Religious islands, partners, and bridges: Studying cross-denominational shared ideas using book co-purchase networks

INTRODUCTION

Despite studying one of the most diverse religious landscapes in the world, including well over 1,000 independent religious groups (Melton 2003), sociologists of U.S. religion rarely consider how and under what circumstances ideas are shared in common or spread between those groups. This may result in part from the relative ease, when relying on national surveys and membership counts, of classifying denominations or individuals. We tend to put our subjects into boxes for comparison, but spend less time understanding what makes or breaks the ties between each box. This dissertation is designed to help remediate that limitation for the case of Protestant Christian groups, and answer three specific questions about the beliefs and ideas that are shared between denominational families (e.g. Methodists, Baptists, etc.):

1. What denominational groups are isolated from others in practice and why?
2. What factors help understand which groups of denominations most commonly share idea space?
3. Does the practical ecumenism taking place tend to be visible and direct, or by means of shared exposure to more general and not denominationally specific popular Christian books and media?

Accomplishing this requires an unusual approach to studying religious ideas: co-consumption analysis. Most commonly, sociologists restrict the religious ideas they study to a small list of beliefs (e.g. belief in the existence of angels or Biblical literalism) and moral attitudes (e.g. views of sexuality or abortion) that tend to correlate closely with social groupings.[[1]](#footnote-1) Church historians and theologians might consider denominational genealogy, formal ecumenical agreements, and the development of doctrinal markers qualitatively. But today, individuals have a plethora of religious choices to mix or match, “none” is an increasingly common religious identity (Pew Research Center 2015), church attendance is declining, and individuals receive an idiosyncratic mix of religious messaging from beyond the pulpit through media such as popular books and movies (Park and Baker 2007). Thus an effective analysis of religious ideas *must* move beyond formal doctrine or accords and take into account how religious groups are connected by the everyday lives and sense-making of their adherents.

Evidence that religious culture is important outside of places of worship abounds and is widely acknowledged. *The Prayer of Jabez*, a Christian devotional book, was one of the bestselling nonfiction titles of 2001. Fox News commentator and former ABC News correspondent Bill O’Reilly, included Jesus in his bestselling “Killing” biography series (*Killing Kennedy, Killing Lincoln, Killing Jesus*). Even among the irreligious, scientists ranging from Richard Dawkins to Bill Nye have achieved increased cultural prominence and high book sales writing about religion. On the big screen and the radio, religious messages have met with similar, if not greater, success ranging from contemporary Christian and crossover music to the movies *Left Behind* and *The Passion of the Christ.* There are theoretical reasons to study religious consumption, as well. Religious cultural exclusivity and strictness (Kelley 1972; Iannaccone 1994) have figured prominently in the development of scales and classifications commonly used to distinguish religious groups (Alwin et al. 2006; Iannaccone 1994). Little has changed since Kelly’s lament that “The few sociologically-informed studies of ecumenism that have been done are generally speculative rather than empirical” (1971). All of this suggests the need for high quality data on religious cultural consumption outside the worship space. Without this data our understanding of a foundational institution of society may be handicapped by a restricted scope and an amalgam of dissociated theories and measurement levels.

To begin filling this hole and understanding what lies behind the isolation, partnerships, and informal bridges of denominational families (e.g. Baptist, Methodist, etc.), I will combine new data on recent co-purchases of books relevant to each group at Amazon.com with information on the historical, formal, cultural and structural ties between denominations and families in the U.S. This complements existing studies with an alternative test of religious exclusivism and provides additional means of evaluating common methods of categorizing religious groups. I also apply core findings from the field of social network analysis on group structure, inter-group ties and diffusion, and the consequences of popularity and structure for the ongoing development of networks. Finally, I introduce sociologists to a new type of data which is relatively accessible and enables less expensive quantitative studies that are potentially richer than survey or observational studies of consumption. Beyond the discipline of sociology, the dissertation can provide religious leaders and scholars a clearer understanding of the factors that affect the practical ecumenism of lay Protestants in the U.S. This new source of data can provide insights into how official doctrine and teaching are actually engaged, the effectiveness of different forms of intergroup cooperation, and practical factors of the “everyday religion” (Ammerman 2007) of U.S. Christians.

PREVIOUS WORK AND THEORY

*Denominations, Families, and Sociological Categorization*

A study of denominational families first requires a basic understanding of the history of Protestant denominationalism in the U.S. The flames of reformation and schism from the Roman Catholic Church, sparked by the actions of Martin Luther and other early reformers, spread to North America with the immigration of majority protestant ethnic groups and were fanned by the promise of relative autonomy in the new world and the infusion of religious refugees it drew across the ocean. When the various settlements and colonies were united as a new independent nation, this freedom and diversity were ensconced in the first amendment to the U.S. Constitution. With this protection and the lack of an official state religion, denominational families, including those that initially transplanted the beliefs and practices of European state churches, become increasingly divided over time. Schisms were often occasioned by resistance to gradual shifts in the theology and practices of the existing group (Stark and Bainbridge 1985; Stark and Finke 2000). Occasionally, struggling denominations within a single family also chose to merge into a new, consolidated body.

The net result of this history is a denominational landscape that is a complex pastiche of religious groups which may share genetic principles inherited from their founders or ancestral denominations, but tend to be diverse enough to preclude easy categorization along a single spectrum, even within a single historic family, such as Lutheran churches. Because schism tends to occur along lines of theological and cultural liberalism or conservatism, denominations belonging to different lineages may share as much or more of their theology and identity as those which share a common origin but distinct attitudes toward the world. In response, sociologists of religion have tended since the 1980’s to reject the denominational family as unit of comparison. Instead, they have mounted any number of efforts to categorize denominations or individuals in ways that correlate more neatly with a variety of sociological outcomes (Smith 1990; Woodberry and Smith 1998; Steensland et al. 2000). Each index and scale embeds different notions about group boundaries and intergroup relations, but comparisons have had to rely on formal teachings and survey data (Alwin et al. 2006). Which religious ideas lay people actually connect with, whether through sermons or (increasingly) through the books they read and the music they listen to, may have a closer relation to the day-to-day realities of religious practice. Formal denominational teachings may or may not be reflected to lay Christians at all. Survey data tends only to capture beliefs well if they also serve identity markers. If the intention is for standard indices and scales to reflect somewhat of the content of religion and not primarily the social circumstances of its practitioners, their salience should also be tested in relation to the actual informal content that religious individuals are seeking out and being exposed to.

*Structural Approaches to Religious Group Relations*

Big data, such as social media and online purchasing data, provide the base material necessary to analyze, but to do so meaningfully also requires incorporating fundamental structural insights and methods from the field of social network analysis. Network studies in the sociology of religion remain rare outside of adolescent behavior (Regnerus 2003; Adamczyk 2012, 2009) and terrorism (Everton 2012); only in the area of religion and social support (Putnam and Campbell 2010) has network language seen wide adoption. Three particular structural properties are particularly important here: exclusivity, dyadic partnership, and bridging relationships. I describe the theoretical importance of each below in terms of past research in both religion and social networks.

Exclusivity has loomed largest of the three in sociology of religion. Niebuhr (1929) proposed a theoretical distinction between churches and sects to help explain the life courses of Protestant denominations. According to Niebuhr, new religious groups typically begin as sects, drawing adherents with high commitment who actively reject other groups and beliefs. Over successive generations, sects become more settled and focused on faithful administration and transmission than radical service. Johnson (1963) proposed treating the salient differences between church and sect as single axis of church-society tension between world-rejecting and world-affirming. Scholars observed that in spite of demanding higher costs of their members, sect-like groups are more likely to grow in membership, on account of what became known as the “free-rider problem” (Douglas 1986; Olson 1965). When receipt of collective benefits is not tied to the level of individual contribution, rational optimization suggests individuals should contribute less and rely on others more (Stark and Finke 2000). By treating involvement as an all-or-nothing decision to commit fully to the teachings and practices of the group, strict religious groups, whether they originated as schismatic sects or new cult movements (Stark and Bainbridge 1985), are able to circumvent free-riding and grow their resources (Iannaccone 1992, 1994). This kind of exclusivism manifests itself not only in attitudes toward secular culture but also in suspicion of the beliefs and practices of other Christian groups, and thus a tendency toward ideological isolation and strong in-group preference.

Such radical rejection of everyone and everything which is not part of one’s primary group provides a paradigmatic case of the principle of cohesiveness in social networks, which Kadushin (2012) describes as one of only two “master ideas” about social relations in networks. As early as 1908, Simmel recognized the co-constitutive relationship of internal group solidarity and external conflict, writing that “only both together constitute the group as a concrete, living unit” (Simmel 1971). While a variety of mathematical definitions have been proposed for what constitutes a cohesive subgroup (Wasserman and Faust 1994) or community, all are based on the idea that members of cohesive groups have relatively more and stronger ties (friendships, common interests, etc.) with fellow group members than with those outside their group. Thus strict churches solve free riding and simultaneously promote in-group solidarity, but at the potential cost of social and cultural isolation from other groups.

