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A Mixed Membership Approach to the Assessment of Political Ideology from Survey Responses

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Political scientists have long observed that members of the public do not tend to exhibit highly constrained patterns of political beliefs and values in the way that partisan elites often do. In answering survey questions designed to measure latent ideology, they may act as if drawing responses randomly from different perspectives. In the American context, survey respondents frequently defy easy categorization as prototypical liberal or conservative, and yet their response patterns reflect structure that may be characterized by reference to such ideal types. We propose a mixed membership approach to survey-based measurement of ideology. Modeling survey respondents as partial members of a small number of ideological classes allows us to interpret the “mixed signals” they seem to send as a natural consequence of their competing inclinations. We illustrate our approach by reanalyzing data from a classic study of core beliefs and values (Feldman, 1988) and find that the most dramatic difference between prototypical members of the two main ideologies identified is not their vision of what society *should be* but rather their belief in what American society *actually is*.

6.1 Introduction

A rich and important tradition in political science involves the analysis of patterns of political ideology.¹ Initially, the identification and characterization of such patterns had been performed in a rather ad-hoc manner, albeit based on careful philosophical and qualitative considerations within a theoretical framework established by leading scholars on the subject. This approach reached its peak with what many consider its best and most influential example, *The American Voter*, by Campbell et al. (1960, see especially ch. 9, “Attitude Structure and the Problem of Ideology”). Beginning with Converse (1964), a wave of critical rethinking on the subject emerged. Along the way, various researchers have applied modern empirical tools of survey analysis and statistical inference to revisit previously held assumptions about the structure of American political attitudes and beliefs (e.g., Marcus et al. (1974); Achen (1975); Stimson (1975); Feldman (1988); Conover and Feldman (1984); Zaller (1992); Pew Research Center (2011); Ellis and Stimson (2012)). In essence, this constitutes a measurement problem: we treat data, e.g., responses to survey questions, as manifest indicators of respondents’ latent dispositions on politics and policy. A number of different analytical tools have been utilized in approaching the problem, with factor analysis being the most frequently employed and item response models gaining in popularity. The basic goal of these endeavors is typically to understand the structure of—or constraints on—beliefs, values, and attitudes at two levels: the individual and the population at large. Thus, the objects of interest include configurations of views that may be expected to coexist within a single person and the relative frequency with which these particular sets of views are held (or called upon in responding to survey items).

A basic task in the study of ideology is the construction of typologies. Simple examples of typologies are the well-known distinctions between “left” and “right” or “liberal” and “conservative.” Types such as “liberal” or “conservative” correspond to particular configurations of attitudes, values, and beliefs that hypothetical adherents to these ideological types are supposed to exhibit. Of course nothing precludes the construction of typologies with more than two classes, as long as they offer meaningful analytical distinctions. For example, in the most recent (as of 2012) of a series of reports from the Pew Center for People and the Press, survey response data, grouped using clustering techniques,² revealed two distinct groups of Republican-leaning respondents (labeled post facto as *Staunch Conservatives* and *Main Street Republicans*); three categories of people inclined toward the Democratic party (*New Coalition Democrats*, *Hard-Pressed Democrats*, and *Solid Liberals*); and three so-called “Middle Groups” (*Libertarians*, *Disaffecteds*, and *Post-Moderns*) (Pew Research Center, 2011).³ In previous reports in the Pew series, issued in 1987, 1994, 1999, and

¹Except where noted, we use the term *ideology* somewhat generically to include any patterns of political and policy-oriented beliefs, values, and attitudes. Within political science, psychology, and the scholarly study of public opinion, the term is more narrowly defined as a highly constrained special case of this.

²The full Pew report provides little detail on the clustering procedure employed, indicating only that scales were developed using factor analysis, with clustering carried out on responses measured along the resulting scales. The report does not specify the particular clustering algorithm employed: “The typology groups are created using a statistical procedure called ‘cluster analysis’ which accounts for respondents’ scores on all nine scales as well as party identification to sort them into relatively homogeneous groups.” Several competing cluster solutions were then compared, “evaluated for their effectiveness in producing cohesive groups that were sufficiently distinct from one another, large enough in size to be analytically practical, and substantively meaningful.” Other than citing the reliance on both statistical and substantive criteria, no additional detail is provided on the selection of the particular clustering appearing in the report. Aside from modeling assumptions implicit in the first-stage factor analysis, the overall approach is not model-based; certainly the clustering stage is model-free.

³Worth noting is that those identified as middle-groups were not necessarily neatly placed on a scale from liberal to conservative, as is typically done for “moderates” not clearly identifiable as liberal or conservative in contemporary terms. For example, Libertarians were those who tended to express strong views in favor of reduced government in all aspects of life, social and economic, leading to positions more associated with Republicans on economic issues and with Democrats on a number of social issues including support for political secularism. Meanwhile, Disaffecteds would not be fruitfully described in terms of a continuum between liberal and conservative, as they were typified more by their cynicism regarding politics and voting in general, yet they did tend to be somewhat more likely to consider themselves Republicans. While

2005, somewhat different typologies emerged from cluster analysis. It is unclear whether identical clustering techniques have been used in all Pew typology studies.

A straightforward means of employing typologies in describing ideological inclinations is to use the types as direct descriptions of individuals. This allows us to partition the population of interest into a few disjoint homogeneous subsets, whose members share the same configuration of attitudes, beliefs, and values—for example, “liberals” and “conservatives”—or perhaps a larger set, as in the Pew report. This approach, however, requires an important trade-off between interpretability and ability of accounting for individual heterogeneity. On the one hand, we want to be able to rely on as few types as possible, each specifying meaningful distinctions pertaining to its members. On the other, we want to avoid oversimplifying the ideological phenomenon, thereby creating too coarse of a partition to adequately account for reality.

A different approach, which we consider more natural for the study of political ideology, is the use of a mixed membership (MM) framework. Mixed membership allows us to specify partial membership in multiple reference types and to quantify the strength of these memberships. This enables us to describe ideology in terms of a reduced number of prototypical configurations, such as liberal and conservative, while allowing these configurations to coexist within a single individual. In this way we could, for instance, describe an individual’s ideology as a combination of “14% conservative and 86% liberal.”

In the remainder of this introductory section, we consider the challenge of measuring individuals’ ideologies or political belief systems, typical methods for handling the task, and what a mixed membership modeling approach may offer political scientists wishing to answer key problems in the study of ideology. We also reflect briefly upon the notion of individuals as partial adherents to more than one ideological profile and look a bit more closely at why MM models provide such a suitable empirical counterpart to this analytical framework. The data with which we illustrate an application of this measurement model are described in Section 6.2. Next, in Section 6.3, we present a general mixed membership model for ideology, which treats survey respondents as if they were drawing upon partial membership in different latent ideological prototypes (or *extreme profiles*) in order to determine their responses. Some details regarding model fit are offered in Section 6.4, after which we discuss our results in Section 6.5. Finally, we conclude with a brief examination of how scholars of political psychology and public opinion stand to benefit more broadly from a mixed membership approach to their investigations, and offer a candid assessment of the limitations of the current model and possible remedies to be pursued in future work.

