In this chapter, we reviewed the distinction between taxa and dimensions, and we explored some of the conceptual implications and complexities of the taxon concept, as discussed and refined by Meehl, his colleagues, and subsequent taxometric researchers. In some ways, our elucidation of the nature of taxa and dimensions paints a more complex picture of latent structure than is usually presented in the literature. We have noted that a taxon (a) is rarely observable from manifest scores or symptoms, (b) can contain meaningful dimensional variation, (c) can be hierarchically nested within another taxon, (d) can contain individuals who differ from one another in a number of ways, and (e) need not be biologically based or involve a shared essence among individuals. We have also suggested that categorical distinctions imposed on latent dimensions may be justifiable, useful, and even necessary. Finally, we have emphasized that dimensional structure is no less important than taxonic structure, and that either outcome of a taxometric study provides a framework to be elaborated and fleshed out by explorations of more complex structures. These issues are not overly difficult and need not be confusing. They do, however, require a nuanced view of latent structure that can accommodate more complex structural models.

The distinction between taxa and dimensions highlighted in this chapter is not merely a subtle intellectual curiosity, but a truly fundamental issue in how we think about differences among individuals. Indeed the latent structure of a construct has important ramifications throughout the behavioral and social sciences. In the next chapter, we review these ramifications and consider why taxonicity matters deeply for basic and applied science, with implications for areas as diverse as personality assessment, diagnostic classification, and lay perceptions of mental disorder. Because empirical testing of latent structures has often been neglected in the behavioral disciplines, taxometrics opens up a wide array of research frontiers, allowing researchers to contribute in substantial ways to the advancement of theory and practice. It is to this diversity of issues and implications surrounding latent structure that we now turn.

CHAPTER TWO

Why Latent Structure Matters

The previous chapter provided a conceptual background for taxometrics and explained the difference between taxonic and dimensional latent structures. The next chapter begins to explore the ways in which these structures can be differentiated. But before we launch into a discussion of *how* this can be done, we must consider the fundamental question of *why* it should be done. Why does it matter whether variation along a latent variable is a matter of degree or a matter of kind?

To some readers, the answer to this question might seem self-evident. Science is all about discovering how the world is. Therefore, knowing whether mental disorders, personality characteristics, or other phenomena are better understood as categories or dimensions is intrinsically worthwhile and valuable. Determining latent structure is a basic question for behavioral science regardless of whether any practical consequences or implications follow from this determination.

Other readers will not be satisfied with this view of taxometric research as a purely curiosity-driven exercise divorced from application. They will want to know how resolving latent structure can make a difference for the sorts of practical activities and problems that behavioral scientists face. For example, if taxometric research shows a form of psychopathology to be taxonic, are there practical implications for how this condition should be classified, diagnosed, measured, investigated, or explained? The skeptical reader may well wonder whether this sort of finding makes a difference, practically speaking.

In this chapter, we hope to lay the skeptic's concerns to rest. It turns out that latent structure matters in a multitude of ways for the tasks facing both scientist and practitioner, and that taxometric research can serve many purposes, both basic and applied. Although we separately discuss the important intellectual versus practical implications of latent structure, it should be noted that many of the relevant issues overlap and interrelate across these domains.

CLASSIFICATION

Classification comes naturally to people. We are forever grouping things into categories, naming them, and making inferences about them based on the categories into which they have been placed. Classification is also, of course, a core business of science. It is hard to imagine chemistry without the periodic table of elements, physics without its classification of subatomic particles, astronomy without its nomenclature of heavenly bodies, or biology without its taxonomy of living things. This is no less true in the behavioral sciences. Although many theorists and researchers concern themselves primarily with processes and mechanisms, rather than with classification, their work rests on a bedrock of ideas about the distinctions between—and relations among—important phenomena within their area of study.

Classification is especially central to the enterprise of psychologists interested in individual differences. Clinical psychologists operate (sometimes reluctantly) within the context of psychiatric classification systems, and clinical researchers and theorists often argue that the boundaries drawn by these systems between mental disorders, or between particular disorders and normal functioning, are incorrectly located or arbitrarily imposed on latent dimensions of pathology. Personality psychologists have long been preoccupied by the structure of the trait universe, whereas the organization of intellectual abilities has been a focal task for some cognitive and educational psychologists.

Although classification is a common concern among psychologists, it is interesting to note how classifications differ across domains. Within abnormal psychology, for example, the prevailing reliance on psychiatric classification systems leads mental disorders to be represented and diagnosed as discrete, tightly bounded categories similar to classifications of disease in general medicine. These disorders are diagnosed as present or absent within any individual person, allowing estimation and monitoring of their prevalence in the general population at any particular time or over a given period. In the personality and ability domains, by contrast, classifications usually specify dimensions along which people are presumed to differ in a purely quantitative fashion. Where neuroticism or intelligence are concerned, for example, individual differences are taken to be matters of degree rather than differences in kind.

Needless to say, these differences among classification systems reflect differences in default positions about the nature of variation underlying psychological phenomena, and these positions are taxonic and dimensional, respectively. A perusal of the research literature or even an introductory textbook suggests that taxonic beliefs are held more often about psychopathology, whereas dimensional beliefs are held more often about normal personality and abilities. However, these general positions are open to empirical challenge on a construct-by-construct basis. Many structural beliefs are based on intuitive plausibility, theoretical presumptions, or barely questioned disciplinary traditions, rather than empirical tests (Meehl, 1992). Moreover, there is often disagreement about the taxonic versus dimensional nature of specific constructs. Some writers, for example, have criticized the categorical view of psychopathology embodied in standard psychiatric nosology (e.g., Widiger & Clark, 2000), whereas others have challenged the prejudice against taxa in personality psychology (Gangestad & Snyder, 1985). In short, the default positions of classification across behavioral sciences are often contentious and provide a fertile ground for empirical study.