The isolation of religious groups is rarely total, however, except in the case of cults designed as total institutions with complete monitoring power (Foucault 1977). Instead, the ties between groups can characterized as a web of affiliations (Simmel 1964, 1971), with members of more similar groups likely to interact and influence each other. The similarity of religious groups might be judged on any number of dimensions, including three which have already been discussed: level of strictness or tension, shared historical roots, and similarity of teachings or moral attitudes. In addition to these, formal partnerships are both intuitively and theoretically important in understanding group relationships, whether as part of a broad coalition of denominations with similar goals or by agreements of mutual recognition between two or more bodies (Kelly 1990, 1971). Finally, just as demographers are quick to point out the aggregate consequences of decisions as intimate as childbearing for denominational growth (Hout et al. 2001), contact theorists (e.g. Allport 1954) and network analysts (e.g. Christakis and Fowler 2009; McPherson 1983) both document the consequences of social proximity in the adoption and diffusion of attitudes and ideas.

Schemas such as RELTRAD (Steensland et al. 2000) may recognize the potential role of overlapping categories of similarity, but their limited dimensionality provide little traction in disentangling the complex web of historical, organizational, structural, and societal factors of intergroup relationships. Scheitle and Smith (2011) find that even given high religious homophily in a variety of close relationships, both religious and non-religious factors predict how likely individuals are to have close ties to people outside their broad religious group.

Instead, scholars have frequently drawn on Smith’s (1998) notion of selectively permeable religious boundaries, that religious groups can selectively emphasize certain aspects of symbolic distinctiveness while continuing to engage with the world (Bok 2014). Decisions of how and on what issues to compromise (Finke 2004), including the willingness of even conservative evangelical churches to form coalitions around mutual goals, can produce exchange of ideas both directly and indirectly, and can be detected in patterns as distinct as website links (Scheitle 2005) and religious switching (Loveland 2003). Thus it is of great interest whether idea overlap between pairs of religious groups is largely idiosyncratic, varies primarily along a small number of axes, or reflects a more complicated pattern of social and historical circumstances.

Finke’s (2004) work suggests a final way in which the study of ecumenical partnership might be productively complicated and studied. The strictness-growth relationship (Kelley 1972; Iannaccone 1994) is non-monotonic; while high demands produce strong group boundaries, excessive demands will eventually drive away even relatively committed individuals (Finke and Stark 2005). Finke (2004) makes an historical case that denominations can adopt organizational and aesthetic innovations while maintaining the distinctiveness of core teachings. Such adaptation has been a feature of U.S. religion throughout the nation’s history. Talleyrand is said to have quipped that “the United States had 32 religions, but only one sauce” (quoted in Smith 1990). Today, Buddhist associations in the U.S. follow a congregational form virtually unknown in their nations of origin and even secular groups experiment with gatherings modeled after congregations (Cimino and Smith 2014).

The sheer ubiquity of the congregational pattern in the U.S. demonstrates how innovative accommodation, even while maintaining distinct teachings, can make religious groups better adapted not only to reach out to secular society but also to communicate and share with each other. An individual Protestant Christian can move throughout the country and find a worship service that they feel comfortable with the music and format, even if there is no congregation belonging to their former denomination available. Nondenominational parachurch ministries such as YoungLife and InterVarsity Christian Fellowship rely on this as well. In network terms, the leadership and organizational practices of these doctrinally distinct groups can serve as local bridges (Easley and Kleinberg 2010) or bridging social capital (Putnam 1995). Beyond its effect on the ease of re-affiliation, these weak ties (Granovetter 1973) can potentially bring individuals, groups, and as a result their ideas into direct contact with each other through joint reliance on tools and organizations that are not specific to a single denomination or family of denominations, but claim to have universal appeal. Individuals in such “structural holes” have both access to and power over the flow of information (Burt 2004; Lin et al. 2001; Frank et al. 2004).

Likewise, the most popular Christian books (Park and Baker 2007) and bookstores (Bader and Lockhart 2006) are not those designed to ensure compliance with the teachings of a single group (most ubiquitously in the form of Catholic bookstores) but those which are marketed as generically “Christian” rather than as affiliated with the specific denominational tradition. Brick and mortar Christian bookstores feature a wide range of products including Bible study resources, devotionals, leadership guides, fiction, music and movies, relatively few of which even denote the denomination or tradition of the author. This pan-denominationalism can be contrasted with the idea of an ecumenism founded on intentional relationships between specific groups. This idea that pan-denominational resources can and do serve as bridges between distinct denominational cultures complements recent studies of “cultural holes” (Pachucki and Breiger 2010; Lizardo 2014) which ask the question: “What type of person tends to consume or enjoy multiple cultural genres that are not commonly associated?” For the study of denominations and groups (rather than individuals) the question is flipped. Instead of “Which persons span unique sets of genres?” it becomes “Which genres span unique sets of people?”

Large, open and heterogeneous networks, like the network of religious ideas and consumers, tend toward hierarchy and clustering (McFarland et al. 2014). In such a structure, relatively cohesive or isolated subgroups will tend to be bridged by the most popular or universal items and ideas will tend to be network stars or hubs, forming the primary bridges between otherwise distant or isolated groups. The implications for religious ideas, if the networks are indeed structured this way, do nothing less than challenge traditional assumptions on the diffusion of ecumenical ideas. Ecumenical dialogue has been cast as a high-level activity of teachers of the church or denominational leaders, aimed at producing academic, formal, or structural ecumenism (in the terms of Kelly 1971).[[2]](#footnote-2) But the flattening of media distribution and increasingly homogeneous exposure to pan-denominational messaging through Christian radio, television and popular books, suggests folk ecumenism will have increasing salience and that in the future, the most organizationally effective cross-denominational outreach may begin at the grassroots level of laity and popular religion.

To summarize, placing past research on the relationships between religious groups in the context of social network theory both enriches our theoretical understandings of the processes driving such contact and suggests that questions of exclusivity, of partnership, and of ties hidden in plain sight should be asked not only regarding formal denominational relationships, but of the informal networks of idea exchange between groups that take place invisibly through the consumption of religious media by everyday Americans.

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CHAPTER ABSTRACTS

*Chapter 2: Denominational Exclusivism and Isolation*

The first empirical chapter combines book- and group-level network statistics with estimated relative sales data from Amazon with group membership data from the 2010 U.S. Religion Census to answer two question “Which denominational families' ideas are most or least isolated from other families?” and “What accounts for this diversity or lack thereof in the denominational families a book is purchased with?” I review existing literature on the structure of U.S. denominational families and the relationships between them on both formal and informal levels, as well as findings from related studies of corporate board interlocks and scientific co-citation.

Based on this foundation, I propose five hypotheses concerning how characteristics of both the denominational family associated with a book and of the book itself are related to the overall isolation of the book within its denominational family, as measured by the proportion of all co-purchases that take place within the group. The hypothesized relationships can be summarized as (1) structural effects of the book network, (2) structural effects of adherence rates, (3) effects of clergy/lay balance in local congregations, (4) effects of exclusivist orientations of religious groups, and (5) effects of denominational diversity within the denominational family. I will use a two-level hierarchical linear model (L1=books, L2=denominational families/topics)[[3]](#footnote-3) to test the hypotheses below.

*Hypothesis one: structural effects of the book network*

Certain structural processes operate to affect co-purchase rates regardless of the content of items. Specialized books tend to have both limited sales and a relatively specific target audience. More popular books (those with higher overall sales) by contrast will be those more often bought by lay people and interested parties with less specialized knowledge to look for specific items. Popular books may also fill multiple roles, e.g. act as bridges between otherwise distinct subgroups of buyers, and thus have more diverse networks. And the sheer number of ties to a popular node also introduces an element of randomness or entropy in the content of those ties. These processes can also aggregate up to the group level, with the added complication that the network of ideas within a group is more diverse than that within a single book.

I state this formally for testable relationships in the data, both in the following paragraph and the table below. Books which are more popular (H1.1a) and frequently co-purchased with more items (H1.1b) will have higher proportional ties outside their own denominational family. The same should be true at the group level. Denominational families with more books in the network (H1.2a), higher average sales (H1.2b), and more ties per books (H1.2c) are likely to have more diverse networks due to network entropy, independent of actual variations in group ideas.