6.1.1 Understanding Ideology and the Structure of Politically-Oriented Beliefs, Values, and Attitudes

Among scholars who wish to understand how members of the public reach evaluations about parties, policies, and candidates, or simply about what they see on the evening news, there are a variety of approaches that may be taken. What is common to most of these is an assumption that people have certain dispositions, outlooks, or “basic orientations” (Feldman, 1988) upon which they rely in making such evaluations. Important debates have revolved around the question of whether ordinary people seem to apply “abstract ideological principles, sweeping ideas about how government and society should be organized” (Kinder, 1983, p. 390) in order to reach opinions on a variety of issues. For some, the notion of *ideology* itself is inherently unidimensional, a “general left-right scheme. . .organizing a wide range of fairly disparate concerns” (Zaller, 1992, p. 26). In this narrow sense of “ideology,” as the term is typically employed by political scientists, the observation that

the Disaffected category had been identified in all three previous reports, Post-Moderns, on the other hand, were a newly emergent type. Young and heavily Democratic in party membership, they agreed with staunch liberals on such issues as the environment, immigration, and separation of church and state, yet were more wary of New Deal and Great Society policies. (Pew Research Center, 2011, pp. 20–21).

most people do not rely on such a unified structuring of political views and perceptions has long been of great interest (Campbell et al., 1960; Converse, 1964). And yet, even though members of the mass public do not think about most political issues using a left-right scheme to nearly the extent that political elites do, they neither approach each new object of evaluation independently, nor do they think or care enough about politics and policy to be able to do so (Page and Shapiro, 1992; Lupia and McCubbins, 1998). Thus, the basic orientations people use to make sense of the political world may be somewhat varied and not well captured by a single—or possibly even a small number—of dimensions.

We start from the widely shared assumption that such latent structure does exist in individuals and that it drives, probabilistically, their responses to survey questions, as proposed by Zaller (1992). It is this latent structure that we refer to here as *ideology*. As a prominent example of fundamental latent structures that do not meet the classical notion of a left-right overarching scale, some have suggested that particular nations or cultures have a few prominent core beliefs and values (e.g., communitarian or individualist orientations) that may have a high degree of popularity, but which may be of more or less importance in individuals' psyches. Converse (1964, p. 211) posits that "psychological constraints" may be at play, whereby "a few crowning postures—like premises about survival of the fittest in the spirit of Social Darwinism—serve as a sort of glue to bind together many more specific attitudes and beliefs, and these postures are of prime centrality in the belief system as a whole."

Feldman (1988) and others follow up on this by examining the *core beliefs* and *core values* that may provide just this sort of psychological constraint. More recently, Ellis and Stimson (2012) make similar ideas the centerpiece of their "alternative conception of 'ideology,' ... defined by citizens' specific beliefs and values regarding what governments should and should not be doing." This "operational ideology" is distinguished from a "symbolic ideology" based on a person's self-identification or one based on more vague sentiments about " 'government' or 'government programs' broadly framed."

Our own conceptualization of ideology here follows that of Ellis and Stimson in its reliance on fundamental values and beliefs, especially as related to the appropriate role and obligations of government. Note that there is nothing inherent in such a definition that requires ideology to be unidimensional, although left-right orientation can certainly be a useful heuristic and is the focus of these authors' own discussion. If ideology is instead conceptualized as the degree to which certain values and beliefs are salient for individuals as they evaluate political objects such as candidates and policy proposals, it may be less than ideal to measure ideology using a continuous, unbounded interval. For instance, we might expect that the vast majority of Americans will embrace values of reward for hard work, equality of opportunity, or freedom from governmental interference. Different kinds of people may find some of these considerations more compelling than others, but it would be surprising to find, for example, a group of Americans openly hostile to the notion of equal opportunity. Thus, we would like our measurement tools to be able to reflect this, by allowing us to distinguish groups of respondents not only by the values and beliefs which most starkly divide them, but also by how consistently they embrace those values and beliefs that are widely held.

6.1.2 Measuring Ideology with Survey Data

Regardless of the details of a latent structure approach to ideology (whether, for example, we treat latent and observed variables as continuously varying, ordinal, or measurable in terms of unordered levels), a key assumption is that all variation in survey responses can in fact be explained by the underlying latent structure. Survey responses will thus be conditionally independent given one's ideology (i.e., belief/value structure). The matter of how to conceptualize the latent space, whether as a multidimensional continuum or a typology with multiple possible latent classes, is largely a pragmatic question about what best reveals an otherwise invisible structure to the researcher in a manner appropriate to the questions being asked. It may be that certain renderings of this space (as,

say, a unidimensional continuum) are rather limited in what they can tell us about how opinions are generated, but a choice among different representations will quite properly hinge upon what best allows lucid communication of findings. A discrete multivariate approach to the survey responses themselves makes sense, since such a treatment reflects the actual structure of Likert scale items typically found in public opinion surveys, allowing the researcher to avoid the false assumption of a continuous scale and comparable units separating response levels.

The main approaches one may take in measuring ideology as a latent construct, inferred from responses to carefully selected survey questions, can be divided into heuristic or purely descriptive techniques on one hand, and principled, model-based approaches on the other. Among the former are basic principal components analysis (PCA),⁴ multidimensional scaling (MDS) (Marcus et al., 1974), Q-analysis (Conover and Feldman, 1984), and correspondence analysis (CORA), a categorical analogue to PCA. The latter includes factor analysis (FA) (Feldman, 1988) and other forms of latent structure analysis such as latent trait analysis/item-response theory (IRT) (Treier and Hillygus, 2009) and latent class analysis (LCA) (Taylor, 1983; Feldman and Johnston, 2009), as well as mixed membership/Grade of Membership models (MM/GoM), which may be thought of as either a sort of discrete factor analysis (Erosheva, 2002, pp. 16–20) or an extension of latent class analysis.

Although there are a number of different options for handling the measurement of ideology (and beliefs, attitudes, values, etc.), the most common approach is some form of factor analysis. As the oldest latent variable measurement technique, and the most deeply ingrained in the habits of social scientists, it has the advantage of being easily related to ordinary regression techniques, and dominates the early literature on mass belief structures. Converse sets the precedent of actually equating the factors discovered or confirmed via FA with dimensions of belief structure, generating political evaluations much as Spearman's general intelligence quotient g generates responses to IQ test items (Spearman, 1904). "Factor analysis is *the* statistical technique designed to reduce a number of correlated variables to a more limited set of *organizing dimensions*" (Converse, 1964, our emphasis). One reason that factor analysis became the dominant approach to measuring latent ideological structure was that it was the earliest to be implemented in standard statistical computing packages. The representation of individuals' ideals and beliefs located in a low-dimensional continuous space also conformed well with evocative metaphors, adapted from economics, by which voters were considered to occupy a location in ideological space (or representing preferred tradeoffs among various competing public goods) and should be expected to prefer candidates located nearby (or with similar ideal balance among policy priorities) (Downs, 1957). Although the application of factor analysis in such situations is a deeply entrenched tradition in the study of ideology and public opinion, and is not an unreasonable approach, it is more appropriate for continuous multivariate data than discrete multivariate data typically found in survey responses.

