# What Is a Cultural Belief System? Rethinking Theory and Measurement*

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2021-03-01

**Abstract**

Culture and cognition theories argue that culture shapes social behavior by producing durable cognitive sturctures that shape how people interpret social situations and recall concepts over time. Despite significant advances in measuring culture in people, approaches that rely on measuring the relationship between attitudes are undermined by the high variance people demonstrate in survey responses over time. As a result, testing the relative influence of cultural belief systems and other social factors, such as organizations and social networks, has proven elusive. This paper makes three contributions to these debates. First, I argue that rather than think of belief systems as evident in pairwise relationships between attitudes at a single point in time, as many existing measures do, belief systems should be thought of as underlying cognitive sturctures that probabilistically produce different responses. Second, I use Latent Class Analysis to derive five belief systems that differently constrain religious, family, and moral beliefs in the National Study of Youth and Religion and show that the variance in responses within groups at the survey's second wave strongly predict how much people change their responses over time, as well as which responses they give. Third, I adjuducate between cultural-schematic, organizational, and social network sources of attitude structuring, showing that as people change their organizational and social contexts, their beliefs remain more stable than these changes would imply, suggesting that belief structures are organized early in life and shape people's beliefs over time.

## 1 Introduction

A key way that society is assumed to shape human behavior is through the internalization of culture into people's heads.

In his review paper on culture and cognition, DiMaggio suggests that a contemporary understanding of human cognition "directs the search for sources of stability and consistency in our

*Thanks to Craig Rawlings, Christopher Johnston, and Nicholas Restrepo Ochoa for feedback on a very early, very different draft of this paper.

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beliefs and representations, first, to schematic organization, which makes some ideas or images more accessible than others; and, second, to cues embedded in the physical and social environment" (**???** p. 267). The first of these pieces suggests that culture, internalized as shared cognitive structures, shapes how people process, store, and recall information in ways that facilitate stable lines of action, including the production of attitudes, over time [(**???**); ]. The second posits that social environments – organizations, institutions, and social networks – constrain people's understandings of which attitudes and behaviors are related and keep certain attitudes at the forefront of people's attention (**???**; Goldberg and Stein 2018).

In sociology, work highlighting the influence of social and physical structures on attitude structure has been quite successful (Martin 2002; Rawlings 2020), but work showing the relative role of cognitive-cultural structures in producing stability is quite rare, and a conclusion across the social sciences has been that people's cognition, in general, is not strongly constrained and therefore does not reflect the internalization of belief systems (Converse 1964; Zaller 1992).

This is due in part to the challenges of measuring cultural-cognitive structures. Measures of attitude structuring have tended to focus, in one form or another, on the pairwise relationship between survey responses in cross-sectional data (Baldassarri and Gelman 2008; Baldassarri and Goldberg 2014; Boutyline and Vaisey 2017; Goldberg 2011; Hunzaker and Valentino 2019; Martin 2002). This work has led to numerous insights into the structuring of political and cultural thought in different groups, heterogeneity in belief patterns, and the social factors that give rise to constrained thinking. But there are two limitations to these approaches as they pertain to measuring cultural-cognitive structuring.

First, decades of research in cultural sociology and public opinion research find that people do not have *an* attitude on a topic. Instead, they have a range of considerations shaped by culture and personal experience (Swidler 1986, 2001 @zaller1992). Because people often hold contradictory considerations, and because which considerations influence cognition at any time can be shaped by local circumstances, attitudes as measured by surveys change substantially and seemingly randomly over time (Converse 1964). If the assumption of measuring cultural-cognitive structures is that the

over-time relationships between survey responses do not change, the high degree of movement over time suggests that cognition is not structured.

However, theories of cultural cognition say that schematic structures organize people's underlying considerations, not in their manifest survey responses (**???**; **???**). Under this framework, schematized networks of considerations should *probabilistically* produce certain lines of behavior such as survey responses, subject to local influences. Shared networks of considerations do not have to produce shared attitudes at a single point in time. If two people have shared (culturally shaped) schema that connect diverse and contradictory considerations, this can result in similar instability over time. That does not make these schema any less cultural or shared.

The second major challenge of this approach is apparent in the central metaphor researchers use to explain attitude constraint: movement. The structuring of attitudes is consistently described as limitations on the movement of attitudes over time, but it is rarely tested using within-person, over-time data (for an exception, see Rawlings 2020). In using static measures of constraint, researchers tend to assume that because people hold two attitudes at the same time or because beliefs covary in the population, people understand these ideas as related and constraining. But co-occurrence and co-variance in static data does not prove the cognitive linkages or the presence of constraint that these researchers tend to assume (Martin 2000). The clustering of people in social groups with distinct attitudes could be driven by a number of processes besides cognitive linkage, such as social influence or selection (Lewis and Kaufman 2018; Vaisey and Lizardo 2010).

Because measuring culturally structured beliefs has proven difficult, evidence that organizational and social influences shape and constrain attitudes have tended to dominate explanations of the social structuring of attitudes over explanations of cultural background. At the same time, people's dispositions across a range of topics appear to be much more stable over time than would be predicted based on people's movement across contexts, suggesting that some degree of cultural structuring of dispositions likely occurs early in the life course (Kiley and Vaisey 2020; Vaisey and Lizardo 2016).

In this paper, I attempt to reconcile these conceptual and methodological issues by rethink-

ing the empirical signature of a belief system. I make three principal contributions. First, drawing on insights from sociology of culture and cognition, the social psychology of attitude development, and political psychology, I argue that the cultural-cognitive variant of attitude structuring is not well demonstrated by attitude clustering at a single time, measures of the relationships between attitudes at a single time, or even pairwise change over time. Instead, a belief system should be conceptualized as a set considerations that results in a restriction (or lack of restriction) on which responses a person feels they can give over time. While some belief systems might result in constraint, other belief systems might produce inconsistency. These latter systems should still be conceptualized as cultural belief systems, reflecting patterned cognitive structures.

Second, given this model of a belief system, I argue that Latent Class Analysis – a method of data reduction that groups people into classes with similar probabilities of giving different responses to particular questions – reflects the theoretical tenets of this kind of belief system better than many existing measures designed to tap attitude structuring, such as pairwise correlation, relational class analysis, and correlational class analysis (Converse 1964; Goldberg 2011; Boutyline 2017). I argue that, to the extent LCA can deduce belief systems, the constraints evident within latent classes at a single point in time should predict the degree to which people change their attitudes over time. I test this proposition using data on religious, moral, and family-structure beliefs from the National Study of Youth and Religion. Latent class analysis identifies five belief systems. These systems vary in the the degree to which they constrain beliefs and the portions of belief space to which they constrain respondents. I show that the constraints evident in cross-sectional data at a single time point predict which attitudes people change between waves and how they change them better than competing models of attitude formation.

Third, I adjudicate the relative importance of these cultural-cognitive belief systems and structural influences such as organizational participation and social networks on the pattern of changes in attitudes over time. The results suggest that belief systems deduced at a single time better predict the pattern of attitude changes over time than models accounting for changing social circumstances.

These results have two major implications. First, they suggest that cognition is likely more patterned than existing approaches posit, but that this shared cognition often manifests as shared instability. Culture is messy, but just because it is messy does not mean it is idiosyncratic. Second, the results suggest that cultural background plays a much larger role in the structuring of attitudes over time than is often supposed. As people move across social contexts, the web of considerations they draw from in constructing attitudes appears much more stable than this movement would imply. This further directs attention to the circumstances of socialization relatively early in life if researchers want to understand why people believe what they believe and think how they think.

# 2 Theoretical Framework

## 2.1 What Are Attitudes?

Understanding the empirical signature of a cultural belief system in survey data must start with a model of the behavior of attitudes and survey response. A key finding from decades of work in cultural sociology and public opinion is that people consume diverse and contradictory bits of culture, often storing this heterogeneous mixture without taking time to reconcile its contradictions (Martin 2010; Swidler 1986; Zaller 1992). Without strong motivation to reconcile inconsistencies, people have a hard time keeping conflicting considerations out of their minds (Martin 2010; Zaller 1992). As a result, "our heads are full of images, opinions, and information, untagged as to truth value, to which we are inclined to attribute accuracy and plausibility" (DiMaggio 1997: p. 267). In their day-to-day lives, people seem to have no trouble believing that "love is (1) a clear, all-or-nothing choice; (2) of a unique other; (3) made in defiance of social forces; and (4) permanently resolving the individual's destiny" while simultaneously believing that "(1) Real love is not sudden or certain … (2) There is no 'one true love' … (3) The kind of love that leads to marriage should not depend on irrational feeling in defiance of social convention … [and] (4) Love does not necessarily last forever" (Swidler 2001: pp. 113-114), despite the inherent contradictions in these sentiments.

This heterogeneity of considerations has consequences for survey response over time.

When asked to give an opinion on an issue, people seem to sample from the range of considerations stored in their heads, shaped by local influences such as question structure and wording, as well as recent stimuli such as discussions with peers or the news, and generate an opinion on the basis of these stored considerations and short-term influences (Swidler 2001; Zaller 1992). People with conflicting considerations do not simply average their considerations and pick scale midpoints (though they do this occasionally), but they can range widely in their beliefs over time as local influences shift. This behavior is evident in interviews, where people tend to draw on diverse considerations to explain or justify behavior, often contradicting themselves (Swidler 1986, 2001). It is also evident in people's responses to the same survey question over time, as they vacillate between ends of scales much more frequently than we would expect if they were stable opinion holders (Zaller 1992; Converse 1964).

At the same time, not all people display this level of ambivalence. On any particular question, some proportion of the population does clearly articulate the same opinions over time, with people differing on which issues they are stable (Converse 1964; Hill and Kriesi 2001). And social behaviors affect attitude stability, suggesting that variation is not simply attributable to measurement error. In politics, people who pay more attention to political news tend to be much more stable on their attitudes over time than people who do not (Converse 1964; Freeder, Lenz, and Turney 2019; Zaller 1992). Other work shows that the presence of cognitive authorities in small communities facilitates the structuring of attitudes over time (Martin 2002; Rawlings 2020). And work in cultural sociology suggests that attitudes can predict behaviors and patterns of affiliation over time (Vaisey 2009; Vaisey and Lizardo 2010), which we would not expect if attitudes were temporary constructs shaped exclusively by local circumstances.