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| **Hypothesized book network structural effects (on denominational family isolation)** | | |
| **Hypothesis Number** | **Predictor Variable** | **Direction** |
| *Book-Level Hypotheses (1.1)* | | |
| 1.1a | Sales Volume | Negative |
| 1.1b | Co-Purchase Volume (with book) | Negative |
| *Denominational Family Level Hypotheses (1.2)* | | |
| 1.2a | Number of Books (in observed network) | Negative |
| 1.2b | Mean sales | Negative |
| 1.2c | Mean co-purchase volume | Negative |

While these first hypotheses may seem technical and content-less, they have two important functions. First, including them in equations as controls will provide less noisy (more reliable) estimates for whether and how substantive group differences matter in inter-group idea networks. Second, co-purchasing or rather the shared exposure it reflects, is substantively important in its own right, thus understanding the technical processes that produce it can provide insight into the development of inter-group relationships over time. Note that these effects are autoregressive (i.e. they feed back upon themselves), but are being treated cross-sectionally for the purposes of this paper. In the future, TERGM or SIENA models, which are designed specifically to account for network autocorrelation, would ideally be used to verify these findings.

*Hypothesis 2: structural effects of adherence rates*

The size and scope of a religious group in a context affects how likely its members are to come in contact with other members of their group throughout their daily lives, at least by random chance. But larger religious groups and those with wider dispersion tend to have lower tension levels with society, in part because they make up more of the society around them and in part because the lower demands on adherents allow a wider niche of potential members. While selection effects of the pool of potential out-group members might be salient at the level of religion (Christianity, Islam, Judaism, etc.), at the level of denominational families, there are few areas in the U.S. with so little diversity as to prevent regular contact with members of other families. Thus I limit comparisons to the national level and predict (H2) that denominational families with higher adherence rates in the U.S. population will be less isolated in the network of books and ideas.

*Hypothesis 3: effects of clergy/lay balance in local congregations*

Clergy professionalization is a key theoretical transition in the sect to church transformation literature (e.g. Finke and Stark 2005). In addition to reducing innovation and increasing fixed costs for congregations, having settled professional full-time clergy allows for more of the responsibility of leading and guiding religious communities to be taken on by professionals, rather than spread throughout lay adherents. This includes the work of constructing faith and belief themselves; if clergy are not present to lead or oversee every Sunday school class or Bible study (not to mention prescribe resources for use in the home life), the choice of resources is likely to be less homogeneous within denominations and more homogeneous between denominations because of visibility and availability through sources such as Christian book-sellers, radio, and television. Thus, I predict (H3) that books associated with denominational families which have a higher ratio of adherents to clergy in the U.S. population will be less isolated.

*Hypothesis 4: effects of exclusivist orientations of religious groups*

Given the centrality of exclusivism, strictness, and tension to discussion in the sociology of religion, it is important to include measures which directly test this. Consistent with past research, I predict (H4) that families with a high proportion of adherents in exclusivist groups will be significantly more isolated from other families in the book network. I measure this using the standard RELTRAD scheme, and test independently for effects of the proportion of adherents within each family belonging to both Evangelical Protestant and African-American Protestants denominations (the control group being Mainline Protestants).

*Hypothesis 5: effects of denominational diversity within the denominational family*

Internal divisions within denominational families are likely to encourage adherents and leaders to band more closely with other denominations (outside the family) to which they are culturally or theologically similar. Theologically and socially conservative Lutheran and Presbyterian denominations, for example, may share more ideas in common than the most liberal and most conservative Lutheran groups. Thus, I predict (H5) that families dominated by a single denomination (as a proportion of total adherents) will be more isolated in the network of books and ideas.

To summarize, I predict that families with more popular books, more adherents, less clergy, more exclusivist denominations, and more internal diversity of denominations will have higher rates of out-linking and be less isolated from other denominational families in the overall network of religious ideas.

*Chapter 3: Understanding Factors of Pairwise Inter-Denominational Relationships*

In Chapter 2, I considered the isolation of individual denominations from all others in the network of shared idea exposure. In this chapter, I complicate this omnibus notion by studying how closely individual pairs of denominational families are tied through co-purchasing and what characteristics of denominational families predict this relationship. I use MR-QAP, a nonparametric permutation test of matrix similarity, to test the importance of three kinds of denominational relationships in predicting quantities of co-purchases between pairs of denominations: historical genealogy, formal ecumenical cooperation, and sociological similarity between present-day denominational families.

Historical genealogic similarity represents relationships of descent and has two elements. The first is distance, i.e. how many “generations” in the family tree of U.S. Christianity you would need to go back to find a common ancestor. The second is directness, i.e. whether one family is directly descended from another, they split from a single common ancestor, or they split from groups with a common ancestor. Two hypotheses result from this:

*H1: Families which were more recently related (in number of generations) with each other will have greater idea overlap.*

*H2: The relationship in H1 will be stronger for families which are more directly related.*

Formal ecumenical cooperation results from intentional collaboration of denominational leaders and reflects the intentions and perceptions of those leaders about what types of ecumenism are faithful and/or pragmatic, as well as with whom. There are two primary types. Ecumenical associations unite many denominations in a single group (most notably the National Council of Churches and National Association of Evangelicals). They form amongst groups with similar goals and similar theological and practical orientations toward the purpose of engagement in the broader society. Because of the diversity of groups within each, shared membership is more a marker of common goals than of a given pair of denominations intentionally pursuing a relationship. Pairs or small groups of denominations also make formal accords and joint statements, however. Often these are practical agreements about clergy recognition, full communion, or the creation of union churches.[[4]](#footnote-4) Nevertheless, such accords typically integrate theological language in their justification. Because they indicate the willingness to invest in a direct partnership which often builds on similarities in theology and worship, these partnerships are likely to relate more strongly to overlap of ideas and books. Together, this suggests three related hypotheses concerning formal collaboration:

*H3: Denominational families with a high proportion of adherents in denominations with membership in the same ecumenical associations will have greater idea overlap.*

*H4: Denominational families with a high proportion of adherents in denominations with ecumenical agreements or partnerships will have greater idea overlap.*

*H5: The relationship in H4 will be stronger than in H3.*

The factors subsumed under the sociological similarity of present-day denominational families are similar to those in chapter 2. Groups of similar size (adherence) and sales volumes (readerships) face similar majority-minority status and will experience similar (non-content-related) structural effects in the book-buying networks (see Chapter 2). Religious tradition (RELTRAD) captures something of the overall culture of denominations, and families with similar proportions of adherents in each tradition are likely to have similar tastes. Similar ratios of adherents to clergy likely reflect denominations or families with similar readerships and priorities. The similarity of average annual clergy compensation is also important for evaluating the role of clergy professionalization and socioeconomic difference. Formally:

*H6: Families with similar adherence rates will be more closely tied in the book network.*

*H7: Families with similar sales volume will be more closely tied in the book network.*

*H8: Families with similar makeup of religious traditions (Evangelical and African-American Protestant) will be more closely tied in the book network.*

*H9: Families with similar adherent to clergy ratios will be more closely tied in the book network.*

*(If possible)H10: Families with similar clergy compensation will be more closely tied in the book network.*

MR-QAP allows testing the relationship between similarity (of pairs of denominational families) on various factors and the frequency of inter-group co-purchases, producing results which look similar to a typical regression table, despite having used matrices, rather than single quantities, as the variables of analysis. I hypothesize that all three types of similarity (historical closeness, formal ties, and group sociological similarity) are important in understanding which families are most closely tied to one another, and that each factor plays a role. Which groups and which specific factors are actually significant and the relative strength of the relationships can provide far more useful detail about the structure of inter-denominational ties than a simple matrix of overall patterns.

*Chapter 4: Pan-denominationalism and Inter-group Shared Knowledge*

Previous chapters have sought in turn to understand the factors of the general isolation of denominational family ideas and those of ties between the ideas of specific pairs of denominational families. The final empirical chapter attempts to move beyond the level of orientation and testing existing theory to test the implications of such group preferences for broader patterns of intergroup relations.

Building on the distinction made between network structure, formal ecumenism, and informal overlap in chapter 3, I will investigate a more specific hypothesis here that the most popular Christian books serve as network hubs in the space of shared ideas between denominational families. In a hub and spoke network (typically referred to as stars), the most popular actors (here books) are the primary means through which others are connected. The most popular books are what I will refer to as “pan-denominational;” they appeal to a general Protestant or even general Christian audience without claiming the ideas of a single specific group.

Overall sales patterns for bestselling books and widespread adoption of certain pan-denominational programs simply branded “Christian” (such as Alpha Course and YoungLife), suggest a potential for effective ecumenical dialogue which leverages popular items of generic Christian culture, including specific books, general ideas, phrases, or even approaches to leadership with broad cross-denominational appeal. Despite the rhetorical conceit of pure pan-denominationalism in generic Christian products, actual ecumenical idea effects are likely to be moderated by the degree of distinction between the topical preferences of each denomination. This creates a complex question not easily answered with existing measures.