6.1.3 Citizens as Partial Adherents to Distinct Ideologies

Converse (1964) set forth a research agenda, carried out in various forms over the decades since, aimed at understanding the "constraints" on patterns of belief which people may simultaneously hold. He refers to the "combinations" and "permutations" of "idea-elements" actually observed for individuals. When the constraints are severe enough, the resulting packet of beliefs to which a set of people subscribes is considered an *ideology*, in its strict sense as a psychological term of art. As Kinder (1983, p. 390) puts it, the notion of ideology upon which scholars once focused, but which guides the political evaluations of few actual citizens, consisted of "abstract ideological principles, sweeping ideas about how government and society should be organized." In this previously

⁴Social scientists regularly use the term "principal components analysis" interchangeably with (exploratory) factor analysis—and PCA is treated as a special case of FA in statistical computer packages—but we are referring to its standard statistical meaning, a process by which orthogonal basis vectors of the reduced-dimensional space are chosen to maximize variance accounted for with each additional dimension included. The goal of PCA, as with the other descriptive approaches, is simply dimension reduction, not modeling or inference regarding the data generation process.

dominant understanding of ideology, answers to a variety of public opinion questions could be thought to follow logically from a highly rigid, overarching outlook. Of course, if ideology operated as a purely deductive process among adherents, survey responses would be generated deterministically, and we should see certain beliefs and opinions always occurring together and others never co-occurring.⁵

Given such a narrow view of ideology, it is easy to look at actual patterns of response as evidence that people are haphazard in their thinking about politics and policy. Zaller (1992) countered this by developing a highly influential theory of how individuals formulate their responses to public opinion polls by randomly sampling from a number of privately held “considerations” relevant to the question at hand. Such a formulation helps account for a number of puzzling observations, such as the tendency for particular individuals to give different answers to the same question on different occasions.

Latent class statistical modeling (Lazarsfeld and Henry, 1968; Goodman, 1974) corresponds fairly well to Zaller’s theoretical model, as each member of a distinct class responds by drawing a particular response from a distribution associated with that type. However, such an approach has the intrinsic limitation of assuming that individuals belong exclusively to just one ideological group and that each such group is homogeneous. This characterization leaves out the possibility of individuals who do not fully conform to any of the categories of a typology, but rather respond as something of a hybrid.

Mixed membership models offer a conceptually attractive way of overcoming this limitation. Under mixed membership analysis, we still try to identify and characterize typical ideological classes. However, we regard individuals not as full members of those classes, but as *partial members*. This way, we take individuals’ responses as arising from all the distributions associated with the classes, weighted according to individually specified membership in all of them.

Mixed membership models help formalize the idea of people as being partial adherents to different recognizable ideologies. Some—especially political leaders or “elites”—may adhere vigorously to a particular ideology and this would be reflected by full or nearly full membership in one group to the exclusion of the others. Others, perhaps the vast majority of the mass public, will draw on more widely dispersed vectors of partial membership in each. This offers a nice compromise between a continuous Euclidean latent space on one hand and a categorical latent space on the other; patterns in the population and in individuals themselves are described in terms of easily understood prototypical distributions over categorical responses, and yet individuals are treated as combinations of the various prototypes, with their partial memberships allowed to vary continuously. The generating process of responses may indeed be thought of hierarchically: in encountering a survey item, the respondent first randomly draws an ideological profile based upon his or her relative degree of membership in each extreme profile and then randomly draws a response from that profile’s response distribution.

6.2 Application: The American National Election Survey

The data we analyze here come from a pilot study for the 1984 American National Election Study (NES), conducted by the Center for Political Studies of the Institute of Social Research at the University of Michigan during the summer of 1983. The study’s purpose was to introduce and test new survey items, including a number of questions on core values that we will be using to illustrate

⁵Empirically, not only do people hold sets of beliefs and values that do not logically follow from one another, but we simultaneously hold beliefs and values that are logically inconsistent; the commonly held trio of preferences for more government spending, lower taxes, and a reduced deficit is but one prominent example.

our mixed membership modeling approach to measuring ideology. The complete data consist of reinterviews with 314 randomly selected respondents to the earlier 1982 National Election Study. We reanalyze the same 19 items investigated by Feldman (1988),⁶ using only the 279 complete responses.

The initial national sample, obtained for the 1982 NES and from which the individuals in the 1983 pilot study considered here were subsampled, consisted of 1,418 respondents living within the primary areas of the survey's county-based sampling frame. These areas were all located within the 48 contiguous states (not including military bases). They include 12 major metropolitan areas, 32 other standard metropolitan statistical areas, and 30 counties or county-groups representing the rural subpopulation. Stratification was implemented independently within each of the four major geographical regions of the United States, as recognized at the time: northeast, north central (loosely, the midwest), south, and west, with each represented in proportion to population. The population under study included only United States citizens 18 years or older on Election Day, 1982.

According to Feldman's review of the existing literature at the time, three political attitudes dominated the American political psyche: "belief in equality of opportunity, support for economic individualism, and support for the free enterprise system," and the 19 items to be analyzed were all developed with the intent to measure these components of ideology. We have labeled all of these with our own variable names, which are intended to capture the spirit of the questions and distinguish similar items from one another based on the subtle wording differences. (See the Appendix for a complete list of the wording of questions.) Seven of the 19 items are intended to measure support for or belief in what Feldman calls "equal opportunity," including statements that attribute inequality to inherent individual differences (*natural inequality 1*, *natural inequality 2*, and *equality goal misguided*), one that claims a key role for society—perhaps understood as "government" by some respondents—in ensuring equal opportunity for success (*equal opportunity–society's responsibility*), assessments of whether inequality is a serious problem (*equal treatment and inequality big problem*), and one expressing support for the ideal of shared governance (*democracy*). The items dealing with "economic individualism" are closely related to one another and differ mostly in subtle ways, as indicated in our choice of variable names: *hard work optimism*, *hard work realism*, *hard work idealism*, *ambition pessimism*, *effort pessimism*, and *individual responsibility for failure*. Finally, the "free enterprise" items (*less intervention is better*, *intervention populism*, *laissez-faire capitalism*, *regulations not a threat to freedom*, *intervention causes problems*, and *free enterprise not intrinsic feature of gov't*) allow respondents to weigh possible tradeoffs between positive and negative consequences of governmental regulations. All items consist of statements to which the respondents may say that they "agree strongly," "agree but not strongly," "can't decide," "disagree but not strongly," or "disagree strongly." In order to avoid overparametrization for such a small sample yet capture the main qualitative differences in responses, we collapse these responses into three categories: agree, can't decide, or disagree.

6.3 Methods

We apply a technique known as the Grade of Membership model (GoM) to the study of political ideology. GoM models (Woodbury et al., 1978; Manton et al., 1994; Erosheva et al., 2007) are a sub-family of mixed membership models (Erosheva and Fienberg, 2005). They are well-suited to obtaining low-dimensional representations of high-dimensional multivariate unordered categorical data, such as those that are generated by opinion surveys. Similar to other MM techniques, GoM

⁶Feldman served on the ANES planning committee and was apparently directly involved with formulation of these questions, intended to measure three particular core values and beliefs of Americans.

models represent individuals as individually weighted combinations of a small number of “ideal individuals” or “extreme profiles” and use the data to estimate both the extreme profiles themselves and each subject’s membership structure. The Bayesian version of the GoM model, which we introduce here and use throughout this chapter, was introduced by Erosheva et al. (2007) and applied to the study of disability in elders.