In general then, it is wrong to say that people have *an* attitude about something measured in a survey. What they have is a set of considerations that might point toward giving the same response over time or a set of considerations that might cause them to shift around in response to local changes, or something in between. Any single response will be a draw from this consideration set with more or less random error shaped by personal circumstances at any time. For example, a person might

have the heterogeneous and conflicting models of love that Swidler (2001) documents. When asked if unhappy couples should get divorced, this person could give either answer depending on which considerations are foremost in their mind. If something has triggered the prosaic model of love, the person might say that people should get divorced if they are unhappy. If something has triggered the romantic model of love, the person might oppose divorce.

## 2.2 Sources Belief Structuring

If public culture is heterogeneous and conflicting, and if people tend to internalize bits of culture uncritically, how do we explain the fact that some people demonstrate remarkable consistency in their attitudes over time and the fact that that different kinds of attitudes often predict behavior (Miles 2015; Vaisey 2014)? There are two principal explanations in sociology: one cultural, and one structural (DiMaggio 1997: p. 267).

The cultural-cognitive explanation for attitude stability posits that people's attitudes are shaped by underlying cognitive structures called schema, "knowledge structures that represent objects or events and provide default assumptions about their characteristics, relationships, and entailments under conditions of incomplete information" [DiMaggio (1997); p. 269]. In cultural sociology, schema are conceptualized as connections of concepts, generated through repeated exposure, that shape how people process information.

While schema can be idiosyncratic, many are shared or cultural. Because they are assumed to form through repeated exposure to concepts, they tend reflect institutionalized and recurring social structures, which facilitate many people developing similar cognitive structures. Schema then shape the interpretation and recall of information, shared interpretation of cultural objects, and patterns of interaction, all shaping the patterns of attitudes people exhibit over time (DiMaggio 1997; **???**; Hunzaker 2016; Rawlings and Childress 2019).

In this framework, people demonstrate stable attitudes because their cultural-cognitive schema prevent the internalization of schema-inconsistent information and facilitate the storage and recall of schema-consistent information across social settings (Hunzaker 2016; Hunzaker and

Valentino 2019). A person who believes in an all-powerful God who deems divorce antithetical to eternal salvation – a set of connections in the underlying belief structure – is going to have an easier time consistently giving the same response to a question about whether divorce is acceptable than someone who has internalized Swidler's heterogeneous models of love. But people might also demonstrate inconsistency when schematic structures point to conflicting outcomes. This might be because schematic structuring is weak, preventing the rejection of heterogeneous information and making attitudes susceptible to short-term influences (Martin 2010). But strong schematic structure can also produce inconsistency if it is misaligned with a question. A question asking whether Jesus Christ was a man or God might prove problematic for the most structured Christian belief system (Martin 2002), but not very challenging for an atheist.

The principal alternative explanation for attitude stability argues that it is principally social structures – organizations and social networks – that facilitate attitude stability across the life course. Under this framework, people's attitudes and beliefs are shaped by social influence and by the scaffolding provided by organizational structures (**???**; Martin 2002; Rawlings 2020).

Research suggests multiple paths from social structures to attitudes. People maintain consistency because they consistently hear a single line of cultural reasoning and rarely hear heterogeneous or conflicting information (Zaller 1992). Cognitive authorities, leaders endowed with the social responsibility for shaping beliefs, provide clear guidelines for what attitudes go together, and organizational hierarchies make certain belief structures appear impossible (Martin 2002). Affect- laden social interactions can make holding some attitudes feel uncomfortable, leading people to change their attitudes (**???**; Rawlings 2020). Physical features of the social environment consistently facilitate the recall of certain beliefs []. These explanations do not require any durable cognitive structuring at the individual level, simply short-term representations repeatedly reinforced by the social environment (Martin 2010).

In reality, attitude stability likely reflects a dynamic interplay between cultural-cognitive structures and social structures (Lizardo and Strand 2010; Martin 2010; Goldberg and Stein 2018). And adjudicating the relative influence of these processes is difficult because people's cultural beliefs

and preferences appear to shape their social networks and their organizational participation (Lizardo 2006; Lewis and Kaufman 2018; Vaisey and Lizardo 2010). But research in the social sciences has tended to focus on using social structures to explain stability and change in behavior. A key reason for this is because measuring cultural belief structures in people has proven challenging, while measuring social structures have proven easier. Without a clear measure of a belief structure, there is no way to adjudicate the relative influence of these cognitive representations on attitudes over time.

## 2.3 Measures of Attitude Structures

Measures of belief structures principally focus on the pairwise relationships between survey items in cross-sectional data, typically using covariance or correlation (Baldassarri and Gelman 2008; Boutyline and Vaisey 2017; Converse 1964; DellaPosta, Shi, and Macy 2015). Related measures designed to account for measurement error in individual responses (Ansolabehere, Rodden, and Snyder 2008) still tend to look at the pairwise relationship between latent beliefs.

These correlational models rest on what I call the "diametric assumption" that beliefs are structured or constrained when they covary across people; people who are high on attitude are high on a second, while people who are low on one attitude are low on the second. While this is good evidence of what Converse (1964) calls the "static" form of attitude constraint – that two issues tend to cluster in the population – it is not necessarily indicative of the schematic organization of considerations in people's heads. Under this logic, liberals and conservatives who hold opposite positions are assumed to understand a link between them, even if they, in their own heads, do not. Similarly, if they do not have opposite positions, neither is assumed to display structured belief systems, even if members of both groups subjectively understand their belief system to imply that position (the theoretical definition of the cognitive version of constraint).[1] But there are often times when differ-

[1]This fallacy, assuming that Belief 1 is associated with Belief 2 only if Belief 1's opposite is associated with Belief 2's opposite, is also called "denying the antecedent" or the "fallacy of the inverse," and should be familiar to social scientists. Avoiding this problem is the reason classical statistical tests in the social sciences have the structure they do: rejecting a null hypothesis rather than affirming an alternative hypothesis, since there are always other things that could cause an outcome. The statement $P \rightarrow Q$ (if conservative, then oppose abortion) only implies one conclusion (the contrapositive), $\neg Q \rightarrow \neg P$ (if not oppose abortion, not conservative). It does not imply the the inverse, $\neg P \rightarrow \neg Q$ (not conservative, not oppose abortion).

ent belief systems constrain people to the same position in belief space. For example, all varieties of American popular nationalism uncovered by Bonikowski and DiMaggio (2016) restrict people to some level of agreement that it is important for Americans to have American citizenship and some level of pride in the Armed Forces. No form rejects these, saying that Americans should not have U.S. citizenship, but that does not make these unstructured forms of thought.

A more recent development in schema measurement are relational and correlational class analysis methods, which attempt to partition samples into groups that have similar patterns of relationships among beliefs, allowing for heterogeneous belief systems in the population (Goldberg 2011; Boutyline 2017). However, the diametric assumption still underlies interpretation of these methods. If people are located in opposite positions, researchers employing these methods assume that people see the same "logic" of a space. For example, Baladassarri and Goldberg assume that "a high-earning and secular Manhattan lawyer, squeezed by her progressive leanings on moral issues and her support for fiscal austerity" and "a working-class devout churchgoer torn between his moral conservatism and redistributive economic interests" see politics through the same logic, though this might not be true (Baldassarri and Goldberg 2014: p. 46). In fact it is hard to imagine that these people see U.S. political conflict as an opposition between "libertarian" thought on one hand and "populist" thought on the other, when the main political parties align orthogonal to this axis. What is more plausible is that these people's views are simply unconstrained by the liberal-conservative paradigm, not exhibiting a separate "logic" of the space.

These methods, as well as measures based on entropy (Martin 1999, 2002), face three other major challenges. First, as discussed above, the schematization of cognition takes place well below the level of survey responses, in connections between concepts and representations, not in connections of attitudes. As Hunzaker and Valentino (**???**) show, people with very similar schema frequently produce different answers to the same attitude question. In other words, schema are connections of concepts that *probabilistically* produce lines of action, and they can produce inconsistency if they connect conflicting concepts and considerations. This means that measuring belief systems as networks of connections between survey responses is hard to justify. In any survey wave, people might be pre-

senting one of several answers that does not truly reflect the breadth of their considerations, which itself is a product of the schematic structuring of considerations.

Second, these approaches all fail to connect the method of measuring belief structuring with the core theoretical implication of a belief system: constraints on change. These authors all repeatedly invoke the imagery of movement to explain what a belief system is (emphasis added in all):

- "However, these beliefs are still tightly connected, in that *movement* in one implies *movement* in the other" (Martin 2002: p. 868). "Tightness, as defined above, can be interpreted as the imposition of *rules of movement* within the belief space (think of the difference between the constrained motion of driving on surface streets and the unconstrained motion of four-wheeling on the beach). Consensus, on the other hand, can be interpreted as a gross *inability to move away from* some privileged areas of the belief space toward others (without channeling in particular directions whatever degree of *motion* is allowed)" (Martin 2002: p. 874).
- "we might best see the distribution of people in this space as giving us clues about the *rules of motion* in the belief space. If one were to take a picture of some well populated area from a low-orbiting satellite, and marked a spot wherever there was a car, one would be able to figure out rather well where the roads were, and where cars were allowed to go. It is these analogous *rules of movement* that will give us clues as to the nature of social cognition" (Martin 2000: p. 11).
- "Culture, in this context, can be understood as the unspoken set of rules that tie beliefs together by restricting *movement* in this space along certain axes, which demarcate different social worlds" (Goldberg 2011: p. 1403).
- "We therefore interpret different *axes of movement in a belief space* … as the empirical signature of ideological constraint" (Baldassarri and Goldberg 2014: 59).
- "attitudes toward science and religion *move* in tandem" (DiMaggio et al. 2018: p. 40).

These researchers understand constraint to be a dynamic phenomenon, but in these studies dynamics are inferred from a snapshot and, importantly, not tested over time. Because people are arrayed along a diagonal in belief space, they are assumed to only travel along this diagonal (Martin 2002; Baldassarri and Goldberg 2014). Because people are clustered in portions of the belief space,

they are assumed not to move from one cluster to another. These might not be unreasonable assumptions, but they are assumptions that are not tested.