I will use a modified form of Everett and Borgatti’s Group Betweenness Centrality measure I term Partial Group Betweenness Centrality to test this intuition as a formal hypothesis that cross-denominational ties between denominationally oriented resources (e.g. books whose primary category is a specific Christian group) are most frequently indirect, taking place through shared resources on ministry, Christian living or other applied topics rather than directly with other denomination’s resources. In addition to answering the primary question of overall importance of pan-denominational books in inter-denominational cultural contact, this also allows asking two supplemental questions of (H2) whether some topics are more likely to mediate than others and (H3) whether the matrix of relationships through indirect ties follows the same pattern as direct ties (e.g. generalized connectivity) or is stronger and thus more promising as an avenue of ecumenical approach specifically for those denominations without close direct overlap or relationships. Formally:

*H1: Co-purchase ties between denominational families are frequently through shared interest in popular pan-denominational books and ideas rather than through direct co-purchasing of a partner denomination’s books.*

*H2: Pan-denominational topics with higher overall sales more often mediate cross-denominational ties than those with lower overall sales.*

*H2: The relationship in H1 is stronger for pairs of denominational families which are more distant from each other (in the findings of Chapter 3).*

POTENTIAL CONTRIBUTIONS

Past studies of relations between denominations and denominational families have laid important theoretical, empirical, and terminological groundwork outlined above, but the field remains relatively undeveloped, particularly at the informal or lay level of shared popular ideas. Most have been limited by reliance on a single data source (whether survey or administrative data),[[5]](#footnote-5) have relied on a single conception of how denominations might be related, clustered, or differentiated. Their use of network theory, even when relying on concepts of relationships, group boundaries, and inter-group contact, has been informal and inconsistent.

Technically, this dissertation will demonstrate a new and promising source of data, co-consumption networks, and a series of theoretically useful and statistically responsible methods for analyzing it. Studying these networks requires careful attention, different types of statistical and programming skills, and a measure of creativity, but they hold potential to open not just sociology of religion but cultural sociology as a whole to more comprehensive empirical studies of how groups and ideas relate to one another among the general public. And such studies could be just as successful using other types of media (movies, streaming television, music purchasing or listening), in other cultures (there are 13 international Amazon stores, in addition to other retailers). While I am limited by the structure of the data (not including records of individuals) and by my reliance on retailer classification of book topics, the scope and complexity of the data, both easily customized by the researcher, cannot be matched in any survey of cultural consumption. Co-purchase networks can also complement current methods in the sociology of science by providing a point of comparison between networks of formal/scientific and informal/popular knowledge.

In addition to opening up analysis of a different type and level of cultural data, the dissertation will both test and build on existing theories of religious exclusivism and ecumenism. Each chapter will begin with one or more established theories, reinterpret them in network terms, and test a number of structural mechanisms or factors that might plausibly explain actual patterns. The most important advantages of this are (a) the ability to differentiate effects of historical genealogy, formal ties, and societal and network effects (b) the ability to differentiate group (denominational family) level and individual (book) level effects on group relations, (c) the systematic exposition of exclusivity, direct connection, and indirect bridge structures in religious culture systems, and (d) the ability to compare which of the above are driving the informal conversation of ideas in U.S. Protestant churches. In the process, it will also indirectly provide a test of whether indices such as RELTRAD remain valid outside of the survey contexts in which they were developed and tested.

The final contributions I propose to make specifically to the sociology of religion are introducing more concepts from network and consumption theory to the subfield, where they are underdeveloped despite important theoretical connections with religious beliefs, practices and organizations. Of particular note, the combination of networks and consumption allows for direct measurement of action without being limited by recall and social desirability bias like self-reported measures, as well as enabling the capture of relationships between exposure to (not just profession of) religious ideas at a popular level.

This dissertation will also provide value for a number of other subfields. It includes the production of data files that will be distributed through the ARDA of co-purchase networks featuring all recommended co-purchases, when previous publicly available Amazon data (Leskovec et al. 2007; Yang and Leskovec 2015) was limited to five co-purchased products per item. Associated with this, I will also design and document techniques for extracting relative sales and co-purchase volumes from rank data with a known power-law sales distribution. Furthermore, I demonstrate multiple valid methods for sociological analysis of a single projection of bipartite network data, a distinction that has most often either been ignored or treated as reason to reject the data source entirely.

Finally, the research will have important application for religious leaders. Both contextual theology and doctrines of vocation make claims regarding the importance of the laity in constructing religious meaning structures (Schreiter 1985; Kolden 1994). Denominational leaders and religious academics should also have both theoretical and pragmatic interest in understanding how doctrine, formal ecumenism, and history interact in the practical self-construction of theology by average adherents, in light of the realities of religious media and consumption. Such knowledge can inform both resource allocation and program design to best match the ecumenical or evangelical goals of leaders, including local clergy, to approaches which are most likely to be effective at eliciting the desired change, much as business leaders use network analysis to help design project teams and epidemiologists seek to find the most effective intervention approaches to stop the spread of disease.

Like the books studied within it, this dissertation can serve a dual role, adding depth and breadth to our understanding of core concepts like religious exclusivism while also bridging gaps between quantitative sociology of religion, social network analysis, and the broader sociology of culture. It poses old questions of strictness and ecumenism in new ways, but also asks new questions: Do intergroup patterns of religious consumption resemble what we’ve found in surveys and other sources? Are there important relationships or overlaps between religious groups that we miss by looking only at the most direct connections and not how genres and ideas may span cultural holes? In summary, I seek to leverage the combined power of a new tool (co-purchase data) and older ideas that have nonetheless been missing or underdeveloped in the sociology of religion to provide insight into how and why religious denominations and families interact and overlap each other in the contemporary U.S.

CURRENT STATUS AND PROGRESS

Co-purchase data that would suffice for this project has already been collected (networks from December 2014) and cleaned. Ideally, another complete set of data will be scraped later this fall, to provide the most recent information and a point of comparison. Unless the structure of the product pages has changed (which does happen on occasion) collecting additional data should take no more than 1-2 days. Transformation of sales rank into relative sales quantities is straightforward; the parallel operation for co-purchase quantities is more complex but can be accomplished using matrix algebra. Religious census data (2010) to measure denominational adherence, clergy and family in the US are freely available through the ARDA, as are the denominational genealogies. The only data which would require somewhat more effort to collect and code are information on ecumenical association memberships (still fairly simple) and smaller-scale formal ecumenical partnerships.

The majority of the literature review and data and methods sections for each chapter are written (in addition to the summaries here), including a description of all methods and variables, which I intend to clean and provide to the committee in the coming weeks and include in the dissertation as an appendix, given the level of technical complexity, instead summarizing methods and key information regarding variables in each chapter as appropriate.

APPENDIX A: DATA AND METHODOLOGY

*Overview*

This dissertation is one of a growing number of studies using big social data. Because these data are complex, the size of data sets is large, and because they arise as by-products of public or online activity rather than being intentionally created for the purposes of research, responsible analysis requires particularly close attention to both the structure and the origins of the data (Lazer et al. 2014; Bainbridge 2014). This appendix is structured in three sections. The first provides an overview of co-purchase data, including its origins, past uses, and some of the challenges it poses for analysis. The second section describes details of the specific data sources and variables which will be used in one or more chapters of the dissertation, including derived variables. The final section describes the analytic methods which will be used in each chapter.

Amazon pioneered a recommendation algorithm, known as item-to-item collaborative filtering, which has since been adapted by many e-commerce sites but is most conspicuous in the “Customers who bought this also bought” feature embedded in product pages across Amazon family sites (Linden et al. 2003). The algorithm polls a database of past Amazon purchases by all users and recommends those most frequently bought by the same customers, without taking into account the present user’s other preferences or any other complicating factors. This approach is computationally efficient for the seller[[6]](#footnote-6) and still effective at locating items a viewer of a given item may also be interested. A variety of other algorithms are also used by Amazon, including ones which do take into account past behavior of the user, but the base algorithm is remarkable in its interpretability.

On each product page, Amazon displays up to 100 of the items most commonly purchased together with a product, in descending order of frequency. For electronic content, including Kindle e-books, digital audio and video, and downloadable software, recommendations are restricted to items in the same format. Physical items will recommend any category of item (audio, video, books, clothing, etc.) but will only recommend physical purchases. Within the books category, then, there are four recommendation classes: physical books (primarily printed or on CD), paid Kindle e-books, free Kindle e-books, and Audible.com audio-books. Bestseller lists, updated hourly, list 100 top items in overall sales and in any number of nested sub-categories and are available for all books (including print and electronic formats) or separately for paid Kindle, free Kindle, or Audible.

While the underlying customer databases are unavailable to external researchers, researchers can use data scraping tools to collect both basic information on each product (e.g. title, author, topic, sales rank, publisher, and publication date) and a list and ranks of frequently co-purchased items. From this, a network of books can be constructed, where each edge (recommendation) represents a pair of items frequently purchased by the same customers or equivalently, some number of individual shoppers who chose to buy both items.