6.3.1 Grade of Membership Models

We consider a sample of N individuals. Each individual $i = 1, 2, \dots, N$ has a corresponding J dimensional vector of manifest variables, $X_i = (X_{i1}, \dots, X_{iJ})$, that collects the outcomes of interest. We assume that the components of the outcome’s vector are unordered categorical variables with n_j levels each ($j = 1, \dots, J$). In our application, these outcomes are the answers to each of the J questions of the survey. For convenience, we label component’s levels using consecutive numbers, $X_{ij} \in \{1, 2, \dots, n_j\}$. We assume that there is only one response vector per individual.

GoM models assume the existence of a specific number, K , of “extreme profiles” or “pure types.” These are idealized versions of individuals that we use as reference types for specifying the response distributions of actual individuals. We assume that real individuals are combinations of these extremes types. To formalize this, we endow each individual with his or her own *membership vector*, $g_i = (g_{i1}, \dots, g_{ik}, \dots, g_{iK})$. Each component of g_i , g_{ik} for $k = 1, \dots, K$ specifies the degree of membership of individual i in the corresponding extreme profile among all K . We restrict membership vectors so that $g_i \in \Delta_{K-1} = \{(g_1, \dots, g_K) : g_k \geq 0, \sum_{k=1}^K g_k = 1\}$, where Δ_{K-1} is the $K - 1$ -dimensional simplex. Ideal individuals of the k th extreme profile have a membership vector whose k th component is $g_{ik} = 1$ and the rest, zeros.

We characterize the extreme profiles as follows: For any individual that is a *full member* of the k th extreme class (i.e., such that its membership vector has $g_{ik} = 1$ and $g_{ik'} = 0$ for $k' \neq k$), we assume that the response distribution of the j th entry of the manifest variables vector is a simple discrete distribution:

$$\Pr(X_{ij} = l | g_{ik} = 1) = \lambda_{jk}(l), \quad (6.1)$$

where $l \in \{1, 2, \dots, n_j\}$ and $\lambda_{jk} = (\lambda_{jk}(1), \dots, \lambda_{jk}(n_j)) \in \Delta_{n_j-1}$.

For generic individuals with membership vector g_i , we characterize their component-wise response distribution as the convex combination

$$\Pr(X_{ij} = l | g_i) = \sum_{k=1}^K g_{ik} \lambda_{jk}(l).$$

Geometrically, this specification means that the individual response distributions are located within the convex hull defined by the extreme profiles.

We further assume that the item responses j are conditionally independent given membership vectors. This local independence assumption (Holland and Rosenbaum, 1986) expresses the idea that the membership vector g completely explains the dependence structure among the J binary manifest variables. By making this assumption, we can construct the conditional joint distribution of responses:

$$\Pr(X_i = x_i | g_i) = \prod_{j=1}^J \sum_{k=1}^K g_{ik} \lambda_{jk}(x_{ij}).$$

Assuming further that the individuals are randomly sampled from the population, we finally obtain

$$\Pr(X = x|g) = \prod_{i=1}^N \prod_{j=1}^J \sum_{k=1}^K g_{ik} \lambda_{jk}(x_{ij}). \quad (6.2)$$

Membership vectors are unobserved latent quantities. In order to derive an unconditional expression for the joint distribution of observed responses, we assume that membership vectors are sampled from a common distribution, G_α , with support in Δ_{K-1} ; whereby

$$\Pr(X = x) = \prod_{i=1}^N \int_{\Delta_{K-1}} \prod_{j=1}^J \sum_{k=1}^K g_k \lambda_{jk}(x_{ij}) G(dg). \quad (6.3)$$

An interesting perspective on the GoM model results from considering the following equivalent data generation process, which generates N variates $x_i = (x_{i1}, \dots, x_{iJ})$ for $i = 1, \dots, N$, according to a GoM model with K extreme profiles (Haberman, 1995; Erosheva et al., 2007):

GoM Data Generation Process

For each $i = 1, 2, \dots, N$

Sample $g_i = (g_{i1}, \dots, g_{iK}) \sim G$;

For each $j = 1, 2, \dots, J$

Sample $z_{ij} \sim \mathbf{Discrete}_{1:K}(g_{i1}, g_{i2}, \dots, g_{iK})$;

Sample $y_{ij} \sim \mathbf{Discrete}_{1:n_j}(\lambda_{jz_{ij}}(1), \dots, \lambda_{jz_{ij}}(n_j))$.

According to this process, we can understand the generation of individual GoM variates as arising from a two-step procedure: (1) Given a membership vector g_i , we obtain the components of the response vector one by one. (2) For each of the J components, we determine an effective extreme profile—which is allowed to vary from component to component—by sampling it with probabilities given by g_i . Next, we sample the actual response as if the individual were a full member of that extreme profile for that question. The multiple membership is reflected by the fact that the individual answers to each question are generated according to different extreme profiles.

6.3.2 Full Bayesian Specification

For this application we closely follow Erosheva et al. (2007). We complete the specification of the GoM in a full Bayesian fashion by choosing the distribution of membership vectors, G_α , and a prior distribution for all parameters of our model.

For the membership vectors distribution G_α , we specify their common distribution as

$$g_i \stackrel{iid}{\sim} \mathbf{Dirichlet}(\alpha),$$

with $\alpha = (\alpha_0 \cdot \xi_1, \dots, \alpha_0 \cdot \xi_K)$, $\alpha_0 > 0$ and $\xi = (\xi_1, \dots, \xi_K) \in \Delta_{K-1}$. Parameter ξ is the expected value of distribution G_α . Using the generative process interpretation from the previous section, each component of ξ represents the expected proportion of item responses generated by

each of the extreme profiles; thus we can understand it, informally, as the relative importance of each extreme profile in the population. Parameter α_0 is a concentration parameter that expresses how concentrated the probability distribution is about its expected value (as α_0 increases) or near the vertices of the simplex Δ_{K-1} (as α_0 decreases). When $\alpha_0 = K$ and $\xi = (1/K, \dots, 1/K)$ so that $\alpha = \mathbf{1}_K$, distribution G_α becomes uniform over Δ_{K-1} .

We specify the hyperpriors of G_α as $\alpha_0 \sim \mathbf{Gamma}(1, 2)$ (in shape/rate parametrization) and $\xi \sim \mathbf{Dirichlet}(\mathbf{1}_K)$. These choices specify a priori ignorance about the relative importance of each extreme profile in the population and a slight preference (although not so strong) for small values of α_0 , with individuals likely to be relatively pure adherents to one or another extreme profile unless the data provided suggest otherwise.

Each conditional response distribution for item j and extreme profile k , $\lambda_{jk}(\cdot)$ consists of n_j scalar parameters restricted to the simplex Δ_{n_j} . For these parameters, we choose the prior distribution

$$\lambda_{jk} = (\lambda_{jk}(1), \dots, \lambda_{jk}(n_j)) \stackrel{iid}{\sim} \mathbf{Dirichlet}(\mathbf{1}_{n_j}),$$

or a uniform distribution over Δ_{n_j-1} .

6.4 Fitting the Models

We have employed an MCMC algorithm to obtain samples from the posterior distribution of parameters given the data. The algorithm is an extension for multilevel variables of the sampler presented in Erosheva et al. (2007), originally developed for binary variables. This sampler is based on a data augmentation strategy using the equivalent generative process outlined in Section 6.3. We have fitted models with $K = 2, 3, 4$, and 5 extreme profiles using the prior distributions described in Section 6.3.2.

