The Structure of Lay Belief Systems

Alec McGail

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1 Introduction and definition of terms

I will here be concerned with what Converse (1964) described as "a configuration of ideas and attitudes in which the elements are bound together by some form of constraint or functional interdependence". With Converse (and many other scholars following him), I will call this a **belief system**. To develop a definition most closely related to what I will explore here, I would like to replace "ideas and attitudes" in this commonly used definition more concretely with "beliefs". As is typical, contention about the proper definition of beliefs does arise, but I will bracket a deep dive into this discussion and define **beliefs** as, "enduring, unquestioned ontological representations of the world [which] comprise primary convictions about events, causes, agency, and objects that subjects use and accept as veridical," (Connors and Halligan, 2015). I do not necessarily worry about whether held beliefs are true or false, or shared by others, although a restriction along these axes (or simply a definition of what these axes really refer to) is interesting and useful for more specific substantive investigations. In this quite broad definition I refer to conscious and unconscious beliefs, metaphysical beliefs, political beliefs, the meaning of words or phrases, intersubjectivity, beliefs about past events, about other individuals or their beliefs, about relations between ideas or beliefs in the abstract, etc. By the **functional interdependence** of beliefs I will consider primarily which beliefs are used as justification for which others, which beliefs seem to the individual to contradict which others, and other psychological and

discursive analogues to formal logic[1]. Beliefs exhibit other forms of structure however, which are important and considered in this literature review. For instance, beliefs can refer to other beliefs (for example, a person's belief that "A implies B", or a belief about the social impact of holding a belief). They also may have the same referent, mobilize the same cultural symbols, or what is not always the same thing, simply be expressed using the same words. Of course beliefs can also be completely unrelated. In all this, it is useful to keep in mind that this structure is here defined in the mind or practice of a single person, begging for extension to collective belief systems (see Zerubavel, 1997, for an introduction to "cognitive sociology," which refers to collective beliefs, symbols, ways of thinking, history, etc.).

Belief systems as a focus of study have a rather overwhelming scope, permeating every facet of social and psychological life. I contend that *belief systems as such* have enjoyed too little systematic analysis, despite convincing presentations of the potential of such analyses (Griffiths, 2014; DiMaggio, 2014). More precisely, I argue that many existing explanations of belief formation and change will benefit from a tighter methodological framework for both the measurement and analysis of belief systems. To justify this I will survey a selection of theories about belief systems from multifarious viewpoints, highlighting those which benefit from a structural viewpoint or are explicitly structural, as well as what has been done thus far to empirically explore the structure of belief systems, attempting to be thorough, but emphasizing works I find inspiring. I then will propose a survey methodology suitable for the large-N empirical study of the structure of individuals' lay belief systems, an ambition called for but only partially realized.[2]

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[1] I readily admit that when handled by individuals, the way propositions are formed and held, justified and manipulated differ wildly from what one would see in the proofs of formal logic. E.g. Converse (1964): "There is a broad gulf between strict logic and the quasi-logic of cogent argument." The analogy is useful, however, as long as it is recognized as such.

[2] This part of the paper is mostly incomplete, but is the main motivation for this literature review.

2 Theories of belief and belief systems

Belief systems, as a quite general class of cognitive structures (see Connors and Halligan, 2015, for a cognitive science perpective), subsume religious, ideological, and cultural belief systems, allowing us to draw fruitfully on thinkers in these areas for inspiration. Of course, the nature of the distinction between these categories of belief system is not immediately clear (for example, Balcerowicz, 2017, explores the difference between religious and non-religious belief), but they each are endowed with their own literature which offer theories and lines of research relevant to this project. There is also a large body of relevant literature on beliefs in ethnomethodology, exploring individuals' taken-for-granted assumptions of the world (Geertz, 1973). For example, Pollner (2010) is concerned with what he calls "mundane reasoning," which employs assumptions which are almost completely universal, and even surprising to consider as assumptions ("how could it be otherwise?"). In sociological social psychology, the concept of "social representation" describes a belief system held by multiple individuals, and brings with it a theory of maintenance and structure (see Sammut et al., 2015, for a thorough overview and future directions). Although many other substantive fields deal primarily with belief systems, we desire some limitation of scope in this particular literature review, and will not stray far from these literatures. For example, ethnographies many times explore and compare the commonplace reasoning of cultures, subcultures, families, etc., and although they deserve space here they will not get it. I will not even give a comprehensive overview of the fields I have identified, but instead a sampling to sensitize the reader to the value of the rest of this essay. For a more thorough overview of the sociology of belief systems, see the excellent reviews of Dubois (2001, 2015), and (Boudon, 1994, first chapter).