This type of data may only capture a small proportion of individuals, particularly in studying the consumption of cultural items pertaining to a specialized topic such as religion, but it has distinct advantages over randomized national surveys and surveys or statistics from places of worship. First of all, the scale of the data is impossible to match in survey data and the detail is correspondingly difficult to match in administrative data from religious organizations. Although it impracticable to capture every one of the millions of items in the Amazon database using data scraping before the network has evolved significantly (Rasti et al. 2009), datasets can easily comprise tens of thousands of ties between thousands of books, yet be collected in a single day by a single investigator with no special equipment except a personal computer, open-source software, and an internet connection. Such data allows the meso-level, i.e. the social structure, to be investigated directly, rather than extrapolated from higher or lower-level properties. Again, because we do not have lists of what individual customers bought, conclusions about individual level processes must remain somewhat circumspect, but cultural connections between ideas and groups can be uniquely illuminated.

This is not the first time co-purchase data has been collected or studied. Two large data sets with co-purchases are available through the Stanford Network Analytics Project (Leskovec et al. 2007; Yang and Leskovec 2015), but their application has been limited to studies of online marketing and computer algorithms. The Stanford data are also limited to the top five outgoing co-purchase recommendations per item, Valdis Krebs has illustrated the potential of co-purchase networks for understanding the audiences of individual books (Eakin 2004; Krebs 2003, 2008), but I have not located any instances where large-scale co-purchasing networks have been used in a sociological study. In part, this is because few sociologists are trained in methods of collecting and analyzing massive network data, but it also reflects a hesitancy on the part of network researchers to use incomplete data.

In social network terminology, the user-facing data that can be collected represents one mode of the bipartite network of users and items (Breiger 1974). Unlike in a single-mode network such as friendship ties, certain edges are impossible in a bipartite network. For co-purchasing, the only tie between books is indirect (via purchasers) and the only tie between people is indirect (via the books they purchase). Many studies (e.g. Davis et al. 1941) have relied on projections of a single-mode, including previous co-purchase studies (Yang and Leskovec 2015). The social network research community has recognized for some time, however, that that the inherent data loss can lead to biased results if using procedures designed for single-mode networks (Li et al. 2014; Borgatti 2012).

Intuitively, this limits the ability to draw conclusions beyond the dyadic level; for example you may know which two books are most frequently bought together with book *a* but it provides no information on whether all three were bought together, or whether the customers for each of the co-purchases with book *a* were entirely different sets. Furthermore, path lengths longer than two are difficult, if not impossible, to interpret. A path of length ka,b =1 is a measured co-purchase tie of books *a* and *b*. Length ka,b =2 represents two items which were both bought together with a third book *c*, but not directly with each other.[[7]](#footnote-7) Book *c* then represents a body of shared knowledge, exposure, or interest for readers of *a* and *b*, and thus a potential point of cross-denominational contact. At length three, the most that can be concluded is that readers of *a* have an interest *c* that shared something in common (i.e. had shared readership) with a fourth item *d* which is an interest of readers of *b*. The complexity and tenuousness likewise increase with each additional step. Chapters 2 and 3 take only dyadic data (i.e. path length 1) into account; chapter 4 extends to paths of length 2, but is intentionally circumscribed in the conclusions it proposes to make.

To perform without bias, most network procedures require special bipartite adaptations that take either the affiliation matrix (the ties between each person and each item or event) or the dual projections (the item by item *and* person by person matrices) as their input (Everett and Borgatti 2012; Jasny 2012; Latapy et al. 2008; Tutzauer 2013). Given the goal of integrating the networks with supplemental data on books and denominational families a variety of sources, care will be exercised to circumscribe claimed conclusions in each chapter based on the technical limits of the data. Below, I will discuss in turn, the technical specifications and collection procedures of the network to be used, the other data and its origins, and the methods used in each chapter.

*Data*

I use data and recommendations from the top 100 bestselling paid Kindle e-books[[8]](#footnote-8) in each of eight Protestant denominational families and nine denominationally neutral subtopics of “Christian Books & Bibles,” as outlined in the table below. The denominational families represent the full set of Protestant Christian groups with equivalents in the 2010 U.S. Religious Census. The topics, which are used only in Chapter 4, are intended to represent a wide range of subtopics of which might bridge denominations. In two cases, Amazon distinguishes multiple categories in the same denominational family; for each of these, I combine the two topics and retain only the top 100 books in overall sales rank. Books listed under more than one topic by Amazon are recoded as the topic in which they are most highly ranked among those included in the dataset. Current data were collected in December 2014; if additional topics or newer data are necessary, collection should require 1-3 days.

|  |  |
| --- | --- |
| **Protestant Christian Denominations** | **Topics in Ministry and Christianity** |
| Anglican/Episcopalian  Baptist  Calvinist/Presbyterian  Lutheran  Methodist  Pentecostal/Charismatic  Quaker  Seventh-Day Adventist | Bible Study & Reference  Christian Biographies  Christian History  Christian Theology  Literature & Fiction  Christian Living  Worship & Devotion  Churches & Church Leadership  Ministry & Evangelism |

Sampling methods have been developed for web-based linking data (Kurant et al. 2011) but the primary goal of this study is not to produce a random sample of the ties between books on Amazon, but to analyze the most common points of overlap between denominational families. Restricting the sample to 100 bestsellers per group provides a variety of titles, while still focusing on the most salient connections. For purposes of analysis, only ties to other books in the analytic sample are retained, resulting in a sample of up to 1700 books (100 per topic) and up to 100 co-purchased items per sampled book. The actual sample will be somewhat smaller because some books may be listed in multiple topics and some may lack any in-network ties, preventing the calculation of all outcome measures. Examining whether any findings hold for the long tail (Fenner et al. 2010) of less-frequently purchased books is an important question, but one that would require different methodological approaches and more caution, as co-purchases are more prone to random fluctuation when overall sales are lower (i.e. the central limit theorem).

From these raw data, I will construct a valued symmetric network of co-purchases, with link weight equal to the co-purchase volume of the pair of books.[[9]](#footnote-9) To do so, requires two steps. First, overall sales ranks on Amazon’s website are transformed into relative sales volumes using the known power-law distribution of book sales on Amazon (Fenner et al. 2010). This sales volume will be expressed as a proportion of total book sales volume rather than a rank. Because co-purchase volumes for a pair of items are definitionally identical but the *relative* rank of co-purchase frequency varies based on overall sales and the structure of the network, I can also calculate the relative frequency of co-purchase for each pair of items in the main component of the network as a standardized measure of co-purchase that does not treat ranks as equivalent for items with different overall sales.

Other network-based measures will be calculated and used throughout the chapters at both the book and denominational family level, always adjusted to be consistent with the co-purchase volume weights for ties. Instead of degree being the number of other books a book is tied to, it represents the estimated total co-purchase volume with other books in the network. Group means for sales and co-purchase volume are used to adjust for differences between denominational families in the popularity and connectedness. The outcome measure in each chapter (isolation, dyad co-purchase rates, and partial group betweenness) will be discussed within that chapter’s methodology notes below.

This overall approach to data has important strengths compared to traditional approaches. It allows for direct measurement of quantitative consumption data, not only as total sales or consumption but as relationships between consumption of distinct items. It allows for large samples to be gathered quickly at low cost and is highly flexible. Using networks allows for different questions, particularly concerning group and genre relations in religion and culture. There are, however, important limitations that must also be noted. The sampling of both books and co-purchases is truncated. I rely on Amazon for topical classification. As discussed above, there are no records of individuals and their total list of purchases, the order in which items were purchased, or whether some of those purchases were intended for others.[[10]](#footnote-10) There is no measure of actual consumption (whether a book was read, and how thoroughly), although this is no less true of survey data on preferred genres or artists (Lizardo 2014; Bourdieu 1984) and e-books offer for the first time the ability for the seller (Amazon) to track when and how books are used by purchasers. Finally, the sales and co-purchase volumes used in my analyses are estimates, and although based on known mathematical properties, estimates are prone to error if those properties change notably, for example in the distribution of sales by sales rank.

Data from Amazon are supplemented from a number of additional sources. The 2010 U.S. Religion Census, a decennial count of congregations and adherents in the U.S. based on reporting by denominational offices, is used for characteristics of denominational families in the U.S. Adherents “include all full members, their children, and others who regularly attend service.”[[11]](#footnote-11) The overall adherence rate of 48.8% is much lower than the nearly 85% of respondents who reported a religious preference in the 2012 General Social Survey (Smith et al. 1972-2012), because only those who are members or actively attend are counted as belonging. Each denomination is classified in the U.S. Religion Census as belonging to a single denominational family and a single religious tradition. I combine all denominations within a religious family to create the adherence variable (expressed as a proportion of overall religious adherents in the U.S.) for each denominational family in the data. Adherent to clergy ratios are calculated directly from the total for each family. Religious tradition is expressed as a proportion of each family belonging to the three major Protestant traditions: Evangelical Protestant, Mainline Protestant, and African-American Protestant. I use two additional measures of within-family diversity, the number of independent denominations within the family (count) and the proportion of the family’s total adherents who belong to the largest single denomination. Family trees used for measuring genealogical closeness of denominational families are drawn from the family tree feature on The ARDA. Formal ecumenical ties are measured as present or absent using secondary sources from official association or denominational websites and presses, and separated into membership in large coalitions or associations (NAE and NCC) and accords among two or a small number of denominations.[[12]](#footnote-12) Together, these variables, all of which are clearly and reliably measured, can help elucidate the reasons and mechanisms for observed patterns of inter-group shared ideas. Next, I discuss the outcome and key methods for each chapter in more detail.