Similar to other latent structure models, GoM models are invariant to permutations of the extreme profile labels. For this reason we have re-labeled extreme profiles according to the decreasing sequence of the posterior estimates (posterior means) of the components of ξ . This ordering makes comparisons easier.

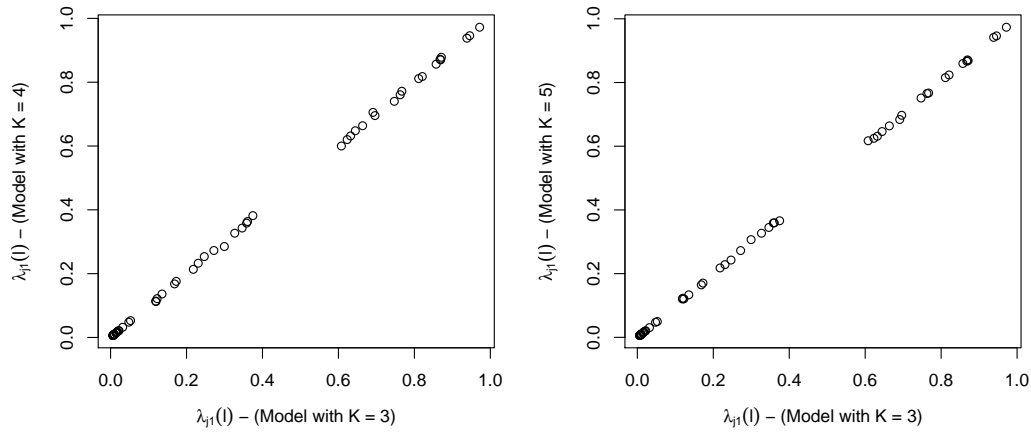
Table 6.1 shows posterior estimates (posterior means and standard deviations) for the population-level distribution of membership vectors α_0 and ξ for models with $K = 2, 3, 4, 5$ extreme profiles. In all cases, posterior estimates of α_0 are relatively small. This causes most membership vectors in the population to be dominated by a single extreme profile. However, α_0 is large enough so that the mixed membership becomes an important structural feature. For instance, for model $K = 3$ the probability that a single individual's responses to different questions are drawn from more than one extreme profile is approximately 0.65. Not surprisingly, given the scarcity of data ($n = 279$), posterior dispersions are rather large.

Investigating the posterior estimates of ξ we see that for $K \geq 3$, all models feature two dominant

K	α_0	ξ_1	ξ_2	ξ_3	ξ_4	ξ_5
2	0.510 (0.236)	0.971 (0.009)	0.029 (0.009)			
3	0.765 (0.233)	0.604 (0.129)	0.373 (0.129)	0.023 (0.007)		
4	0.772 (0.238)	0.591 (0.131)	0.384 (0.131)	0.016 (0.010)	0.010 (0.010)	
5	0.827 (0.229)	0.613 (0.122)	0.359 (0.121)	0.013 (0.010)	0.011 (0.011)	0.003 (0.003)

TABLE 6.1

Posterior estimates of parameters α_0 and ξ for models with $K = 2, 3, 4$, and 5 extreme profiles. Numbers between parenthesis are posterior standard deviations.

**FIGURE 6.1**

Comparison of posterior estimates of the first extreme profile, $\lambda_{j_1}(l)$, for model with $K = 3$ versus models with $K = 4$ and $K = 5$ extreme profiles.

extreme profiles, with $\xi_1 \approx 0.60$, $\xi_2 \approx 0.36$, and $K - 2$ profiles with very small values of ξ_k . Closer inspection reveals that those two dominant extreme profiles ($k = 1$ and $k = 2$) are very similar for all models with $K \geq 3$. Plots in Figure 6.1 show the posterior estimates of $\lambda_{j_1}(l)$ (parameters of the first extreme profile) for the model with $K = 3$ extreme profiles versus their counterparts for models with $K = 4$ and $K = 5$ extreme profiles. We see that all points lie almost perfectly on the main diagonal. The situation is similar for the second extreme profile ($k = 2$, not shown).

Based on these observations and the qualitative inspection of the estimates, we have selected the model with $K = 3$ for our inferences. This was the smallest model for which the two dominant extreme profiles appear, and any more complex model basically gives us the same information, supplemented only by additional extreme profiles with very small values of ξ_k . Interestingly, the estimate of the conditional response distribution, λ , for the dominant extreme profile in model $K = 2$ is almost numerically equal to the weighted sum (by ξ_1 and ξ_2) of the estimates of the two dominant extreme profiles of our selected model ($K = 3$, but also for $K = 4$ and $K = 5$). This suggests that the two dominant extreme profiles in our chosen model are basically a split of the first dominant profile of model $K = 2$. Our attempts to perform more formal evaluations failed to produce anything illuminating. Posterior predictive counts were difficult to produce and analyze due to the small sample size and large number of variables. We also evaluated the Advances in Computational Mathematics (AICM) index (Raftery et al., 2007; Erosheva et al., 2007), which selected a model with $K = 2$ extreme profiles.

6.5 Results and Discussion

6.5.1 Results

The multinomial conditional probabilities of responses given full membership, λ_{jk} , define the extreme profiles. Two of the three extreme profiles, $k = 1, 2$, account for 98% of the item responses, while profile $k = 3$ generates around 2%, and seems to be associated with a high probability of responding “can’t decide” ($l = 2$) to the survey items (estimated as anywhere from around 10% to 83% for different items when $k = 3$).

Analyzing the posterior membership estimates of the 279 respondents, the vast majority have partial membership of less than .01 in $k = 3$. Just five members of the population would answer survey questions as primarily a member of this class (from .71 to .91 membership), and only 23 of the 279 have greater than 2% membership in this “neutral” prototype.

In order to better characterize the two dominant ideal types identified, let us examine each simply in terms of the probability of agreeing or disagreeing with each item when answers are based on considerations⁷ rooted in one or the other dominant profile. For convenience—and in order to connect our findings with standard writings on American ideology—we use the term *conservative* as shorthand for $k = 1$ and *liberal* for $k = 2$. For reasons that will become apparent shortly, we might more accurately refer to these as, respectively, something like *Individualist/Believers in Realized American Ideals* and *Social Responsibility-Oriented/Still Waiting for American Ideals to be Realized*. Given the clumsiness of such labels, we will stick with the more common ideological identifiers, but consider them to be best understood in terms of response distributions associated with survey items, which we are about to examine.