One common explanation for belief formation is that of motivated reasoning. This considers individuals as holding some "passion," any belief they are not willing to forgo, as well as constraints on "acceptable reasons." In times of threat to this passion they will produce derivations (using Pareto's term) which buttress it, and these derivations are called motivated reasoning. The basis of this explanation is in the psychological theory of cognitive dissonance (Festinger, 1957), which claims

that individuals find it uncomfortable to consciously hold beliefs they feel to be logically contradictory. They modify their belief system to accommodate unwelcome truths, as well as their immovable passion, without contradiction (for an interesting experimental exploration, see Prasad et al., 2009). Boudon (1994) reviews sociological explanations of belief based on motivated reasoning in depth (he calls them "type II" beliefs) finding Marx, Durkheim, Levy-Bruhl, Freud, Pascal, and Pareto, among others, to have employed such an explanation. Pollner (2010) observes a sort of motivated reasoning in traffic court in reference to unquestioned, unstated, immovable assumptions of the world, e.g. the assumption of an objective reality, or of the "mundane" properties of cars, stoplights, or roads. Pollner also expounds in length upon the infallibility of the Azande poison oracle (Evans-Pritchard, 1937). No matter what events threaten the Azande's belief that the life or death of poisoned chickens tell the future or can determine whether someone is a witch, the Azande are ingenious in their construction of explanations to support their faith. [3]

Another important explanation for the formation of beliefs is this reasoning process itself. Durkheim and Weber in their studies of magical beliefs (Weber, 1922; Durkheim, 1915) seek explanations of a belief in people's stated reasons for it. This may seem contrary to the notion of motivated reasoning, but in situations where an individual has no indication of what to believe, they will attempt to produce a common-sense explanation from what they know to be true[4]. Individuals avoid cognitive dissonance, and thus when presented with a new situation will extrapolate from beliefs already held. Boudon (1994) describes a large body of research into how individuals construct intuitive justifications, mostly based on experiments involving logical puzzles. He then presents "Simmel's model," how unstated unconsciously-held a priori assumptions creep into commonplace reasoning (see also Dubois, 2015, p. 166).

A third common theory employed in understanding this reasoning process is the notion of bounded rationality (Simon, 1956; Bendor, 2015). In full scope, bounded rationality seeks to incorporate

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[3] One explanation for my formation of this long ratiocination is that I have an inherent desire to build a new method for studying lay belief systems. For instance maybe I think it would simply be enjoyable to build, and I would like an essay detailing what "actual" reason there is for such work to be done.

[4] I use the phrase "know to be true," simply as a welcome stand-in for "believe," and do not assume anything additional about some inherent "truth" of the belief.

cognitive limitations (or more broadly, what we know from cognitive psychology and cognitive science about the functioning of human cognition) into our understanding of human rationality, updating Weber's ideal type of the fully rational actor. For instance, humans have quite limited working memory (Miller, 1956; Baddeley, 2010). This affects, for instance, their ability to generate counterexamples to "if-then" claims (Verschueren et al., 2002). The link between memory and belief is explored in-depth from the perspectives of psychology, social psychology, and neuroscience in "Memory, brain, and belief" (Schacter and Scarry, 2000). See Cherniak (1983) for a more theoretic investigation of the relationship between memory and rationality. Bounded rationality is a well-trodden road in social science theorizing, but it is only a small artifact of the body of knowledge amassed by cognitive science in the pursuit of understanding the brain, all of which can be seen as fodder for theories of the structure of belief systems. For example, Willard et al. (2016) review, critique, and experiment, exploring an explanation of beliefs based on their being "minimally counterintuitive," and thus memorable.