Finally, while these methods identify structuring of the population's beliefs at a single point in time, they do not make clear predictions for the behavior of attitudes over time, making it is hard to assess their validity and compare their influence to other competing influences. In fact, their assumptions imply that schematically organized beliefs do not change (or change in very specific, pairwise ways), which is undermined by the high degree of variance in people's attitudes over time (Converse 1964; Zaller 1992).

# 3 Rethinking Belief Systems

The preceding discussion suggests that cultural belief structures should be thought of as shared sets of considerations (concepts, representations, etc.), and schematic connections between them, that exist well below the level of observed behavior and survey response. A cultural belief system might shape people's considerations by directly providing them ("marriage is good"); by linking considerations together ("god exists says that marriage is important for eternal salvation"); by linking considerations to social groups ("getting married is an important part of being a member of this community"); or by linking considerations to identity ("to be a good Christian, I need to get married"). In doing these things, belief systems shape the range of considerations people have, the ease with which they can accept or reject other messages they are exposed to, and their ability to recall considerations over time. As a result, these cognitive structures *probabilistically* produce lines of action such as survey responses, and thereby limit (or not limit) people's responses to certain portions of the belief space over time. But, importantly, they might not manifest as the same response at each time point.

Because people are continually bombarded with cultural information that might shift their attitudes, belief systems make themselves apparent not just in what people say, but also in which responses they prohibit. Only the first is observable in a single survey wave. In this sense, belief systems reflect "some process whereby the arbitrary movement of individuals in [belief] space has

been reined in; more exactly, it may be thought of as the most general introduction of form to an otherwise formless distribution" (Martin 2002: p. 865).

Figure @ref{fig:sysexample} presents two hypothetical belief systems. Two panels of the figure represent two people in the population with different belief systems. The columns reflect the proportion of times they give each answer to two binary questions – one about whether divorce is acceptable and one about whether God exists – assuming we sampled them an infinite number of times under slightly different circumstances. The first system reflects a strong Christian belief system that makes marriage a sacrament and indissoluble. Because the system strongly links marriage to the existence of a deity and eternal salvation, people have a relatively easy time rejecting competing considerations they hear in the social environment. A crisis of faith or actual error in filling out the survey might lead him to say that God does not exist at certain time points, but he is expected to enact a fairly consistent line of action over time.

The second system reflects a heterogeneity of considerations present in contemporary American culture. This person has internalized the heterogeneous messages present in the population about love and religion, as a result, vacillates on both questions over time local influences trigger.

An important point here is that the lack of constraint in the second system is still a reflection of a culturally shared schema. If we could get into the second person's head, we would likely see a schematic structure that connects representations of love to both prosaic and romantic notions (but maybe not the religious notions of love expressed by the first person). We would likely see such a structure repeated across people, and we could trace it to similar exposure to cultural artifacts, such as movies, books, and music, and observations of how people behave in communities. The two systems might have different (but predictable) consequences for social behavior. The former constrained system would likely also constrain action to certain lines of behavior (Vaisey 2009); the latter heterogeneous system might facilitate a broader range of action and greater susceptibility to institutional constraints (Harding 2007, 2011). In other words, inconsistency in attitudes can be as much a product of cultural-cognitive structuring as consistency.

[Figure 1 about here.]

Belief systems, then, are not networks of attitudes. They exist well below attitudes and shape the different responses that people give over time and the probability that they give these different responses over time. They might constrain beliefs to some portion of the belief space, but they might not. They might explicitly or implicitly tie beliefs together, but they might not. They reflect culture when they recur across people.

In this framework, then, a cultural belief system is detectable if we see groups of people who have the same probability of answering a question in a particular way over time. The obvious challenge of this approach is that we do not frequently observe people's responses to the same question repeatedly over time, with many panels of attitudes stopping at three waves. And if we use beliefs over time to deduce belief systems, we have nothing on which to test these propositions. Fortunately, a method for detecting such systems in cross-sectional data exists and has been used in sociological studies of attitude structuring before (Bonikowski and DiMaggio 2016; DiMaggio et al. 2018).

# 4 Latent Class Analysis and Belief Systems

Latent Class Analysis is a data-reduction method that attempts to group people into unobserved categories where, within these categories, the probability of giving a particular response to a question is independent from the probability of giving responses to other questions (**???**; **???**; **???**). This fundamental assumption, the conditional independence assumption, assumes that once the latent class is identified, each person's response on a particular question is an independent draw from the probabilities of the different responses observed within that group.

Latent Class Analysis has wide application in sociology. Across its diverse application in the discipline, LCA has been used to deduce classes of gender role attitudes (**???**); explore patterns of cultural consumption (**???**); and evaluate how life course trajectories relate to health trajectories (Willson and Shuey 2016), among many others.

This statistical model aligns closely with the theoretical model outlined above that assumes

that sets of cognitive structures shared across people (belief systems) produce similar probabilities of response over time, subject to local influences that are functionally random. LCA allows for the presence of competing belief systems in the population, reflected in the different latent classes. It does not require people to give the same response to be grouped into the same class, which also means that people do not have to give the same response over time to demonstrate that their responses are reflective of the same belief system over time. And it allows beliefs to be constrained to different degrees in different systems. In cultural sociology, LCA has been used to deduce belief systems in the past. DiMaggio and colleagues (2018) use LCA to deduce belief systems about religion and science from survey responses in the General Social Survey, and Bonikowski and DiMaggio (2016) use LCA to deduce varieties of popular nationalism, also using the GSS. However, these works do not make the strong assumptions about underlying cognition made here or, importantly, test these assumptions over time.

If, as the preceding discussion argues, a cultural belief system is a shared set of considerations and the connections between them that probabilistically produce certain responses over time across a range of questions, then latent class analysis should be able to detect these systems in a single wave of data. Assuming that belief systems do not undergo major revisions over time, the features of these systems observed at one time point should be predictive of the behavior of attitudes over time.

## 4.1 Hypotheses

The preceding discussion suggests a set of hypotheses about the behavior of attitudes over time. The first three are methodological, revolving around the ability of LCA at one time point to identify belief systems that predict attitude behavior over time. The second set of hypotheses pertain to the relative role of cognitive structures in shaping attitude behavior compared to other considerations, such as social networks and organizational participation.

### 4.1.1 Latent Class Analysis as a Measure of Belief Systems

The central assertion of the methodological argument is that Latent Class Analysis, in using data across people at a single time point, should be able to deduce belief systems that predict within-person attitude behavior. As constraints – restrictions of movement of beliefs over time – are taken to be the central signature of a belief system, I focus on those first. Specifically, the constraints on attitudes identified within a latent class at one time should predict the degree to which people change their attitudes over time. This produces the first two hypotheses:

*Hypothesis 1: Within belief systems, beliefs that are more constrained will demonstrate less change over time than less constrained beliefs.*

*Hypothesis 2: Across belief systems, the same belief will show less movement over time if it is in a more constrained belief system.*

The theoretical model outlined above makes a stronger prediction. It says that the belief system at time 1 should not only predict the degree to which attitudes in any particular system will change, but the probabilities that people in these belief systems will give certain responses, assuming changing social circumstances do not severely disrupt belief systems (a point I discuss below). If the theoretical model is correct, responses at any time should be conceptualized as independent draws from the multinomial distribution deduced at time 1. While these probabilities are shaped by broad cultural forces that influence people's considerations, which specific response a person gives at any wave will be shaped by (random) local influences. While it will be very hard to predict what any particular person will say in each wave, especially if they are in a very unconstrained system, assuming these draws are independent can give us strong predictions for the overall count of observed patterns over time. This produces the third hypothesis:

*Hypothesis 3: Over time, the aggregate response patterns of the sample should reflect a multinomial draw from the deduced belief systems.*

### 4.1.2 Adjudicating Culture and Structure

The preceding hypotheses assume either that social circumstances are invariant or that changing social circumstances do not significantly affect people's belief systems. I test this assumption and, in doing so, compare the relative influence of social structures and cultural belief structures on attitudes over time.

The central claim of the cultural schema literature is that cultural belief systems, once established, should be relatively impervious to outside social influences. If people have structured schematic thinking, then they should be less susceptible to the influence of alternative considerations that come from changing social environments (**???**…). This might in part be because they select into social settings, but it should principally be because these schematic structures influence how they process new information.

The most prominent alternative model is that socially patterned collections of attitudes are largely a product of people being located in similar social structures, and that cultural background, shaping ongoing cognition through durable cognitive structures, is largely irrelevant. Under this hypothesis, the reason people exhibit similar sets of attitudes is not because they have similar cultural cognition, but because they exist in similar social environments that produce similar attitudes independent of one another.

This would posit that as people move across social space, they would hear different sets of considerations that would reshape their consideration sets and the attitudes they report in surveys, with attitudes being shaped largely independent of one another. If this is the case, measures of social structure at the time of the survey should outperform measures of the the cultural structuring of their belief systems in the past in explaining current beliefs.

As noted previously, attitude structuring is undoubtedly an interaction between cultural schema and social structures (DiMaggio 1997; Martin 2010; Lizardo and Strand 2010). But given a lack of evidence for durable change in attitudes over time and the fact that we observe substantially less change in attitudes than changing social circumstances would predict (Kiley and Vaisey 2020), I expect that belief systems play a much larger role in shaping people's attitudes over time than the

strong structural hypothesis suggests. This leads to my final hypothesis:

*Hypothesis 4: Belief systems will better predict people's attitude reports over time than models that account changing social circumstances.*

# 5 Data and Measures

Testing the propositions outlined above requires data on the same beliefs and relevant social structures measured over time. The National Study of Youth and Religion meets these criteria. Below I outline the data set and measures used to these hypotheses outlined above.