A promising remedy for this lack of consensus is to conduct research examining the constructs in question using an approach designed to differentiate taxonic from dimensional structures. Although later chapters review the appropriateness of the taxometric method for this purpose, it is first worth considering what implications such work would have for the task of classification. In other words, how might determining the latent structure of relevant constructs affect the development and revision of classification systems? Given that the preponderance of taxometric research has been done in the field of psychology, our examples focus on the potential impact of such research on psychological classification, although similar implications would be expected for classification systems in related disciplines.

One possible outcome of taxometric investigations would be to support the taxonic view of a mental disorder and yield a taxon base rate that is consistent with the known prevalence of the disorder as it is presently diagnosed. This would bolster the status of the disorder as a discrete category and help validate its diagnostic criteria. An important additional benefit of taxometric procedures is that they can be used to identify the particular individuals who belong to a taxon. By studying the features that best distinguish members of the taxon from its complement class, the most distinctive features of the disorder can be ascertained, and the diagnostic criteria used in classification can be further improved and refined. Comparable outcomes would ensue if structural research supported the prevailing dimensional view of personality traits, with follow-up studies identifying the variables that optimally locate individuals along the uncovered latent continua.

A second possible outcome of taxometric investigations would be to challenge the prevailing structural model of a construct. For example, a mental disorder presumed to be categorical or the supposedly discrete subtypes of a disorder might prove to be dimensional. Findings such as these could call into question the current categorical representation of these disorders and suggest the need for their reevaluation or reconceptualization within the classification scheme. Follow-up work would be needed to determine the points at which distress, disability, or other relevant factors denote clinically significant disturbance (and hence require clinical attention). The dimensional nature of these disorders might be accommodated by adding severity quantifiers (e.g., *moderate* or *severe* designators, 0–8 clinician severity ratings) at the symptom or diagnosis level; by determining whether clinically meaningful forms of the disorder fall below, at, or above the current diagnostic threshold; and by making diagnostic decisions with greater emphasis on practical concerns (e.g., the level of functional impairment) or an optimized weighting of symptom severity than on the presence or absence of a designated number or combination of symptoms. A taxonic finding for a personality characteristic could have similar implications for personality taxonomies, with personality taxa requiring acknowledgment and structure-appropriate classification alongside—or in place of—standard trait dimensions.

A third possible outcome of taxometric studies that bears on psychological classification is a taxonic finding that challenges the boundaries specified by the classification system. That is, a taxon might be detected as hypothesized, but might poorly correspond to the nature, number, or combination of variables currently used to identify it. For example, the diagnostic criteria for a particular mental disorder might give equal weight to eight symptoms indicative of the condition despite possible redundancy, differential predictive power, or disparate sensitivity or specificity in detecting the disorder vis-à-vis normal functioning or neighboring disorders. Alternatively, the criteria might describe a disorder in an overly inclusive or exclusive fashion, drawing the category's boundaries too broadly or narrowly relative to the size of the underlying taxon. In such situations, taxometric findings could be used to redraw the boundaries of the diagnosed disorder to more accurately map the boundaries of its underlying taxonic structure, resulting in greater precision of classification and consequent improvement in the prediction of course, prognosis, treatment response, and other critical outcomes.

A chief impetus for taxometric research has been the desire to improve psychological classification to solve the classification problem (Meehl, 1995a) and in turn achieve greater understanding, prediction, and control over psychological phenomena. The distinction between taxonic and dimensional latent structure has many implications for psychological and related taxonomies, and a rigorous empirical method for making this distinction has a major part to play in classification research.

DIAGNOSIS

As we argued earlier, classification is an important and controversial matter in behavioral science, and one that can be clarified by taxometric research. Whether a particular condition deserves a place in taxonomies of mental disorder—and if, where, and how its boundaries should be drawn—are questions that taxometric research can help address. A thorough and systematic application of taxometric analysis to the hundreds of mental disorders now recognized in formal classification systems such as the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM*; American Psychiatric Association, 1994) or *International Classification of Diseases* (*ICD*; World Health Organization, 1993) might suggest altering these systems in substantial and unexpected ways.

The aim of classification is to catalogue the kinds of entities that are presumed to exist in a particular domain, reflecting the ways in which these entities are understood to vary and interrelate. Assigning individuals to these entities is a matter of diagnosis. Just as taxometric research can clarify and refine classification systems, it can also improve diagnostic practices. How it does so depends crucially on whether the latent structure being classified is taxonic or dimensional.

Imagine that a certain mental disorder is recognized in a psychiatric classification system, which describes the characteristic clinical features of this disorder and lists its requisite diagnostic criteria. Normally a disorder is considered to be present (and a diagnosis is made) when a person is judged to have met some or all of these criteria. The precise rule that governs which or how many criteria must be met for a diagnosis to be made is usually referred to as the *diagnostic algorithm*. For example, the algorithm might specify that a particular number of symptoms (e.g., any five out of seven) must be met to pass the diagnostic threshold. The algorithm operationally defines the boundary of the diagnostic category and effectively determines its prevalence—the proportion of the population who would receive the diagnosis. If the algorithm were to be relaxed (four out of seven) or tightened (six out of seven), this proportion might change substantially.