6.5.2 Analyzing the Extreme Profiles: Americans’ Core Values vs. Core Beliefs

In considering the estimated response distributions λ_k for the “conservative” ($k = 1$) and “liberal” ($k = 2$) ideal types (Table 6.2), one important thing to notice is the presence of certain high-valence items, enjoying the consensus one might expect of core values shared by most members of a society. For such items, the distinction between liberals and conservatives is not especially stark, but to the extent that one type is more predictably supportive of a statement than the other, the differences are in the direction that would be expected. For instance, both prototypical respondents would be unlikely to agree that our inherent differences should lead us to give up on the goal of equality ($j = 2$, *equality goal misguided*), but the prototypical conservative may have a greater probability of breaking with the norm: $\hat{\lambda}_{21}(1) = .272$ (*sd.* = .045) as opposed to $\hat{\lambda}_{22}(1) = .136$ (*sd.* = .063) for the prototypical liberal. Whether responding as a liberal or conservative, an individual would very likely support the democratic ideal of governance by all sorts of people—not only the most successful—($\sim .94$ or $.86$, respectively) as well as the notion that society has a responsibility to ensure equal opportunity of success for all ($\sim .89$ or $.82$, respectively). Yet, while a commitment to the ideal of equal opportunity in personal and public life is widely embraced, so too is the recognition that people are not equally well-suited to leadership positions (*natural inequality 1* ($\sim .87$ and $.76$) and *natural inequality 2* ($\sim .95$ and $.85$) among prototypical conservatives and liberals, respectively.)

⁷Here we intentionally use the term *considerations*, from Zaller (1992) in order to emphasize the connection between our measurement strategy and Zaller’s theoretical framework. Just as Zaller depicts respondents drawing at random from an unobserved distribution of considerations in order to answer each question, we model such individuals as drawing an ideal type at random in proportion to their own latent membership vector, and then generating a response according to the distribution associated with the selected ideal type on the particular item.

j	Question	$\lambda_{jk}(l)$			
		Level: $l = 1$ (Agree)		$l = 3$ (Disagree)	
		$k = 1$	$k = 2$	$k = 1$	$k = 2$
1	<i>Equal treatment</i>	0.61 (0.10)	0.92 (0.05)	0.37 (0.10)	0.07 (0.05)
2	<i>Equality goal misguided</i>	0.27 (0.05)	0.14 (0.06)	0.7 (0.05)	0.83 (0.06)
3	<i>Equal opportunity society's responsibility</i>	0.82 (0.05)	0.89 (0.05)	0.17 (0.05)	0.10 (0.05)
4	<i>Natural inequality 1</i>	0.87 (0.04)	0.76 (0.07)	0.12 (0.04)	0.22 (0.07)
5	<i>Natural inequality 2</i>	0.95 (0.02)	0.85 (0.06)	0.05 (0.02)	0.14 (0.05)
6	<i>Democracy</i>	0.86 (0.04)	0.94 (0.04)	0.14 (0.04)	0.05 (0.04)
7	<i>Inequality big problem</i>	0.30 (0.14)	0.88 (0.07)	0.69 (0.14)	0.10 (0.07)
8	<i>Hard work optimism</i>	0.97 (0.02)	0.45 (0.17)	0.02 (0.02)	0.54 (0.17)
9	<i>Hard work realism</i>	0.12 (0.06)	0.47 (0.09)	0.87 (0.06)	0.52 (0.09)
10	<i>Individual responsibility for failure</i>	0.77 (0.06)	0.19 (0.12)	0.22 (0.06)	0.77 (0.12)
11	<i>Ambition pessimism</i>	0.76 (0.05)	0.88 (0.05)	0.23 (0.05)	0.11 (0.05)
12	<i>Hard work idealism</i>	0.64 (0.06)	0.21 (0.12)	0.35 (0.06)	0.78 (0.11)
13	<i>Effort pessimism</i>	0.75 (0.07)	0.95 (0.03)	0.25 (0.07)	0.04 (0.03)
14	<i>Less intervention is better</i>	0.81 (0.05)	0.42 (0.13)	0.17 (0.05)	0.55 (0.13)
15	<i>Intervention populism</i>	0.62 (0.06)	0.83 (0.06)	0.36 (0.05)	0.11 (0.06)
16	<i>Laissez-faire capitalism</i>	0.36 (0.05)	0.07 (0.07)	0.63 (0.05)	0.91 (0.07)
17	<i>Regulations not a threat to freedom</i>	0.33 (0.05)	0.49 (0.08)	0.66 (0.05)	0.49 (0.08)
18	<i>Intervention causes problems</i>	0.94 (0.04)	0.58 (0.13)	0.05 (0.03)	0.40 (0.13)
19	<i>Free enterprise not intrinsic feature of gov't</i>	0.12 (0.07)	0.41 (0.08)	0.87 (0.07)	0.58 (0.08)

TABLE 6.2

The two dominant extreme profiles for $K = 3$: Profile $k = 1$ (60.4% of responses) versus Profile $k = 2$ (37.3% of responses). Numbers in parentheses are posterior standard deviations. The grouping of items is based on Feldman (1988) and the original intent of the survey questionnaire design: the first concern *Equal Opportunity*; the second, *Economic Individualism*; and the third, *Free Enterprise*. The variable names, generic in the original, are our own.

In order to clarify which items are most important in defining each dominant extreme profile, we introduce the quantity

$$Cohes_{jk} = \frac{\max_{l=1, \dots, n_j} \{\lambda_{jk}(l)\}}{\min_{l=1, \dots, n_j} \{\lambda_{jk}(l)\}}, \tag{6.4}$$

or the *cohesion* of extreme profile k with respect to item j . The cohesion scores reflect the reliability with which each extreme type responds to an item. In Zaller's (1992) theory of survey response to opinion polling, this might correspond to individuals tending to answer a question predictably, perhaps because nearly all relevant considerations lead to the same response. This may alternatively be thought to measure the cohesiveness of hypothetical adherents to each extreme profile.

Additionally, we consider the hypotheses

$$DR_j : \arg \max_{l=1, \dots, n_j} \{\lambda_{j1}(l)\} \neq \arg \max_{l=1, \dots, n_j} \{\lambda_{j2}(l)\}, \tag{6.5}$$

for $j = 1, \dots, J$. Hypothesis DR_j states that full adherents to the two dominant profiles have different modal responses to a given item j . Obtaining posterior estimates of the probability of DR_j enables us to draw inferences about how well different items distinguish the extreme profiles from one another. For example, a posterior probability value 0.01 for item $j = 7$, *inequality big problem*, $Pr[DR_7|Data]$, means that, given our data on 279 respondents, we find only a 1% chance

that the most likely response to the item by the two types of pure respondents are the same; it is, rather, highly probable that the top response for *liberals* is recognition of inequality as a big problem while *conservatives* are more likely than not to deny inequality as a persistent issue.

Table 6.3 shows our posterior estimates (posterior means) of $Cohes_{jk}$ and our estimated posterior probabilities of hypotheses DR_j , for extreme profiles $k = 1$ (conservative) and $k = 2$ (liberal), and for every item in the survey ($j = 1, \dots, 19$). Analyzing the cohesion scores we see that for certain items, both dominant extreme profiles are predictable and give identical responses (e.g., *intervention causes problems*); for others they reliably give opposite responses, i.e., one type is expected to agree and the other to disagree with an item (e.g., *inequality big problem*); for still other items, prototypical adherents to one profile are highly likely to give their modal response while prototypical adherents of the other are far less predictable (e.g., *laissez-faire capitalism*).