## 5.1 The National Study of Youth and Religion

The National Study of Youth and Religion is a four-wave panel survey of adolescents that began in 2002 when respondents were between the ages of 13 and 17 and surveyed them every three or four years for four waves (Smith 2005). The survey began with a sample of 3,370 adolescents and is designed to be a probabilistic sample of adolescents in the United States at the time the survey started in 2002. The same respondents were asked to complete subsequent waves with response rates varying over time: 2,604 in wave 2 (72 percent); 2,182 in wave 3 (65 percent); and 2,144 in wave 4 (64 percent). In wave 2, respondents were between ages 16 and 20, in wave 3 respondents were between ages 17 and 24, and in wave 4 respondents were between ages 20 and 32.

The age range of the NSYR is important to the theoretical argument outlined above as it pertains to the structuring of cognition and the movement across organizational and social contexts. Existing work suggest that adolescence and early adulthood, the periods covered in the NSYR, are particularly formative periods for the cultural-cognitive structures assumed to shape attitudes and behaviors (Kiley and Vaisey 2020; Ghitza, Gelman, and Auerbach, n.d.; Bartels and Jackman 2014). At the same time, these periods also represent a significant time of transition for young people in the United States as they move out of their parents' homes and into college and the workforce, begin to form long-term romantic attachments, and generally transition from adolescence to adulthood.

There is likely more movement across social contexts at this period than most other periods in the life course. As such, this provides a good window in which to test the competing influences of cultural belief structures, organizational settings, and social change.

Because I only draw a few background variables from the first wave of the NSYR,[2] and because time matters significantly in the testing of the theoretical model outlined above, for clarity I will refer to waves 2, 3, and 4 of the NSYR as times 1, 2, and 3 for the rest of this paper.

Deducing belief systems at time 1 requires people to have responses on all belief measures and covariates. Because the relationships between covariates and beliefs and the relationships among beliefs are the central question of this analysis, any missing data imputation strategy might bias the deduction of classes in unforeseen ways. As a result, I only use people who are observed on all covariates and beliefs at time 1, leaving a sample of 2,521 respondents. Testing hypotheses 1 and 2 requires people to have beliefs observed at all three time points, but does not necessarily require covariates in later waves, and the test does not require people to be observed on all beliefs. As a result I use data on people whose classes are deduced at time 1 and who were observed on any beliefs at times 2 and 3. The sample size for each question varies between 1,668 (divorceok) and 1,699 (demons).

Testing hypothesis 3 and 4 requires comparable social structure and belief variables over time. Because some key social structural questions were dropped at time 3 (specifically questions about social networks), I focus principally on change between times 1 and 2. Again, it is not necessary that respondents report all beliefs at time 2, but respondents must have full beliefs at time 1 and full covariates at times 1 and 2. The analytical samples range from 2,153 (divorceok) to 2,175 (demons).

## 5.2 Measures

### 5.2.1 Beliefs

In times 1 through 3, NSYR respondents were asked a set of questions about their religious, moral, and family-structure beliefs. They include seven questions asking about specific religious beliefs, four

[2] Many of the attitude measures used in this analysis were not added to the survey until wave 2. Focusing on attitudes present in all four waves severely curtails the number of beliefs that can be explored.

questions asking about morality and the role of religion in daily life, and six questions about gender relations and family structures.[3] These questions are reported on either a three-point scales of "yes," "maybe," and "no," or five-point scales of "strongly agree," "agree," "undecided/don't know,"[4] "disagree," "strongly disagree." These variables are summarized in Table XXX.

These responses are treated as nominal in some models and continuous in others. To make the range of responses to each question comparable, I scale all attitude measures to five-point scales between 1 and 5 by converting questions on three point scales: "yes" to 1, "maybe" to 3, and "no" to 5.

### 5.2.2 Covariates

Given the belief domains explored here, I examine three principal sources of attitude structuring: sociodemographic background, organizational participation, and social networks. Sociodemographic background variables include respondent gender (indicator for female), and whether at least one parent has a bachelor's degree.[5]

A second set of covariates is designed to tap organizational participation, which is expected to change to some extent between waves. Given the role of religious organizations in shaping the attitudes under examination here, I include a set of indicator variables for the respondent's religious tradition (Steensland et al. 2000) and a measure of church attendance, measured on a scale from never (0) to more than once a week (6).[6] Because participation in formal education might introduce

[3] An obvious omission from this list of questions is the one Vaisey (2009) uses to predict adolescent behavior and social networks over time, which he argues represents people's "moral typology." Because of a coding error, responses to that question were lost for almost all respondents at Wave 3 of the NSYR.

[4] Responses of "don't know" were not provided in the survey document for questions asked on the five point scales, but if respondents gave them, they were coded as such. As such, they are relatively rare. When responses to questions that include a "maybe" option are coded as "don't know," I recode these responses to the "maybe" response.

[5] These demographic variables are measured at the survey's first wave and are assumed to be invariant during the survey. Preliminary analyses found that other demographic variables, including race/ethnicity, parent's income, and whether people grew up in a two-parent household were unrelated to beliefs, net of other predictors.

[6] The Steensland et al. (2000) religious tradition measures place Mormon respondents in the "other" category. The NSYR includes a separate indicator for the small number of Mormon respondents, who I group with evangelical protestants, based on preliminary analysis of their response patterns. While there are deep theological differences between the groups, these are not reflected in the questions analyzed here, and they behave quite similarly in terms of the beliefs measured in this analysis. The NSYR also includes a code for indeterminate respondents, separated by whether they attend services or not. I group these into a distinct category of indeterminate respondents. Finally, the NSYR includes a separate code for "black Evangelical protestants" and "black Mainline protestants." I group these two categories together.

an alternative set of considerations into people's belief systems, I include a variable measuring the number of years of education a person has received above ninth grade. I also include an indicator for whether the respondent lives in the South census region to capture movement across geographic contexts. Other census regions were uncorrelated with beliefs.

Finally, to measure social network influence, I include the proportion of a respondents' friends who share that person's religious orientation, including no religious orientation for people who do not express one.[7] As a second measure of social networks, I include the highest level of closeness a respondent reported with either parent.

These covariates are measured at times 1 and 2. Table XXX presents these covariates.

## 5.3 Belief Systems

I use Latent Class Analysis to deduce a set of belief systems using the 19 attitude items asked at time 1. Latent Class Analysis attempts to assign a class to each respondent such that their responses are independent from each other within classes. The model uses the Newton-Raphson method to maximize the log-likelihood of multiple parameters under the assumption that indicators are independent conditional on class membership.

A model that predicts the observed response pattern $y$ using a latent class variable $X$ with $L$ values has the following probability structure:

$$P(Y = y) = \sum_{l} P(X = l)P(Y = y|X = l)$$

Because of the conditional independence assumption that $K$ indicators are independent within each latent class $l$, the joint probability of a given response pattern can be rewritten as the product of individual item response probabilities, and $P(Y = y|X = l)$ can be rewritten as:

$$\prod_{k} P(Y_k = y_k|X = l)$$

[7] Almost all respondents at time 1 (about 94 percent) said they had five close friends, making a count of friends as an additional measure superfluous.

LCA estimates a set of parameters that includes the relative class proportions and the probabilities of each response for each class on each question. For the purposes of the latent class analysis, responses are treated as nominal, rather than as scalar responses or reflecting an ordinal scale.

The model also includes the covariates outlined above as predictors of class assignment. The model simultaneously estimates two conditional probabilities: the probability of response conditional on group assignment and the probability of group assignment conditional on covariates.

I use Bayesian information criterion to select the best-fitting number of classes.

## 5.4 Testing Hypotheses

### 5.4.1 Change Over Time

The first two hypotheses make predictions about how much attitudes should change over time as a function of the constraint within a belief system at a single point in time. Within a system, more constrained beliefs should change less over time than less constrained beliefs, and across systems, a belief should change less in a more constrained system.

I measure constraint of a particular attitude, $j$, for members of a designated belief system, $k$, by calculating the within-class standard deviation of responses to that attitude over all people, $i$. Latent Class Analysis assigns each person a probability of belonging to a each class. For this analysis, I assign people to the class with the highest posterior probability. I then calculate the standard deviation of responses within that group, treating responses as continuous, rather than nominal as the LCA does. A group where most people tend to give the same response or cluster in adjacent responses will have a low standard deviation and therefore demonstrate high constraint. A group where people tend to give answers across the scale will have a high standard deviation and therefore low constraint.

$$\sigma_{jk} = \sqrt{\frac{\sum (x_{ijk} - \mu_{jk})^2}{N_k - 1}}$$

The outcome of interest is the amount of variation people express in their attitudes over time – whether they demonstrate contained attitudes. I measure within-person variance over time

using the within-person standard deviation of responses given at times 1, 2, and 3.

$$\sigma_{ij} = \sqrt{\frac{\sum (x_{ijt} - \mu_{ij})^2}{N_i - 1}}$$

I test the first and second hypothesis using a single linear regression of within-person variance on the within-class standard deviation at time 1, with fixed effects for question ($J$) and for person ($I$). This amounts to simultaneously testing whether people exhibit more variation in their less constrained beliefs over time than their more-constrained beliefs and whether a belief demonstrates more over-time variation when it is in a less constrained belief system than when it is in a more constrained belief system.

$$\sigma_{ij} = \sigma_{jk} + I + J + \epsilon_{ij}$$

As an auxiliary test, I conduct a similar fixed-effects regress of each person's mean for each question at times 2 and 3 ($\mu_{ij,t>1}$) on the group mean at time 1 ($\mu_{jk}$) for each question at time 1. This tests whether constraints about where group members fall on average continue to constrain people over time.

$$\mu_{ij,t>1} = \mu_{jk} + I + J + \epsilon_{ij}$$

## 5.5 Pattern Prediction

The rest of the hypotheses reflect the claim that the probabilities identified in the latent class analysis reflect the range of considerations that members of that group possess, and that their responses at any time point can be modeled as independent draws from these probabilities. To assess this proposition, I take a predictive approach to comparing the theoretical model outlined above to competing theoretical processes (**???**; **???**).

Hypotheses 3 and 4 focus on the observed counts of change patterns over time. To illustrate this approach, assume two belief systems that differently constrain people's views on the following

question: "Do you think that, in general, a couple without children should end their marriage if it is empty and unfulfilling, or should they stick with it even if they are not happy?" In one belief system, people are constrained to oppose divorce quite strongly ($Pr(yes) = .9$). These people have many considerations against marriage, but there is a chance that a local event could tip their disposition either way at any particular wave. In the second belief system, people have roughly equal considerations in favor of and opposed to divorce ($Pr(yes) = .5$). And which response they give at a particular wave will be affected by the balance of considerations on their mind at any time.