The study of "Social Representations," a line of research in sociological social psychology, is in our terms the study of the structure of collective belief systems. Moscovici is seen to have initiated the field, building on Durkheim's concept of collective or common consciousness (for instance Durkheim, 1895, p. 40). According to Lopes and Gaskell (Sammut et al., 2015, chapter 3),

> [Moscovici] proposed that social representations are systems of values, ideas and practices which give order and meaning to the material and social world, with which members of a community exchange views, and make sense of their world and their individual and group history.

Social representations are systems of common sense which are used to justify certain human practices (ibid., Chapter 1). They are dynamic within the individual, yet patterned across the society. Abric (1993) has built an elaborate evolutionary theory of representation maintenance within societies. The author distinguishes between the core and peripheral system of a representation. The core is built on shared beliefs, linked to collective memory and the history of the group, while peripheral beliefs are flexible and heterogeneous, and these systems have distinct and identifiable functions related to the

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maintenance of the system.

Liu et al. (2013) proposes a framework where individuals ascribe beliefs to others according to the logic of their own belief system. Although an intuitively pleasing framework, to what extent does this process govern belief formation in everyday life? Individuals *can* hold what most consider to be contradictory beliefs (Wood et al., 2012, is really interesting here). How this is possible, to what extent is it exhibited, and on what time scale is this cognitive dissonance resolved? Marx and Engels (1845), Mannheim (1936), Althusser (1970), Gramsci, and certainly others theorize that the dominant ideology of any time is that of the ruling class, or that ideologies are preserved by and for the benefit of the ruling class. To what extent is this true today, and what are the mechanisms which underly it? Boudon (1999) addresses the academic trope of the "end of ideology" (see Bell, 1960; Jost, 2006) with a theory of local, issue-based ideologies. Are ideologies globally held, idiosyncratic, or somewhere in between?

3   Measurement and analysis of belief systems

I will now entirely switch gears, now that you are inundated with various theories regarding belief systems, to techniques for their measurement and analysis.

Especially in cultural sociology, scholars address and analyze the relational nature of concepts and beliefs themselves. That is, beliefs are themselves relations between concepts, typically expressed using culturally shared (or heterogeneously understood) symbols (see Margolis and Laurence, for a relational analysis of the concept "concept"), in addition to and bracketing their relation to eachother in terms of perceived implication, justification, etc. Paul Dimaggio's 2014 review article "Cultural Networks" speaks to these lines of research well, and is the source of most of my knowledge in this area. For instance, Homer-Dixon et al. (2013) introduce cognitive-affective mapping (CAM), a strategy for visualizing and formalizing a group's or person's perceived relationships between concepts. These relations can be excitatory or inhibitory, taking inspiration from neuroscience, and each concept has

some positive or negative valence attached. Once represented as such, the authors suggest using agent-based modeling, for instance, to explore ideological dissemination. Translating a discourse into a CAM is an interpretive case-by-case process, with no strict methodological underpinnings. Yeung (2005) uses Galois lattices to understand how social ties affect individuals' cultural understanding of concepts such as love. Mohr and Neely (2015) work to operationalizing Focault's theory of institutional logic, employing block-modeling on concept networks to understand what one avoids talking about when speaking of a certain concept. See also Mohr (1998) for a review (two decades old, but thorough) of methods for measuring and analyzing meaning structures.

Other researchers have used survey data about individuals' beliefs to identify their structural relations in aggregate. In this context, the researcher typically identifies positive or negative correlations between the affirmation of two beliefs, thus identifying a relational network structure of beliefs. One of the first such analyses (Converse, 1964) examined the coherence of belief systems by demographic traits. Converse defines the coherence of a belief system as how strongly correlated the individual beliefs are in aggregate[5], and shows that elites' belief systems are more highly structured than those of the lay individual. Similar analyses refining, extending, or debating this thesis followed (see Axelrod, 1967; ?; Bennett, 1973), as well as minor extensions of the method itself (Barton and Parsons, 1977). For example, Martin (1999) seeks to resolve methodological difficulties with Converse's definition of constraint through a new, "entropic" measure. Judd and Milburn (1980) pioneer the use of a structural equation model to understand the structure of belief systems, developing results contradicting those of Converse. Boutyline and Vaisey (2017) develop "Belief Network Analysis", which is quite similar but more methodologically careful. Boutyline and Vaisey define an alternative method of calculating "correlation" between beliefs, as well as a centrality measure for beliefs within the surmised structure. The authors show, arguing with an alternative explanation of political belief formation related to parenting styles (Lakoff, 2002), that ideological standpoint is by far the most central among Americans' political beliefs asked in the 2000 ANES. The authors also use a new method to examine the presence