For the first set of five items listed in Table 6.3, there is a greater than .50 posterior probability that pure liberals and pure conservatives will disagree in their favored responses. We can be highly confident ($> .99$) that prototypical liberals and conservatives—at least to the extent that these labels may be appropriately applied to $k = 1$ and $k = 2$ —will tend to disagree when it comes to their reactions to *hard work idealism* (“If people work hard, they almost always get what they want”), *individual responsibility for failure* (“Most people who don’t get ahead should not blame the system; they really have only themselves to blame”), and *inequality big problem* (“One of the big problems in this country is that we don’t give everyone an equal chance”). Conservatives are also likely to disagree with liberals when it comes to the item most closely associated with contemporary definitions of American liberalism and conservatism: *less intervention is better* (“The less government gets involved with business and the economy, the better off this country will be”). Similarly, we expect them to disagree on an item that perhaps best captures a quintessential American belief that hard work pays off: *hard work optimism* (“Any person who is willing to work hard has a good chance of succeeding”). For the remaining 14 items, the bulk of our posterior probability is placed on identical modal responses for liberals and conservatives, though they may differ substantially in how predictable they are in choosing this modal response. For example, while both are more likely to agree with the statement that “There are many goods and services that would never be available to ordinary people without governmental intervention” (*intervention populism*), the mean posterior cohesion score for a prototypical liberal is 58, in contrast to around only 2 for a prototypical conservative. For eight items, we can be virtually certain that both dominant extreme profiles share a modal response.

If we look closely at the three items that most clearly distinguish our prototypical liberals from conservatives, two have been identified by Feldman (1988) as measures of the core belief in *Economic Individualism* and one as a measure of the belief in *Equal Opportunity*. All three, however, tap into beliefs about what *is* rather than what *should be*:

- *Hard work idealism* ($j = 12$): If people work hard, they almost always get what they want.
- *Individual responsibility for failure* ($j = 10$): Most people who don’t get ahead should not blame the system; they really have only themselves to blame.
- *Inequality big problem* ($j = 7$): One of the big problems in this country is that we don’t give everyone an equal chance.

Indeed, much of what seems to separate the response distributions for the two dominant ideal types has to do with how well respondents view the United States as actually living up to the ideals shared by many in both camps. In order to appreciate this, a distinction should be drawn between *beliefs* and *values*.

According to Glynn et al. (1999), “Values are ideals. Beliefs represent our understanding of the way things are, but values represent our understanding of the way things should be” (p. 105). The difference between beliefs and values is not always well delineated and, in fact, some survey

questions may capture aspects of both. In certain cases, what is presented as a value may imply some belief about the way things actually are, and this may affect the responses of some individuals surveyed. For example, while a majority of individuals answering from either principal extreme profile claim a belief that equal treatment leads to fewer problems (*equal treatment*), pure liberals are nearly in uniform agreement with the statement, but conservatives have around a 38% chance of disagreeing with the sentiment. Why might there be resistance among conservatives, who otherwise generally embrace the goal of equality and the notion that society has a responsibility to ensure equal opportunity, according to their responses to other survey questions? Hidden within the question is an implied belief about the way things actually are: “If people were treated more equally in this country, we would have many fewer problems [*than we have now*],” with the italicized words as implied subtext. So if one believes that inequality leads to problems, but also that people already are treated equally and, perhaps, that commonly advocated programs aimed at the issue (e.g., affirmative action) are misguided, one might disagree with the survey item. Thus, one’s national pride and a tendency to view the nation as having already realized the ideals of equal opportunity are considerations of prototypical conservatives that have a non-trivial probability of being primed by the choice of wording here.

Of the five items on which pure liberals and conservatives are expected to differ on their most likely responses, four address the locus of responsibility for individual success and failure. On all four measures, conservatives embrace the notion of individual responsibility for success and failure, while liberals are less convinced. Conservatives are unified in their belief that hard work has a “good chance” of yielding success, while liberals tend to disagree (albeit only at a 3:2 ratio). On a similar question, phrased differently, liberals largely reject an idealistic view of hard work, with a .79 probability of disagreeing that it will “almost always” lead to satisfying results, while conservatives have a .63 of *embracing* such idealism. On one of the most divisive questions, prototypical conservatives agree three to one that individuals should blame themselves if they “don’t get ahead,” while liberals find “the system” more at fault, by more than four to one! When it comes to the explicit assertion that inequality—specifically a lack of equal opportunity—remains a “big problem” in the United States, there is again a clear distinction between the two dominant types of respondents; liberals identify inequality as a big problem at over seven to one, while conservatives are nearly two to one in the opposite direction.

In short, the results of our Grade of Membership analysis reveal hidden structure in the beliefs and values of survey respondents missing from the original factor analytic results in Feldman (1988). While several core values are widely embraced across extreme profiles, prototypical liberals tend to be more unified in their support of those ideals typically associated with them (equality and democratic principles), while prototypical conservatives tend to be more consistent in embracing values tied to their own central narratives (rewards of hard work, individual responsibility and self-reliance, and antipathy towards government intervention). Only a few survey items serve to starkly contrast the two dominant extreme profiles, and those that most clearly distinguish them involve beliefs about the United States in which they live rather than simply ideals about their nation as it could be.

<i>j</i>	Question	<i>Cohes_{jk}</i>		<i>DR_j</i>
		<i>k</i> = 1 (cons)	<i>k</i> = 2 (lib)	
12	<i>Hard work idealism</i>	1.95	22.29	1.00
10	<i>Individual responsibility for failure</i>	4.14	16.08	1.00
7	<i>Inequality big problem</i>	11.29	14.56	0.99
14	<i>Less intervention is better</i>	5.79	19.11	0.66
8	<i>Hard work optimism</i>	330.92	8.62	0.61
17	<i>Regulations not a threat to freedom</i>	2.13	14.48	0.46
9	<i>Hard work realism</i>	29.55	7.43	0.36
18	<i>Intervention causes problems</i>	67.89	11.28	0.27
1	<i>Equal treatment</i>	1.89	7.35	0.16
19	<i>Free enterprise not intrinsic feature of gov't</i>	70.77	58.83	0.14
15	<i>Intervention populism</i>	1.79	58.46	0.02
16	<i>Laissez-faire capitalism</i>	1.82	14.02	0.01
13	<i>Effort pessimism</i>	3.31	21.71	0.00
11	<i>Ambition pessimism</i>	3.53	5.60	0.00
6	<i>Democracy</i>	6.90	5.89	0.00
5	<i>Natural inequality 2</i>	49.45	7.53	0.00
4	<i>Natural inequality 1</i>	8.18	32.55	0.00
3	<i>Equal opportunity society's responsibility</i>	5.15	55.54	0.00
2	<i>Equality goal misguided</i>	2.66	17.90	0.00

TABLE 6.3

Extreme profiles for $K = 3$: Profile $k = 1$ (60.4% of responses) versus Profile $k = 2$ (37.3% of responses). Cohesion scores represent posterior means for the odds that a prototypical adherent will give the top response to the question.

6.6 Conclusion

Typologies are ubiquitous in political science, providing useful frameworks for understanding variation in ideology, beliefs, and values, as well as conceptual development of many other areas (e.g., comparative political systems and conflicts, policy analysis, and identity politics). Typically, the manner in which such typologies are developed is ad hoc rather than model-based, reflecting a priori qualitative judgments about how the political world is naturally partitioned. As we demonstrate, it is also possible to use a mixed membership approach to construct typologies from data in a principled, model-based way, with qualitative interpretation taking place only after model-based estimates have been drawn, and without imposing a possibly artificially crisp partition on the population of interest. In some cases, the resulting typology will correspond well to what we expect and in others it might offer surprises. In our illustration, we see a bit of both: on one hand, two dominant extreme profiles emerge, which correspond roughly to what might be identified as conservatives and liberals, but on the other hand, the nature of these profiles presents us with a more nuanced view of what these ideal types look like. Analyzing survey response data with reference to such prototypes, we maintain a measure of simplicity that promotes understanding, while accommodating the heterogeneity actually present in real-world populations.