If responses over time are independent draws from this distribution, then if we asked people the question two times, people in the first group should say "yes" in both waves about 81 percent of the time ($.9 * .9 = .81$). People in the second group should say "yes" in both waves about 25 percent of the time ($.5 * .5 = .25$). We can calculate the probability of each of the four possible two-wave response patterns, presented below:

| Pattern | $Pr(yes) = .9$ | $Pr(yes) = .5$ |
|---|---|---|
| Yes -> Yes | .81 | .25 |
| Yes -> No | .09 | .25 |
| No -> Yes | .09 | .25 |
| No -> No | .01 | .25 |

A key assumption of the belief systems model is that predicting any person's response at any particular time will be difficult, especially if it is deduced that beliefs are relatively unconstrained in a particular system, such as in the rightmost column. But the theoretical model can generate strong predictions of counts of response patterns in the aggregate. I can use the distribution of these two belief systems in the population, as well as the distribution of responses observed at time 1, to generate a range of plausible predictions for the count of each pattern I observe in the data set.

Predicting response patterns in the latent class model requires two steps: sampling class identification and sampling responses. The LCA model assigns each observation a probability of belonging to each class based on their covariate profile. I sample class assignment from these prob-

abilities. Then, using these class assignments, I sample responses from the probabilities assigned to members of that class. I can then count the number of people who demonstrate each response patterns ("Agree" at time 1 to "Disagree" at time 2) and compare that to the observed count of response patterns. While the theoretical framework makes within-class predictions, because people are probabilistically assigned to different classes, and to make comparisons to other theoretical processes, I aggregate counts of response patterns at the question level.

To measure the predictive accuracy of a model for each question, $j$, I square the difference between the expected number of response patterns generated by the model for all combinations of responses at time 1 and time 2, $Exp_j(t_1, t_2)$, and the observed number of cases that had that response pattern, $Obs_j(t_1, t_2)$, penalizing larger deviations. I then take the square root of this value.

$$\lambda_j = \sqrt{\sum_{t_1} \sum_{t_2} (Exp_j(t_1, t_2) - Obs_j(t_1, t_2))^2}$$

Because both class assignment and response probabilities reflect sources of uncertainty, I iterate this process 10,000 times to generate a distribution of accuracy that reflects the probabilities of class assignment and response probabilities.

This range of numbers provides a quantification of how good the model predicts response patterns over time, with 0 being a perfect prediction of the count of response patterns, but it is meaningless on its own, since there is no clear alternative expectation for how many counts we observe. It is unlikely that any model would perfectly predict responses over time. However, I can compare whether this theoretical process does a better job predicting the count of observed changes over time than other theoretical models. To generate an plausible upper-bound of prediction, I sample from the marginal distribution at each wave for each respondent.

The first theoretically grounded alternative to the belief system model suggests that beliefs are functionally independent from each other. In this framework, belief in the existence of God is independent from considerations of divorce, and there is no underlying cognitive structure that influences both. Under this model, people have more or less idiosyncratic belief systems (or sets of

considerations) as a function of their social experiences. In contrast to the belief systems model, this theory would expect no systematic relationship between beliefs. Instead, people would receive separate influences on each belief from their social environments – churches, schools, families, friends, etc. – and these would shape their responses at each wave.

To estimate these idiosyncratic patterns, I conduct a multinomial logistic regression for each individual attitude at time 1 using the same set of covariates included in the latent class analysis.[8] This produces a set of individual-specific probabilities of giving each response to a question. I then use those probabilities to simulate potential responses over time and similarly quantify predictive accuracy.

Model comparisons typically penalize models for complexity, as complexity tends to lead to greater predictive accuracy within a sample. The latent class model, while quite complex, is substantially less complex than estimating separate models for each response. If the latent class model makes better predictions, there is no reason to prefer estimating separate probabilities for each response on the grounds of parsimony. There are obvious ways to simplify both models by removing parameters that do not aid in prediction, or by treating responses as ordinal rather than multinomial. However, the main goal of using the same predictors and same outcome scale is to design two models that reflect two similar but distinct theoretical processes: one where beliefs influence and constrain each other, and one where they do not.

## 5.6 Changing Circumstances

To this point, hypothesis testing has been oriented toward establishing that latent class analysis as a good methodological fit for the theoretical concept of a belief system and the predictions it makes over time. If that is established, then we can use the deduced belief systems to compare the relative

[8]This approach assumes that each person's response at each wave is a draw from a multinomial distribution. An alternative is to assume that each person's response is a latent variable observed with error. This would model the outcome not as a set of independent categories (multinomial logit/probit), but as manifestation of a latent variable (ordinal logit/probit). In practice, the multinomial logit is a less constrained version of the ordinal logit model. If attitudes do reflect an underlying latent construct, the multinomial logit will reflect this structure, but the reverse is not true. Since I am not principally concerned with model parsimony, but rather on adjudicating theoretical processes, I use the multinomial logit model.

influence of the belief system with social structural changes that might produce changes in beliefs over time.

Both the LCA model and the idiosyncratic beliefs model outlined above assume that belief systems are shaped early in life and endure, but Hypothesis 4 suggests that changing social circumstances will reshape beliefs over time. To test the influence of organizational and social network change, I use the coefficients derived from the latent class and multinomial logit model at time 1 to predict class assignment and responses at time 2 using social structural and social network variables observed at time 2. If changing circumstances – increased church attendance or a more diverse friend group, for example – have the effect of producing changes in attitudes, then using information about social change between waves will produce better estimates of the patterns of change over time.

To ensure comparability across prediction models, each prediction model uses all people with full beliefs and covariates at time 1 to generate coefficients (2,521 respondents), and people with beliefs at time 1 and all observed covariates at times 1 and 2. A handful of people with covariates at time 2 failed to answer some of the belief questions. They are evaluated on the questions we do observe them on, meaning there is some small variation in the counts of responses tested for each question.

# 6 Results

The results proceed in three parts. First, I deduce and explain the belief systems identified through latent class analysis. Second, I test the proposition that the constraints implicit in each belief system are good predictors of over-time change. Third, I adjudicate the competing influences of the belief system and social structures in predicting responses over time.

## 6.1 Belief Systems

Based on goodness of fit measures and substantive interpretation, I selected and present a five-class model to summarize the belief systems across the three domains outlined above. Figure

@ref{fig:beliefsystems} presents the expected probability of each response option for all 19 questions for all of the classes. I briefly summarize each belief system, giving a substantive interpretation based on response probabilities and covariates, as well as their implications for expected over-time change.

[Figure 2 about here.]

*Constrained Christians:* The first group, which comprises about 10 percent of survey respondents, displays strongly constrained religious beliefs. Almost everybody in this class expresses a belief in the major tenets of Christian theology, and they reject non-Christian beliefs (reincarnation and astrology). They strongly contrast with other classes in being much more likely to say they disagree and strongly disagree with moral relativism (moralchg; moralrel) and the notion that religion is a private matter (relprvte). Identification as an Evangelical Christian/LDS is a strong predictor of being in this class, as is frequent attendance at religious services.

A key feature of this class is that they are less constrained in their beliefs about family and gender than many of the other classes. This lack of constraint arises because their belief space is broader than that of other classes; their belief system presents them considerations that are at odds with the prevailing culture that views divorce as an acceptable option for unhappy couples. Similarly, while most other groups are constrained to the "disagree" side of the scale on whether "Most of the important decisions in the life of the family should be made by the man of the house," members of this group occasionally agree or strongly agree. They are also the group most likely to say that sex before marriage is not acceptable.

Under the belief system framework outlined above, I expect members of this group to be highly unlikely to make changes in their beliefs about religious phenomena, both relative to their other beliefs and relative to other groups. They will also be less likely to change their views of morality than other groups. At the same time, because they have conflicting considerations about family structures, they should be more likely to change those beliefs – both more likely to change them than other groups and more likely to change them than other beliefs.

*Atheists/Agnostics:* The second class, which comprises about 15 percent of respondents, is characterized by a rejection or questioning of religious beliefs. At the same time, they also reject or

question astrology and reincarnation. In fact, they look more similar to the most constrained religious group on these two issues than other classes do. They are the most constrained to the "relative" side of the moral relativism-moral absolutism scales. In terms of covariates, they tend not to identify with a religious denomination or attend religious services. However, people who identify as Jewish cluster in this group.

This group is also quite constrained on some religious beliefs, some family structure questions, and views on morality. As a result, they should change little on these beliefs over time. They are the least constrained on the question of god's existence, about equally split between saying "no" and "maybe." I expect members of this group to vacillate on this question.

*Mainline Christians:* This group most closely resembles the strong religious group in their responses to questions about religious beliefs, but their constrained religious beliefs do not appear to spill over into other domains. Members of this group appear torn between their religious commitments and the culture of contemporary American society, or at least have not taken the time to reconcile these contradictions, producing relatively high levels of ambivalence on issues of family structure and morality, rarely giving "strong" responses to either. This is the largest class in the data set, drawing members from all religious groups, principally people who do attend religious services but do not attend them frequently.

*Ambivalent:* The third group is characterized by a high degree of uncertainty on religious and moral beliefs. They are the most likely to say "maybe" in response to questions about the existence of angels, demons, and god, as well as the non-Christian belief questions such as astrology and reincarnation. These respondents tend to be Catholic or unaffiliated with a religious tradition and infrequent service attenders. Members of this group are the least likely to give strong opinions on questions of morality and family structures.

*Unconstrained:* The final group demonstrates little constraint across the board. While it is tempting to interpret this group as displaying idiosyncratic belief systems, the theoretical model suggests that these people have internalized a broad range of considerations that make them highly subject to local influences. As a result, they should vacillate quite significantly over time on these

questions, especially questions about morality.