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[5]Converse used the Goodman-Kruskal gamma for aggregation. The more standard measure later became the average of pairwise association measures.

of heterogeneity in belief systems (see Boutyline and Vaisey, 2017, Appendix C), by comparing the normalized mutual information to the squared correlation for pairs of individuals. If these measures diverge, this is evidence of heterogeneity of logical organization (although their coinciding does not necessarily imply homogeneity).

Martin and Wiley (2000) systematically unpack survey questions into underlying constitutive beliefs, and identify logical structure exhibited in the underlying components. That is, even when beliefs measured in surveys are not related, many times they will be supported by "latent" unobserved beliefs, which themselves *do* exhibit structure. **?** cluster individuals based on relations between pairs of beliefs, identifying internally coherent "collective logics" within a population (see also Im, 2013; Baldassarri and Goldberg, 2014). This clustering is particularly interesting as it disregards how similar individuals' *beliefs* are (i.e. their answers to specific questions), and focuses instead on how similar their *logics* are. It also addresses directly the heterogeneity present in belief systems, assuming that different individuals possibly have different conceptions of "what implies what".

An interesting and unorthodox method of measuring shared understanding called the breaching experiment was introduced and employed by Garfinkel (1964). The aim of these experiments was to uncover the taken-for-granted assumptions in everyday life, and understand what forms of censure maintains these assumptions. Student participants in the experiment were asked to go into the world and perform an activity which contradicts taken-for-granted assumptions of others. For example, students were asked to endlessly question the assumptions of interlocutors, perhaps responding to "How is your girlfriend feeling?" with "What do you mean how is she feeling? Do you mean physical or mental?" and so on. The students were met with confusion, anger, and worry, as their friends and family tried to piece together how one could have forgotten so basic a notion as how to conduct normal conversation.

Another prominent line of inquiry consider ideology or belief systems in general as intimately intertwined with discourse. One's beliefs are expressed and defended, and this process can be analyzed as the outward expression of the internal coherence of a belief system. For example, Griffiths (2014):

"Since belief systems are, among other things, sets of propositions, the primary and indispensable evidence for their study must be these propositions' expression in words." Despite the apparent banality of this claim, it undermines the study of belief systems through structured survey analysis, as survey questions could at best be considered an approximation to how a respondent would have expressed their beliefs. Under the banner of discourse analysis, scholars have considered how the mode of expression itself conveys and reproduces ideological stances, and the structure of a given belief system. Such analyses work to uncover ideologies not explicitly stated, and possibly even embedded in the grammar of a culture (Dirven, Polzenhagen, and Wolf, 2010; van Dijk, 2006). Finlayson (2013) in his review of political rhetoric and ideology illuminates yet another useful perspective, that "the political theory of ideologies is concerned not only with the internal organization of political thinking but also with its external face—with the ways in which political ideas are presented in public, communicated to varied constituencies and made 'persuasive'." Indeed, if discourse is directed at persuasiveness, the structure of this discourse should indicate something about what it means to persuade, and thus hint at the dynamics of belief systems.[6]

4 Limitations and future directions

Although the methodologies just described get close to a determination of belief systems, I claim they are all either limited in their ability to determine the belief system within any given individual, or

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[6] I would like to note that there are two fields within mathematics which seem to deal primarily with this subject. I had neither the time nor the inclination (as they are not yet used by any sociologists) to study them in depth. The first is "Formal Concept Analysis" (Ganter and Wille, 1999), which is a super-set of Galois lattice theory employed already by sociologists, and works with formal notions of *concepts*, *dichotomous attributes*, *foundedness*, *contexts*, *redundancy*, the concept (within their system) of *implication*, etc.