*Chapter 2: Islands*

For the analysis in chapter 2, I use only books in the Protestant Christian denominations categories (not the topical categories), combined with data from the 2010 U.S. Religion Census. Only direct recommendations between books in the set are used; recommendations of books in the topical subset and of books outside the sample are ignored. I use a multi-level hierarchical linear framework (Raudenbush and Bryk 2002) of books nested within denominational families, which allows the separation of within- and between-group variance. Robust standard errors are used in all models to adjust for unspecified network autocorrelation.

The key variable of interest is the relative isolation of an individual book or denominational family from books in other families. At the book level, this is the proportion of a book’s co-purchases which are inside its own denominational family. This value is weighted using the relative co-purchase frequency described above, so that the most frequently co-purchased titles contribute more to the isolation/mixing parameter than those which are less frequent among the top 100. At the family-level, the measure is equal to the mean book-level isolation for all books within the family, or equivalently the proportion of the most common co-purchases with books in the denominational family that are with other books in the same family. This is then adjusted to down-weight within group co-purchases by 50%, reflecting that each in-group tie will be included in the calculation twice (once originating at each book), while out-group ties will only be included once.

Independent variables for the models follow the hypotheses in the chapter description; the dependent variable in all models is book-level denominational family isolation. Model 1 tests only for network structural effects, including overall sales volume and co-purchase volume for the book, and number of books in observed network, mean sales and mean co-purchase volume at the denominational family level. The remaining models rely on additional variables from the 2010 U.S. Religion Census, all of which are included only in the family-level portion of the models. Each model introduces an additional relevant control, with the goal of pinpointing potential mediating or moderating variables in understanding the group differences. The variables are:

Model 2: Proportion of U.S. adherents in denominational family

Model 3: Ratio of adherents to clergy in denominational family

Model 4: Proportion of adherents in Evangelical Protestant and African-American Protestant denominations (separate variables; omitted category: Mainline Protestant)

Model 5: Number of denominations in family (count) and proportion of family adherents belonging to largest single denomination

*Chapter 3: Partners*

Chapter 3 again uses only the network of ties within the denominational families sample. It expands on the summary measure of isolation in chapter 2 by considering factors in the frequency of ties between specific dyads of denominational families. I begin by using QAP, a non-parametric dyadic network method, to find which pairs of denominational families are more frequently tied to each other than random, less frequently than random, or statistically random. I subsequently utilize MR-QAP, which generalizes QAP to allow for multiple dyadic similarity or relationship matrices as independent variables predicting the outcome matrix. Each matrix is a symmetric 8 x 8 similarity matrix of denominational families, with the diagonal set to zero.

Unlike many social network methods, QAP and MR-QAP have been shown to produce identical results whether used on a bipartite network and subsequently projected to a single mode or used directly on a single mode projection (Jasny 2012). Thus dyadic questions such as the factors in shared idea space can be analyzed without introducing additional bias or uncertainty even in circumstances where the full affiliation matrix is not available to the researcher.

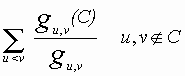
The variables and hypotheses fall into three groupings: historical denominational genealogy, formal ecumenical relationships, and sociological similarity, described in the main proposal. Each set of hypotheses will be tested in a separate model, followed by an omnibus model including all significant controls from previous models. All variables (including non-significant variables) cannot be simultaneously included in the omnibus model, as MR-QAP has no means to adjust for the number of variables included and caution has therefore been recommended when using small matrices of actors or groups (Dekker et al. 2007; Krackhardt 1988). Variables for model 1 are drawn from the ARDA family trees, model 2 from secondary sources, and model 3 from the 2010 U.S. Religion Census. The independent variables, each represented as a matrix of dyadic similarities or relationships, are outlined in the table below and follow the hypotheses listed in the chapter description in the main proposal. The type column denotes whether the matrix is a proportional similarity on a third variable or a measured relationship between the groups. The final variable (hypothesis 10) may or may not be available for inclusion.

|  |  |  |  |
| --- | --- | --- | --- |
| **Hypothesis Number** | **Variable** | **Type** | **Description and values** |
| *Model 1: historical genealogy* | | | |
| 1 | Genealogic distance | Relation | The number of generations separating the two groups in the Protestant family tree. A denomination which split directly from another or two denominations which split from the same parent denomination has distance 1. Each additional generation of separation adds 1. |
| 2 | Direct descent | Relation | Whether one is descended from the other (=1) or they merely share a common ancestor (=0) |
| 2 | Distance\*Directness Interaction | Relation | An interaction to test whether H1 is stronger for directly related families. Equals distance if directness=1, or zero otherwise. |
| *Model 2: formal ecumenism* | | | |
| 3 | Shared Association Membership (NAE and/or NCC) | Relation | Composite proportion of adherents with shared membership in one or more associations. Each dyad of denominations (one from each family) adds zero to the proportion if they are not members of the same ecumenical association. If they are both members of NAE or both members of NCC, they add the product of their proportional adherence within the family to the total. Ranges from 0 if either family has no memberships or if one only belongs to NAE and the other only belongs to NCC to 1 if all denominations in both families are in the same association. |
| 4 | Formal partnership | Relation | Composite proportion of adherents in denominations with one or more formal ecumenical partnerships or agreements, standardized in the same way as shared association membership. |
| *Model 3: sociological similarity* | | | |
| 6 | Adherence rate | Similarity | Similar overall family adherence as proportion of the US population. |
| 7 | Sales volume | Similarity | Similar total sales volume as a proportion of overall network sales. |
| 8 | Religious tradition | Similarity | Similar proportional adherent makeup in Evangelical/African American/Mainline denominations. |
| 9 | Adherent-clergy ratio | Similarity | Similar overall family ratio of adherents to clergy. |
| 10 | Clergy compensation | Similarity | Similar mean clergy compensation. |

*Chapter 4: Bridges*

Chapter 4 uses a different collection of books than previous chapters, including both denominational families and general Christian book topics listed in the proposal, all of which are subtopics of the Christian Books & Bibles category on Amazon. The network includes all recommendations between sampled books in all 17 categories, and ties are weighted according to the estimated co-purchase frequency of each dyad of books. The primary question is whether co-purchase ties bridging denominational families are largely direct or whether they are mediated by shared purchases of pan-denominational (e.g. generically Christian) items. Two secondary questions provide nuance in understanding the processes: (1) What types of pan-denominational topics most commonly mediate cross-denominational relationships? *And* (2) Are there differences between denominational dyads in the frequency of this kind of mediation? No secondary data are used in the analysis. I restrict all path lengths to ka,b <=2 to reflect the limitations of the data (see discussion in *overview* section of appendix for rationale). Note that length 2 paths can still be direct in the terminology of this chapter if node *c* is part of group *A* or *B*.

The key measure is a modified form of group betweenness centrality (Everett and Borgatti 1999; Kolaczyk et al. 2009) which I have designed to enable the testing of specific hypotheses about the structure of relationships by decomposing the summary measure of group betweenness into dyadic parts. Everett and Borgatti define the group betweenness centrality of vertex subset C where gu.v is the total number of geodesics connecting vertices u and v and gu,v(C) is the number of geodesics from u to v passing through one or more vertices in C as:

CB(C) = (n.p.; follows first paragraph under “Betweenness”)

Group betweenness centrality can be standardized by dividing by the theoretical maximum. Group betweenness centrality retains key information that would be lost in a reduced model where each topic is collapsed into a single node with tie weight equal to the total co-purchase volume. Specifically, a reduced model eliminates information on which dyads of books contribute to the overall tie weight and thus what proportion of paths are direct or indirect from one book (and thus group) to another.

For this chapter, I need to be able to distinguish not the overall betweenness centrality of groups but specifically whether geodesics between books in different denominational groups are direct, indirect through other denominations, or pass through topical books. Expanding on Borgatti and Everett, I first decompose ga,b for each dyad of denominations into four components (which total to unity):

For a dyad of denominations A, B with the set of geodesics ga,b from books in A (a) to books in B (b) with set of nodes in all denominational categories D and set of nodes in all pan-denominational topics T:

PGBCdirect = Proportion of *a,b* dyads with geodesic length k=1

PGBCwithin = Normalized GBC for *C* ϵ *A,B* = The proportion of geodesics of length k=2 which do not leave the set of nodes in *A* and *B* multiplied by (1 - PGBCdirect).