These people should be contrasted with the Ambivalent group. Members of the ambivalent group explicitly pick scale midpoints, while members of the unconstrained group range widely. This suggests that the former are actually quite constrained in their cognition, recognizing their conflicting considerations and averaging them. Members of the latter group appear not to recognize these conflicts and be subject to the whims of temporary influences.

While I call these five groups "belief systems," it is not necessary that members of these groups see these domains or beliefs as connected. It could very well be the case that the group I have deemed Mainline Protestants do not see connections between family life, morality, and religious behavior. These groups should be conceptualized as socially patterned sets of influences – schooling, parent's education, social networks, and religious participation – that shape the range of considerations they hold. They represent groups of people with similar sets of considerations in their cognition, not people who necessarily recognize each other as members of a group.

The assumption of the model outlined here is that people in the strongly religious group do not have an attitude about divorce. They have a set of considerations that leads them to respond to "no" about three-fourths of the time. But any particular person in that group might say "yes" about a quarter of the time, depending on his or her circumstances. The only way to test this proportion is to test whether people appear to behave that way over time. I turn to that now.

## 6.2 Change Over Time

Figure @ref{fig:standardeviation} plots the average within-question, within-class standard deviation at time 1 against the average within-question, within-person standard deviation over time. If within-group constraint of a particular question is a good proxy for within-person considerations, there should be a positive correlation between these two measures.

[Figure 3 about here.]

There is an incredibly strong relationship between the amount that a particular question varies within a group at time 1 and the average within-person variance that members of the group

demonstrate over time ($\rho = 0.711$). This relationship holds across questions within groups (lowest correlation is 0.343 for Atheist/Agnostics; highest correlation is 0.835 for the Mainline Protestants) and within questions across groups, ranging from 0.412 for whether religion is a private matter to 0.962 for whether the respondent believes in miracles. The exception of the question about premarital sex, where the correlation is functionally 0.

The diagonal line in Figure … represents a 1:1 prediction of within-group variance at time 1 and within-person variance over time, which is what we would expect if the variation observed in the classes were perfect predictions of people's internal belief systems. Points generally fall below the line, suggesting that people are more constrained than their belief systems. This is not surprising, idiosyncratic forces likely further constrain beliefs over time. But many attitudes fall very close to this line, suggesting a good fit with the theoretical model. A similar comparison of within-group means also produces a strong , and close to the 1:1 prediction ($\rho = .8XX$)

To test hypotheses 1 and 2, I estimate a regression of within-person change between times 2 and 3 on within-group variance at time 2 with fixed effects for question and person. Table @ref{tab:coefficients} presents the results of that regression. I also present a regression of the group mean at time 1 on within-person means for times 2 and 3 to examine whether people are, in general, constrained to the same portion of the belief space.

[Table 1 about here.]

As expected, Table ### shows a strong positive association between within-group variance at time 1 and within-person change over time. In other words, consistent with Hypothesis ###, people are more likely to change attitudes that are less constrained in their group at time 1. And consistent with Hypothesis ###, within questions, groups that are less constrained exhibit more change their answers over time.

## 6.3 Predicting Response Patterns

Hypothesis 3 predicts that the responses that people give over time will reflect a multinomial draw from the probabilities derived from the belief system at time 1. Figure @ref{fig:predictionerror} com-

pares the accuracy of predicted counts of response patterns with predictions using the marginal distribution at wave 3 and predictions generated from the multinomial logit model reflecting independent belief formation.

```
## Scale for 'fill' is already present. Adding another scale for 'fill', which
## will replace the existing scale.
```

[Figure 4 about here.]

```
## Scale for 'fill' is already present. Adding another scale for 'fill', which
## will replace the existing scale.
```

[Figure 5 about here.]

The predictions generated through the latent class model consistently outperform the predictions made through the multinomial logit model. For some questions, especially the Christian religious beliefs, the differences between the two models is stark. Other questions are less conclusive, but the latent class model still tends to outperform the idiosyncratic beliefs model on average. These latter beliefs – astrology, reincarnation, and whether sex before marriage is acceptable – tend to be the least different across belief systems, suggesting that the other beliefs in the system exhibit little constraining influence on how people understand them. They also tend to be the hardest to predict in general, with neither model doing much better than predictions made using just the margial distribution.

The key interpretation of this comparison is that information about people's beliefs tell us something about their other beliefs, suggesting an underlying structure to the belief system. The assumption that responses at any wave are a multinomial draw from the distributions deduced at time 1 is also quite valid, especially for the Christian religious beliefs.

Both the multinomial logit (independent beliefs) and the latent class (belief system) model assume that belief systems that people have, whether idiosyncratic or culturally shared, are durable over time. They cannot adjudicate whether beliefs are principally a result of stable social circumstances or durable cognition. I now turn to adjudicating that question.

### 6.3.1 Changing Social Circumstances

To the right side of the dashed line in each plot in Figure XXX are predictions made using time 2 covariates. If changing social circumstances lead to changes in attitudes, these models should outperform those that do not.

In general, the time 1 belief system predictions outperform both the idiosyncratic influence model (the multinomial model) that uses time 2 covariates and a model that uses covariates at time 2 to revise membership in belief systems. There is little change in the predictions for the multinomial logit model compared to just using wave 1 covariates, but the latent class model performs worse when we account for changes in social structure.

This decrease in predictive accuracy using wave 2 covariates appears to be principally because people decrease their religious participation and increase their education levels between times 1 and 2, which covariates at time 2 tell us should have the effect of shifting people to new belief systems. These changes in social structure are not surprising, as the time between these waves principally reflects people leaving their parent's home and relatively homogeneous communities and transitioning to independent life, college, and the workforce. But it is somewhat notable that these social changes produce worse predictions of what people believe. Frequency of service attendance is a strong predictor of class assignment at time 1.

# 7 Discussion

This paper had two related goals. First, it sought to rethink how researchers interested in the measurement of culturally structured cognition conceptualize and measure cultural belief systems in the general public. It argued that because the schematic structuring of cognition happens well below the level of a survey response, measuring the pairwise relationship between these responses can produce misleading conclusions about how culturally shaped cognition works in people's heads. Similarly, I argued that existing measures of schematic cognition do not fully take into account how culturally shared cognition might produce variation in responses over time that reflect those structures. I argued

that latent class analysis could be used to deduce belief systems that manifest as shared probabilities of giving certain responses to different questions over time.

Using Latent Class Analysis, I deduced five belief systems in the population of adolescents surveyed in the NSYR regarding family structure, moral, and religious beliefs. These systems differ strongly in the constraints on attitude change they imply. The first three hypothesis tests provide a broad test of whether the constraints observed at time 1 predicted people's change over time, finding that the within-group constraints implied by the model at time 1 are reflected in individuals' change and responses over time. The key finding of this paper is that the probabilities derived across people at a single point in time provide a remarkably good prediction of how people changed over time.

As a second goal, the paper sought to adjudicate the relative influence of such cultural-cognitive structures on opinion behavior over time compared to social-structural influences such as social networks and organizational participation. Results from the fourth hypothesis test suggest that the constraints (or lack of constraints) present at time 1 better predict the aggregate pattern of responses over time than models that account for changing social circumstances. Despite expectations that changes in organizational participation and social influences should, in theory, produce changes in beliefs, the constraints deduced at time 1 appear to strongly limit the effect of these changes, especially on religious beliefs and some family beliefs.

These findings have broad implications for social science research across several domains.

## 7.1 Implications for Cultural Sociology

The results presented here suggest that people's cognition is more schematically structured and more durable than lots of work supposes. As people move across social structures they are exposed to new considerations, but the effect of these new influences is limited by the way people are taught to understand the social world.

At the same time, attitudes are not necessarily stable. Belief systems provide a range of considerations that people draw on over time, subject to local influences.

These twin facts make sense of a : high heterogeneity in attitudes at the individual level and

high durability at the aggregate level (**???**).

Because cognitive structures appear to be quite durable in the face of … , there is no reason to expect that inconsistency in survey responses should be associated with inconsistency elsewhere. Inconsistency in survey responses is principally a misalignment between the structures of cognition and the survey question. A schematic structure that produces inconsistency in a survey response might produce predictably produce stability elsewhere.

These findings suggest that research focusing on explaining attitude behavior over time might put too much emphasis on the social structures at the expense of cognitive structures formed early in life.

To be clear, these results should not downplay the role of organizational structures and social networks in shaping people's belief patterns. Organizational participation, especially religious tradition and frequency of religious service attendance, were strong predictors of belief systems at wave 1.

## 7.2 Methodological Implications

Measuring culture is challenging, and measuring culture in the morass that is people's cognition is even harder. For a long time, researchers looked for the signature of shared culture in shared attitudes and stability. But shared culture is often heterogeneous and conflicting, and the product can be shared instability. But that does not make this any less "culture." Taking seriously the measurement of culture means accounting for this instability.

The results suggest that measuring culture in cross-sectional. While … it in no way guarantees that people who are grouped together un…

The results should also pose a challenge to how we understand measurement error. The central assumption of measurement error arguments is that people have an underlying position and that inconsistency is inherent in questions (**???**; **???**). The theoretical model outlined here argues that people do not have "attitudes" or "beliefs" as measured by surveys. They have considerations that probabilistically produce responses under a variety of conditions. What the latent class analysis

shows is that inconsistency is a relationship between people's cognition and the question they answer. The structures of belief that people bring with them into a survey will disproportionately produce inconsistency on some questions. This is not error. It is culture.

# 8 Limitations, Future Directions, and Conclusion

deducing belief systems. The attitudes studied here are , and strongly related in some belief systems.

There are several testable implications of … An Unconstrained person, subject to a prime designed to induce an absolutist morality, might . The first links the schematic organization of beliefs to discursive consciousness.

A second suggests that people might be differently susceptible to social influences and psychological primes based on the structure of their cultural cognition. For example, a member of the Unconstrained belief system deduced above, primed to think about moral relativism, might suddenly act relativistic, since he has nothing to keep out these considerations. But a Constrained Christian might easily (and automatically) filter out this consideration. This is problematic for such studies if the assumption of such studies is that primes affect people randomly and non in systematic ways.