Second is the line of research led by Usó-Doménech and Nescolarde-Selva (2016). I am quite skeptical of this work, as their only citations are themselves, and their theory is extremely complex. For example, they invented "alysidal algebra" across three papers (e.g. Nescolarde-Selva and Usó-Domenech, 2013) in order to express their later papers. However, their later papers seem potentially insightful, as the statements I understand (those which are not replete with jargon) are reasonable sociological judgements. For example:

> Conflict between two groups, including war, may be defined as a battle between belief systems. Symbols emerge strongly in such conflicts: they may be revered objects like stones, writings, buildings, flags or badges; whatever they may be, they may symbolize the central core of belief system. When people become symbols, the real person may become obscured behind the projected symbolic image or person. Organizations develop their own in-house culture and belief system, too, which leads them to act and behave in ways that might not seem entirely rational to an outsider. (Usó-Doménech and Nescolarde-Selva, 2016)

limited in their societal scope. In itself, a claim of limitation is not surprising or novel, but may simply indicate complexity and the presence of a hard problem. I intend however to provide a *less* limited methodology to solve some of these problems.

Methods based on structured survey data assume crucially that belief systems would exhibit themselves in aggregate. This assumption depends first on the relative homogeneity in the organization of beliefs. For example, if each person had a highly structured yet idiosyncratic belief system, this sampling of beliefs would reveal nothing of the underlying structure. Also assumed (as usual) is that the questions asked were understood in the same way by these individuals, and identical answers to identical structured questions actually represent an identical shared understanding. Additionally, these methods are only suitable for studying belief systems built on globally shared symbols and cannot for instance readily study the structure of personal beliefs surrounding individuals' friends' and families' actions, personal situations, histories, and conceptions of the world. Finally, but probably not exhaustively, these methods only investigate the structure of the belief system as described by simple implication between queried beliefs, $A \Rightarrow B$, or of constitutive beliefs in the extension of Martin and Wiley (2000). Many of these limitations are addressed by Wyckoff (1987) in his critical review of the approaches of Converse and those who followed.

Fundamental limitations are also present in more interpretive methods, for example in discourse analysis, analysis of rhetoric, or cognitive-affective mapping. One criticism is well expressed by (Martin, 2002), "When it comes to the interpretation of contentious content, why privilege the analyst's account over that of the analyzed?" These analyses are limited also in the number of belief systems which can be analyzed, and are thus typically limited to the discourse of politicians, newspapers, courtrooms, and other high-impact sources, which are subsequently taken as the expression of the logical structure of a movement or other larger body of individuals who are not studied.

My ambition is to design a computer program which interacts with individuals one-on-one over online chat. This program will be linguistically fluent enough to understand what an individual claims, what claims he uses to support which others, and how one person's claims may or may not relate to

other people's claims. Crucially, this program will not have to be *entirely* linguistically fluent, but instead will be capable of asking questions. The linguistic fluency it does have will be built primarily through this interaction, as the program asks clarifying questions where it is "confused," or where an apparent (or at least socially apparent) contradiction arises. In particular, the program is able to ask explicitly if its interpretation is correct.

The construction of such an application requires a data representation for concepts, claims, and relations between them. It also requires some understanding about how an unstructured interview is conducted, and how to keep the interviewee entertained. Both of these can be informed by the experience of social scientists and the research of conversation analysis.

This project is fairly infantile, and I intend to proceed by conducting these interviews myself, coding the beliefs of individuals by hand. As my own interview practices crystallize, I will slowly add computerized processes, either for specific speech acts (e.g. inquiring into their religious beliefs), or for an automatic coding of interviews I have conducted myself. Then I will build interaction into the system, such that it can formulate its first clarifying question and understand the answer (this very well could be the hardest part).

If this is in fact a feasible idea (a conclusion I will come to in the near future), it offers great promise for the collection of data on belief systems. In particular, an individual can be observed justifying one or another belief, explaining what they believe and why, and what it all means. Possibly more importantly, this information can be coded and analyzed, while preserving reference to the original statements given by the interviewees (no cumbersome transcription). This gives the ability to truly peer into the structure of lay belief systems in a way currently only captured in ethnographies.

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Note to self: This document contains 59 references.