PGBCecumenical = Normalized GBC for *C* in D but not in *A,B* = The proportion of geodesics of length k=2 which leave the set of nodes in *A* and *B* but remain within D multiplied by (1 - PGBCdirect).

PGBCtopical = Normalized GBC for *C* in T = The proportion of geodesics of length k=2 which leave D multiplied by (1 - PGBCdirect).

Evaluating the first hypothesis (relative quantity of topical geodesics) requires aggregating each of the quantities above across all denominational dyads and comparing their values. To evaluate the second hypothesis (differences by topic in frequency of bridging), I further decompose PGBCtopical into individual topics and normalize to sum to unity for easy interpretability (rather than summing to the proportion of overall geodesics which are topical). To evaluate the final hypothesis (differences by dyad in proportion of topical geodesics), I will disaggregate PGBCwithin, PGBCecumenical, and PGBCtopical into denominational dyads (re-expressed as proportion of length k=2 geodesics rather than length k<=2 geodesics). These will be used as MR-QAP predictors following the method of Chapter 3 to test if there are differences in the types of indirect ties between denominational families with many direct ties and those with fewer direct ties.

**References**

Adamczyk, Amy. 2009. Socialization and Selection in the Link between Friends' Religiosity and the Transition to Sexual Intercourse. *Sociology Of Religion* 70 (1):5-27.

Adamczyk, Amy. 2012. Understanding Delinquency with Friendship Group Religious Context. *Social Science Quarterly* 93 (2):482.

Allport, Gordon W. 1954. *The Nature of Prejudice*. Reading, MA: Addison-Wesley.

Alwin, Duane F., Jacob L. Felson, Edward T. Walker, and Paula A. Tufiş. 2006. Measuring Religious Identities in Surveys. *The Public Opinion Quarterly* 70 (4):530-564.

Ammerman, Nancy Tatom. 2007. *Everyday religion: observing modern religious lives*. vol. Book, Whole. Oxford; New York: Oxford University Press.

Bader, Christopher D., and William H. Lockhart. 2006. Spiritual Shopping: The Effects of State-Level Demographics and Religious Economies on the Locations of Psychics, Astrologers, and Christian Bookstores. *Journal of Media and Religion* 5 (2):91-109. doi:10.1207/s15328415jmr0502\_2.

Bainbridge, Willaim Sims. 2014. *Personality Capture and Emulation*. Human-Computer Interaction Series: Springer.

Bok, Jared. 2014. Symbolic Filtering: Selectively Permeable Evangelical Boundaries in an Age of Religious Pluralism. *Journal for the Scientific Study of Religion* 53 (4):808-825. doi:10.1111/jssr.12145.

Borgatti, Stephen P. 2012. Social Network Analysis, Two-Mode Concepts in, 2912-2924. New York, NY: Springer New York.

Bourdieu, Pierre. 1984. *Distinction: A Social Critique of the Judgment of Taste*. Cambridge, MA: Harvard University Press.

Breiger, Ronald L. 1974. The Duality of Persons and Groups. *Social Forces* 53 (2):181-190.

Burt, Ronald S. 2004. Structural Holes and Good Ideas. *The American Journal of Sociology* 110 (2):349-399. doi:10.1086/421787.

Christakis, Nicholas A., and James H. Fowler. 2009. *Connected: The Surprising Power of Our Social Networks and How They Shape Our Lives*. New York: Little, Brown, and Company.

Cimino, Richard, and Christopher Smith. 2014. *Atheist awakening: secular activism and community in America*. vol. Book, Whole. New York: Oxford University Press.

Davis, Allison, Burleigh Bradford Gardner, Mary R. Gardner, and W. Lloyd Warner. 1941. *Deep South: a social anthropological study of caste and class*. vol. Book, Whole. Chicago, IL: University of Chicago Press.

Dekker, David, David Krackhardt, and Tom A. B. Snijders. 2007. Sensitivity of MRQAP Tests to Collinearity and Autocorrelation Conditions. *Psychometrika* 72 (4):563-581. doi:10.1007/s11336-007-9016-1.

Douglas, Mary. 1986. *How Institutions Think*. Syracuse, New York: Syracuse University Press.

New York Times. 2004. Study Finds a Nation of Polarized Readers. March 13.

Easley, David, and Jon Kleinberg. 2010. *Networks, crowds, and markets : reasoning about a highly connected world*. New York: Cambridge University Press.

Everett, M. G., and S. P. Borgatti. 2012. The dual-projection approach for two-mode networks. *Social Networks* 35 (2):204. doi:10.1016/j.socnet.2012.05.004.

Everett, M.G., and S.P. Borgatti. 1999. The centrality of groups and classes. *JOURNAL OF MATHEMATICAL SOCIOLOGY* 23 (3):181-201.

Everton, Sean F. 2012. *Disrupting dark networks*. vol. Book, Whole. New York, NY: Cambridge University Press.

Fenner, Trevor, Mark Levene, and George Loizou. 2010. Predicting the long tail of book sales: Unearthing the power-law exponent. *Physica A: Statistical Mechanics and its Applications* 389 (12):2416-2421. doi:10.1016/j.physa.2010.02.021.

Finke, Roger. 2004. Innovative Returns to Tradition: Using Core Teachings as the Foundation for Innovative Accommodation. *Journal for the Scientific Study of Religion* 43:19-34.

Finke, Roger, and Rodney Stark. 2005. *The churching of America, 1776-2005: winners and losers in our religious economy*. 2nd Aufl. New Brunswick, N.J.: Rutgers University Press.

Foucault, Michel. 1977. *Discipline and punish: the birth of the prison*. vol. Book, Whole. New York: Pantheon Books.

Frank, Kenneth A., Yong Zhao, and Kathryn Borman. 2004. Social Capital and the Diffusion of Innovations within Organizations: The Case of Computer Technology in Schools. *Sociology of Education* 77 (2):148-171. doi:10.1177/003804070407700203.

Granovetter, Mark S. 1973. The strength of weak ties. *American Journal of Sociology* 78 (6):1360-1380.

Hout, Michael, Andrew Greeley, and Melissa J Wilde. 2001. The demographic imperative in religious change in the United States. *The American Journal of Sociology* 107 (2):468-500. doi:10.1086/324189.

Iannaccone, Laurence R. 1992. Sacrifice and Stigma: Reducing Free-Rising in Cults, Communes, and Other Collectives. *Journal of Political Economy* 100 (2):271-292.

Iannaccone, Laurence R. 1994. Why Strict Churches Are Strong. *The American Journal of Sociology* 99 (5):1180-1211. doi:10.1086/230409.

Jasny, Lorien. 2012. Baseline Models for Two‐Mode Social Network Data. *Policy Studies Journal* 40 (3):458-491. doi:10.1111/j.1541-0072.2012.00461.x.

Johnson, Benton. 1963. On Church and Sect. *American Sociological Review* 28:539-549.

Kadushin, Charles. 2012. *Understanding social networks: theories, concepts, and findings*. vol. Book, Whole. New York: Oxford University Press.

Kelley, Dean. 1972. *Why Conservative Churches are Growing*. New York: Harper and Row.

Kelly, James R. 1971. WHO FAVORS ECUMENISM? CORRELATES OF SUPPORT FOR ECUMENISM. *Sociological Analysis* 32 (3):158-169.

Kelly, James R. 1990. Spirals Not Cycles: Towards an Analytic Approach to the Sources and Stages of Ecumenism. *Review of Religious Research* 32 (1):5-15.

Kolaczyk, Eric D., David B. Chua, and Marc Barthélemy. 2009. Group betweenness and co-betweenness: Inter-related notions of coalition centrality. *Social Networks* 31 (3):190-203. doi:10.1016/j.socnet.2009.02.003.

Kolden, Marc. 1994. Work and Meaning: Some Theological Reflections. *Interpretation* 48 (3):262-271.

Krackhardt, David. 1988. Predicting with networks: Nonparametric multiple regression analysis of dyadic data. *Social Networks* 10 (4):359-381. doi:10.1016/0378-8733(88)90004-4.

Krebs, Valdis. 2003. Divided We Stand??? <http://www.orgnet.com/divided1.html>. Accessed October 1 2013.

Krebs, Valdis. 2008. New Political Patterns. <http://www.orgnet.com/divided.html>. Accessed May 8 2015.

Kurant, M., A. Markopoulou, and P. Thiran. 2011. Towards Unbiased BFS Sampling. *IEEE Journal on Selected Areas in Communications* 29 (9):1799-1809. doi:10.1109/JSAC.2011.111005.

Latapy, Matthieu, Clémence Magnien, and Nathalie Del Vecchio. 2008. Basic notions for the analysis of large two-mode networks. *Social Networks* 30 (1):31-48. doi:10.1016/j.socnet.2007.04.006.