An implication of this model is that more constrained beliefs should be more predictive of behavior than less constrained belief. Because Constrained Christians have a clear view of the existence of god that seems relatively impervious to temporary influences on the consideration set, they can bring this consideration … Previous work shows that people who live in environments that contain heterogeneous cultural models show a weaker link between their own expressed beliefs at a single survey wave and their behavior over time (Harding 2007).

An important caveat to the above presentation is that Wave 2 of the NSYR – time 1 in this study – occurs at what seems to be a particularly formative period in people's life course. Respondents were between the ages of 16 and 20 when they were interviewed for wave 2 of the NSYR. Existing research suggests that people's attitudes on a range of issues appear to crystallize prior to adulthood (Kiley and Vaisey 2020; **???**; Vaisey and Lizardo 2016). It is highly likely that … always be the case

that the first wave of a panel survey is as strongly predictive for each belief system. For example, it is not clear if using wave 1 of the NSYR, when respondents were between the ages …

There are two general reasons why we should expect constrained beliefs to demonstrate greater stability. First, people with constrained beliefs will demonstrate less change in their social contexts. Strong belief systems guide people's behavior across domains, including the networks people select into, the institutions in which they choose to participate, and more (Vaisey and Lizardo 2016).

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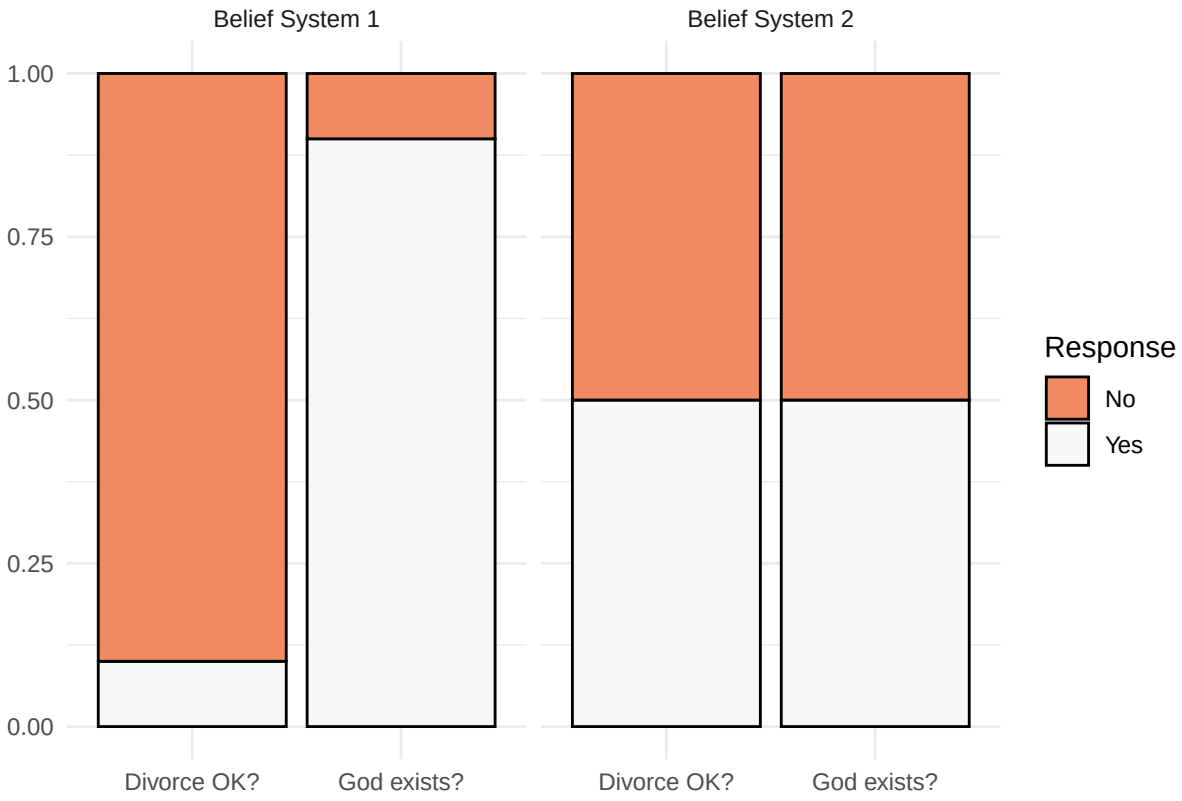


Figure 1: Hypothetical example of over-time responses for two belief systems.