Where some have previously analyzed public opinion in terms of types, they have used ad hoc clustering techniques (Pew Research Center, 2011) without justification for the particular algorithm or verification that the results are robust to other choices of clustering routine. Latent class analysis is a surprisingly underutilized technique in political science that improves upon this by assuming that data are generated from distributions associated with distinct latent types of respondents (Feldman and Johnston, 2009). Our mixed membership approach may be thought of as a generalization of LCA, combining advantages of categorical data inference available in LCA with advantages of continuity assumptions from factor analysis. In fact, one way of thinking about what we are doing here is that we have taken what would be allocated to error in the case of LCA and have integrated it with the structural component of our model. In a latent class analysis, good model fit must reduce the “error” associated with individuals who mostly answer as if they belonged to one type, but respond anomalously on certain questions. Allowing for Grades of Membership in these classes (reconceptualized as ideal types) takes what would otherwise be considered noise and attributes it to a person’s internal complexity.

We see great potential for mixed membership modeling in the study of political psychology, behavior, and public opinion. It offers a sort of compromise between the concreteness of classification by types and the flexibility of multidimensional continuous latent variables as in factor analysis. Informal and qualitative accounts of political behavior, for example, rely heavily on such classifications as the “likely voter,” the “independent voter,” and the “alienated working class voter”; for the most part, evocative labels such as these are replaced in quantitative analysis by measures further removed from the familiar and useful prototypes, but which utilize interval-level scores to reflect diversity across the population. Assuming that individuals manifest partial membership in multiple recognizable types lets researchers use prominent response patterns as familiar reference points without reducing people to stereotypes. Furthermore, it allows us to discover new ideal types, patterns that we might not have otherwise noticed.

Mixed membership is a general idea that can be implemented and exploited in many ways. The particular technique that we employed in this application, the Grade of Membership model, has a fairly simple structure and is an appropriate tool for the basic soft clustering that we presented here. However, in order to investigate a wider array of political science research questions and to better use the available data, we need to develop more tools. First, we would like to investigate the relationship between individual ideology and other relevant variables, like cohort or income. This can be achieved by incorporating covariates into the model. One possible approach, introduced by

Manrique-Vallier (2010), is to specify the population-level membership distribution conditional on the covariates, keeping the extreme profiles common to the whole population. Such an extension would allow to estimate the effect of the covariates into the membership composition of the individuals, enabling us to answer questions such as: “Are older generations more conservative than younger ones?”

Another useful direction would be to use individual estimates of membership as predictors for some dependent variable of interest, for example, one’s position on a particular policy issue, or reaction to an experimental intervention. This is a common approach with factor analysis, where we use scores on estimated dimension-reduced scales as inputs into a regression-style model of substantive interest. We can also understand mixed membership analysis as a dimension reduction technique: in our example we reduced the 19-dimensional response vector into a three-component membership vector that lies in a two-dimensional unit simplex. Thus, performing a similar analysis with membership vectors instead of factor loadings as inputs would achieve a similar aim, but make for a more intuitive analysis of results. For example, we could replace statements such as “For every standard deviation increase on the economic individualism factor, we expect. . .”—where the meaning of this factor is obscured—with more appealing statements of the form “an extra 25% conservatism leads to. . .” The actual implementation of this idea carries some difficulties though. While it might be tempting to perform regular regression analysis conditional on posterior point estimates of the individual membership scores, we have to make sure to correctly reflect the inherent posterior uncertainty of these estimates in the regression. One possible approach is to set up comprehensive hierarchical models that include the mixed membership and the regression parts. Another possible approach is to obtain samples from the posterior distribution of individual membership vectors and use multiple imputation techniques (Rubin, 1987) to perform the combined analysis.

One limitation of GoM models, stemming from their simple, local independence structure, is that given membership, all answers to questions are taken to be essentially equivalent. However, researchers usually design and organize surveys so that questions belong to specific domains, such as “economic issues” or “social issues,” and therefore illuminate different (often known) aspects of ideology. One can envision a hierarchical extension in which, in addition to the mixed membership structure, questions are organized into domains and interact with the membership in different ways. The structure could be such that we take the original classification of questions as prior information with some degree of uncertainty, and learn the rest from the data.

If we or others are to effectively extend mixed membership analysis in any of these potential directions, we would be well-advised to keep in mind the simple observation of Achen (1975), who reminds us: “The greater the distance from data to conclusions, the more opportunity for errors.” While latent variable modeling techniques grant us a principled way to measure underlying hidden concepts only indirectly revealed through survey responses, this typically comes at the expense of transparency; the connection between abstractions such as factor loadings and the observed data is often obscured in the minds of researchers and their audience. Among the various advantages of the MM/GoM approach to survey data in seeking to better understand the structure of mass attitudes, one of the most compelling is that it allows us the luxury of abstraction while preserving the close connection to data.

Appendix: Survey Items

Equal Opportunity

- *Equal treatment:* If people were treated more equally in this country, we would have many fewer problems. (V2169/V3120)

- *Equality goal misguided*: We should give up on the goal of equality, since people are so different to begin with. (V2172/V3122)
- *Equal opportunity-society's responsibility*: Our society should do whatever is necessary to make sure that everyone has an equal opportunity to succeed. (V2175/V3123)
- *Natural inequality 1*: Some people are just better cut out than others for important positions in society. (V2178/V3121)
- *Natural inequality 2*: Some people are better at running things and should be allowed to do so. (V2250)
- *Democracy*: All kinds of people should have an equal say in running this country, not just those who are successful. (V2253, Not in wave 2)
- *Inequality big problem*: One of the big problems in this country is that we don't give everyone an equal chance. (V2256, V3125)

Economic Individualism

- *Hard work optimism*: Any person who is willing to work hard has a good chance of succeeding. (V2170)
- *Hard work realism*: Hard work offers little guarantee of success. (V2173)
- *Individual responsibility for failure*: Most people who don't get ahead should not blame the system; they really have only themselves to blame. (V2176)
- *Ambition pessimism*: Even if people are ambitious, they often cannot succeed. (V2251)
- *Hard work idealism*: If people work hard, they almost always get what they want. (V2254)
- *Effort pessimism*: Even if people try hard, they often cannot reach their goals. (V2257)

Free Enterprise

- *Less intervention is better*: The less government gets involved with business and the economy, the better off this country will be. (V2171)
- *Intervention populism*: There are many goods and services that would never be available to ordinary people without governmental intervention. (2174)
- *Laissez-faire capitalism*: There should be no government interference with business and trade. (V2177)
- *Regulations not a threat to freedom*: Putting government regulations on business does *not* endanger personal freedom. (V2252)
- *Intervention causes problems*: Government intervention leads to too much red tape and too many problems. (V2255)
- *Free enterprise not intrinsic feature of gov't*: Contrary to what some people think, a free enterprise system is not necessary for our form of government to survive. (V2258)

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