Lazer, David, Ryan Kennedy, Gary King, and Alessandro Vespignani. 2014. The Parable of Google Flu: Traps in Big Data Analysis. *Science* 343 (6176):1203. doi:10.1126/science.1248506.

Leskovec, Jure, Lada Adamic, and Bernardo Huberman. 2007. The dynamics of viral marketing. *ACM Transactions on the Web (TWEB)* 1 (1):5-es. doi:10.1145/1232722.1232727.

Li, H. J., W. Fang, H. Z. An, and L. L. Yan. 2014. The shareholding similarity of the shareholders of the worldwide listed energy companies based on a two-mode primitive network and a one-mode derivative holding-based network. *PHYSICA A-STATISTICAL MECHANICS AND ITS APPLICATIONS* 415:525-532. doi:10.1016/j.physa.2014.08.035.

Lin, Nan, Karen S. Cook, Ronald S. Burt, and Inc NetLibrary. 2001. *Social capital: theory and research*. vol. Book, Whole. New York: Aldine de Gruyter.

Linden, G., B. Smith, and J. York. 2003. Amazon.com recommendations: item-to-item collaborative filtering. *IEEE Internet Computing* 7 (1):76-80. doi:10.1109/MIC.2003.1167344.

Lizardo, Omar. 2014. Omnivorousness as the bridging of cultural holes: A measurement strategy. *Theory and Society* 43 (3):395-419. doi:10.1007/s11186-014-9220-9.

Loveland, Matthew T. 2003. Religious Switching: Preference Development, Maintenance, and Change. *Journal for the Scientific Study of Religion* 42 (1):147-158. doi:10.1111/1468-5906.00168.

McFarland, Daniel A., James Moody, David Diehl, Jeffrey A. Smith, and Reuben J. Thomas. 2014. Network Ecology and Adolescent Social Structure. *American Sociological Review* 79 (6):1088-1121. doi:10.1177/0003122414554001.

McPherson, Miller. 1983. An Ecology of Affiliation. *American Sociological Review* 48:519-532.

Melton, J. Gordon. 2003. *Encyclopedia of American Religions*. Seventh edition Aufl. Farmington Hills, MI: The Gale Group, Inc.

Niebuhr, William M. 1929. *The Social Sources of Denominationalism*. New York: Henry Holt.

Olson, Mancur. 1965. *The Logic of Collective Action*. Cambridge: Harvard University Press.

Pachucki, Mark A., and Ronald L. Breiger. 2010. Cultural Holes: Beyond Relationality in Social Networks and Culture. *Annual Review of Sociology* 36 (1):205-224. doi:10.1146/annurev.soc.012809.102615.

Park, Jerry Z., and Joseph Baker. 2007. What Would Jesus Buy: American Consumption of Religious and Spiritual Material Goods. *Journal for the Scientific Study of Religion* 46 (4):501-517. doi:10.1111/j.1468-5906.2007.00374.x.

Pew Research Center. 2015. America's changing religious landscape.

Putnam, Robert D. 1995. Bowling Alone: America's Declining Social Capital. *Current* 373:3-9.

Putnam, Robert D., and David E. Campbell. 2010. *American grace : how religion divides and unites us*. 1st Simon & Schuster hardcover Aufl. New York, NY: Simon & Schuster.

Rasti, A. H., M. Torkjazi, R. Rejaie, N. Duffield, W. Willinger, and D. Stutzbach. 2009. Respondent-Driven Sampling for Characterizing Unstructured Overlays.

Raudenbush, Stephen W., and Anthony S. Bryk. 2002. *Hierarchical linear models : applications and data analysis methods*. 2nd Aufl. Advanced quantitative techniques in the social sciences, vol. 1. Thousand Oaks: Sage Publications.

Regnerus, Mark D. 2003. Moral Communities and Adolescent Delinquency: Religious Contexts and Community Social Control. *The Sociological Quarterly* 44:523-554.

Scheitle, Christopher P. 2005. The Social and Symbolic Boundaries of Congregations: An Analysis of Website Links. *Interdisciplinary Journal of Research on Religion* 1.

Scheitle, Christopher P., and Buster G. Smith. 2011. A Note on the Frequency and Sources of Close Interreligious Ties. *Journal for the Scientific Study of Religion* 50 (2):410-421. doi:10.1111/j.1468-5906.2011.01576.x.

Schreiter, Robert J. 1985. *Constructing local theologies*. Maryknoll, N.Y.: Orbis Books.

Simmel, Georg. 1964. The Metropolis and Mental Life. In *The Sociology of Georg Simmel*, ed. Kurt Wolff, 409-424. New York: Free Press of Glencoe.

Simmel, Georg. 1971. Conflict. In *On individuality and social forms*, ed. Donald N. Levine, 70-95. Chicago: University of Chicago Press.

Smith, Christian. 1998. *American Evangelicalism: Embattled and Thriving*. Chicago: University of Chicago Press.

Smith, Tom W. 1990. Classifying Protestant Denominations. *Review of Religious Research* 31 (3):225-245.

Smith, Tom W., Peter Marsden, Michael Hout, and Jibum Kim. 1972-2012. General Social Surveys. Chicago: National Opinion Research Center.

Stark, Rodney, and William Sims Bainbridge. 1985. *The future of religion: Secularization, revival and cult formation*. Berkeley: University of California Press.

Stark, Rodney, and Roger Finke. 2000. *Acts of faith: explaining the human side of religion*. Berkeley: University of California Press.

Steensland, Brian, Jerry Z Park, Mark D Regnerus, Lynn D Robinson, W Bradford Wilcox, and Robert D Woodberry. 2000. The Measure of American Religion: Toward Improving the State of the Art. *Social Forces* 79:291-318.

Tutzauer, Frank. 2013. A Family of Affiliation Indices for Two-Mode Networks. *Journal of Social Structure* 14:1.

Wasserman, Stanley, and Katherine Faust. 1994. *Social Network Analysis: Methods and Applications*. Cambridge, MA: Harvard University Press.

Woodberry, Robert D., and Christian S. Smith. 1998. Fundamentalism et al.: Conservative Protestants in America. *Annual Review of Sociology* 24:25-56.

Yang, Jaewon, and Jure Leskovec. 2015. Defining and evaluating network communities based on ground-truth. *Knowledge and Information Systems* 42 (1):181-213. doi:10.1007/s10115-013-0693-z.

1. The ARDA’s measurement wizard feature (http://thearda.com/mawizard) provides a more complete list of different beliefs and attitudes that have been included in surveys. [↑](#footnote-ref-1)
2. Academic ecumenism is the exchange of ideas between theologians belonging to different groups. Formal ecumenism is official collaboration or agreements between groups, and structural ecumenism is the complete merger of groups. [↑](#footnote-ref-2)
3. I use robust standard errors to help adjust for unspecified network autocorrelation. [↑](#footnote-ref-3)
4. Union churches result from the merger of congregations from two or more distinct denominations in the same area. This is common in areas such as New England where denominations originally dominated by different ethnicities and worship languages often exist side-by-side. Declining membership and the similarity of theology and practice can motivate the creation of cooperative union or multi-denominational ministries. [↑](#footnote-ref-4)
5. See Bader and Lockhart (2006) for a creative exception. [↑](#footnote-ref-5)
6. Maximal efficiency and optimal page load time require the recommendations to be calculated from an offline database and periodically updated and embedded into the product page rather than dynamically updated each time a user opens a product page (Linden et. al 2003). This introduces some latency into the recommendations, but recommendations are still updated at least hourly for popular products. [↑](#footnote-ref-6)
7. Note that a and b are likely to have been purchased together at least a few times, but if there is no measured path of length 1, neither fell within the 100 most frequently co-purchased items of the other. [↑](#footnote-ref-7)
8. None of the methods I use is strictly dependent on having only one component, so it would be possible to use overall bestseller lists. To do so, however, would introduce complication as the number of books in each denominational family’s subsample in each component (print or Kindle) would vary. The most popular books would also be represented twice, in both print and electronic versions, leading to collinearity. In the event of concern that using Kindle books biases results, the procedures can be repeated with matched samples of Kindle and print books (e.g. both editions of the same book) and compared. [↑](#footnote-ref-8)
9. Past analysis of co-purchasing data has universally treated it as directed, because rankings differ based on the popularity of the two books and the specialization of their audiences. The network is by definition symmetric, however, as it uses only the frequency two books are bought together. Note that while the underlying meaning of this type of recommendation is symmetric, marketing itself is directed (Leskovec et al 2007). [↑](#footnote-ref-9)
10. Limiting to Kindle purchases mitigates the last concern somewhat, as Kindle books are tied uniquely to the purchaser’s account and have only limited capacity to be lent or gifted. [↑](#footnote-ref-10)
11. http://thearda.com/rcms2010 [↑](#footnote-ref-11)
12. Data on ecumenical accords will be gathered from denominational websites and/or reference works. [↑](#footnote-ref-12)