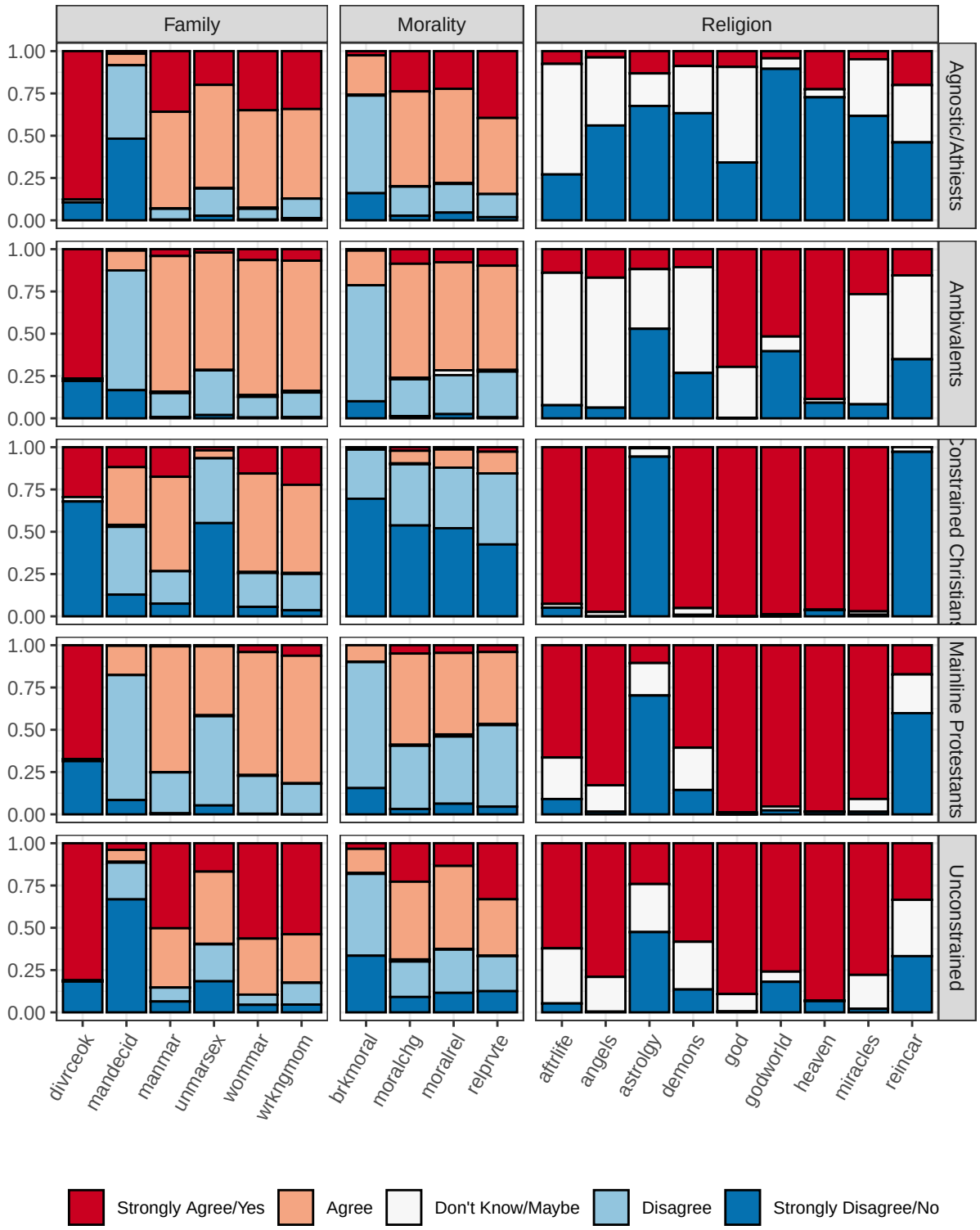


Figure 2: Religious, Moral, and Family Beliefs by Class

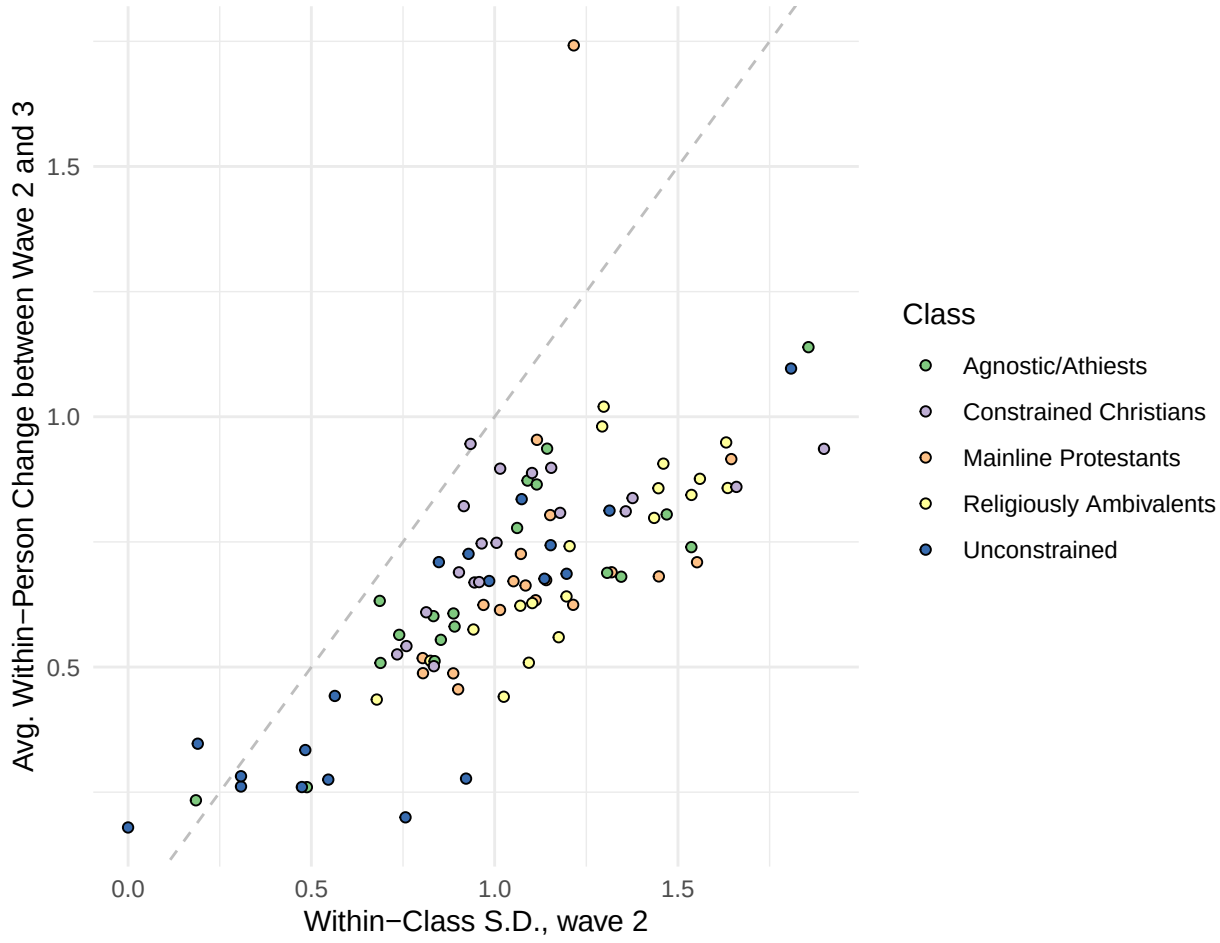


Figure 3: Scatterplot of Within-group Standard Deviation at Time 1 against Average Within-Person Standard Deviation, Times 1-3

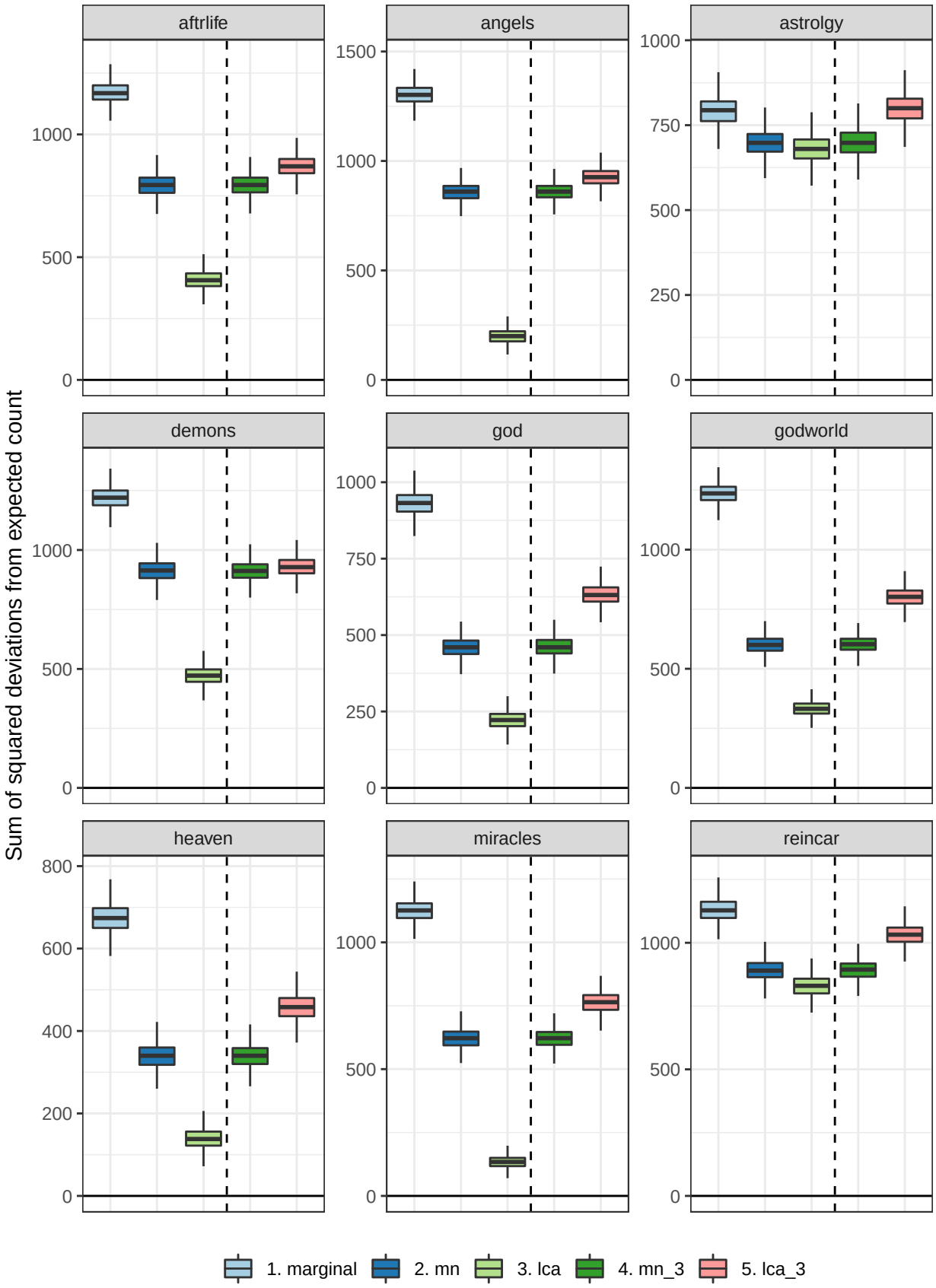


Figure 4: Boxplots of deviation of observed from expected counts of response patterns, 10,000 iterations each, religious beliefs

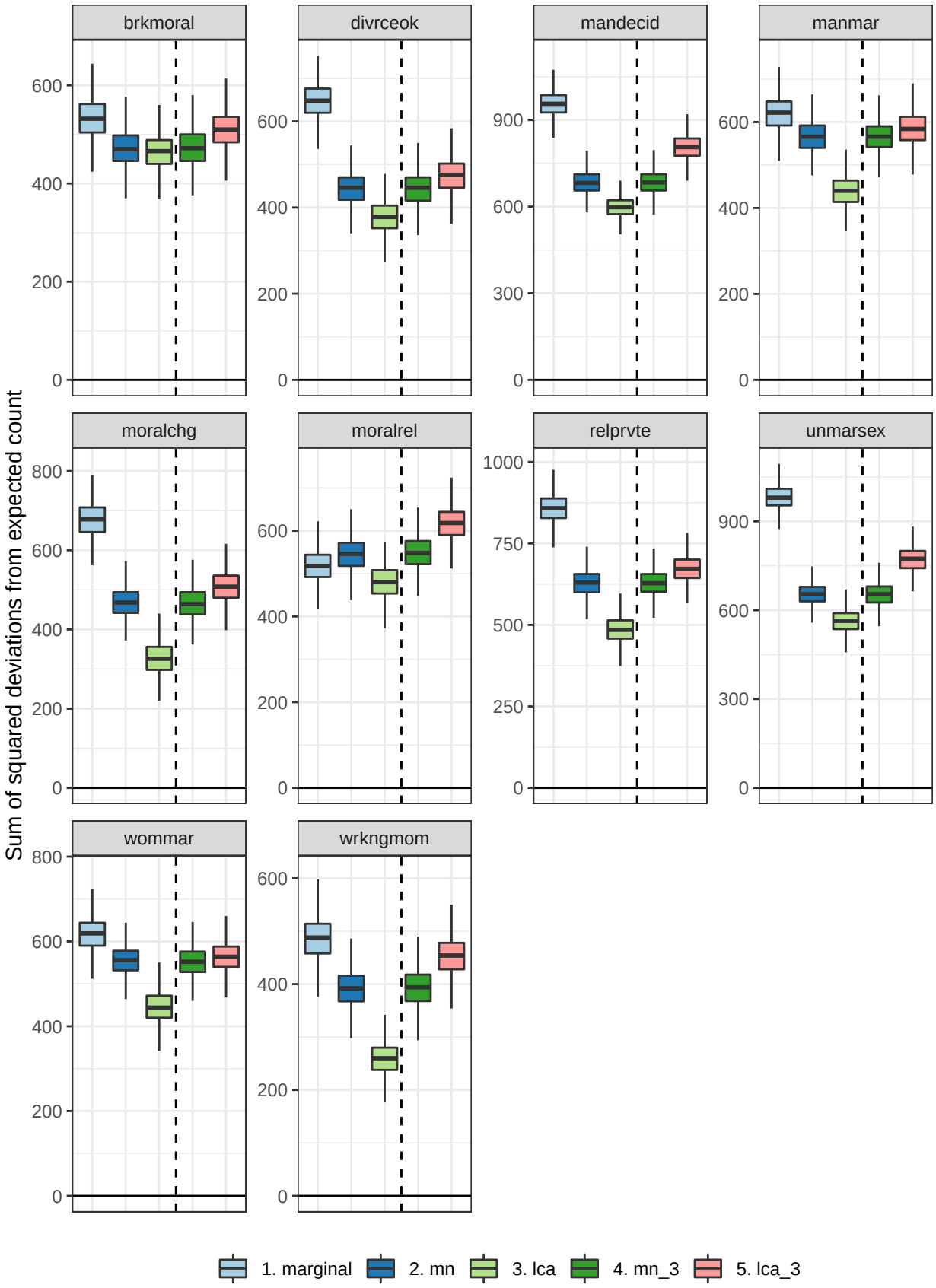


Figure 5: Boxplots of deviation of observed from expected counts of response patterns, 10,000 iterations each, moral and family beliefs

| | Model 1 | Model 2 |
|---|---|---|
| grp_sd | $0.55^{***}$ | |
| | $(0.01)$ | |
| grp_mean | | $0.80^{***}$ |
| | | $(0.01)$ |
| Num. obs. | 32102 | 32102 |

$^{***}p < 0.001; ^{**}p < 0.01; ^{*}p < 0.05$

Table 2: Statistical models