Culture and Demography: From Reluctant Bedfellows to Committed Partners

Christine A. Bachrach[*]

[*]Maryland Center for Population Research & Department of Sociology, University of Maryland, College Park. chrisbachrach@gmail.com 6253 Cardinal Ln, Columbia, MD 21044 410 740-8277 (603 865 5722 through Sept 9)

Abstract

Demography and culture have had a long but ambivalent relationship. Cultural influences are widely recognized as important for demographic outcomes, but are often "backgrounded" in demographic research. I argue that progress towards a more successful integration is feasible and suggest a network model of culture as a potential tool. The network model bridges both traditional (holistic and institutional) and contemporary (tool kit) models of culture used in the social sciences and offers a simple vocabulary for the diverse set of cultural concepts such as attitudes, beliefs and norms, and quantitative measures of how culture is organized. The proposed model conceptualizes culture as a nested network of meanings which are represented by schemas that range in complexity from simple concepts to multifaceted cultural models. I illustrate the potential value of a model using accounts of the cultural changes underpinning the transformation of marriage in the U.S. and point to developments in the social, cognitive and computational sciences that could facilitate the application of the model in empirical demographic research.

In 1996, economists George Akerlof, Janet Yellen and Lawrence Katz developed a theory to explain the dramatic increase in nonmarital childbearing in the United States. Noting that existing explanations – stagnation in men's wages and welfare incentives – could explain only a small portion of the trend, they suggested that the increase in nonmarital childbearing was the result of a "technology shock" – the introduction of effective contraception and legal abortion. Their game-theoretic model relied on a standard model of competitive advantage. Women unwilling to use the new measures to prevent pregnancy and birth had to extract a promise of marriage from their partners in exchange for sex – insurance to cover the risk of a pregnancy. Women willing to use contraception and abortion could offer men sex at a lower cost, without the promise. As the proportion of women able to provide sex at the lower cost increased, women who needed to charge more found fewer buyers, pressuring them to agree to the lower price if they wanted to stay in the relationship business. As a result, fewer premarital pregnancies were legitimated, and rates of premarital birth went up (Akerlof, Yellen and Katz 1996).

This is a straightforward economic model, but Akerlof and his colleagues could not avoid using the language of culture in telling their story. They spoke of a "change in sexual

customs" and new "expectations" for sexual activity without commitment. More implicitly, they assumed that young men and women *knew* that the pill had changed the sexual marketplace. How did these young people know this? Not from their own sexual experience, which was limited. Even by 1988, when premarital sexual activity had become a norm of sorts, only a bare majority of teenagers 15-19 had ever had sex and less than a third of girls and 44 percent of boys had had more than one partner (Abma, et al. 2001). Instead, they learned it from their immersion in media and youth cultures that celebrated new models for sexual behavior. Sex didn't have to be saved for marriage; it was a natural part of love; and the risks could be controlled (Coontz 2005).

Culture has always been important for demography. Malthus (1798) turned to cultural norms and collective values as the basis for "preventive checks" that kept population growth in line. Adolphe Quetelet (1869: 275, quoted in Tyler, 1872) attributed regularities in age at marriage to cultural "laws" that were so pervasive that they escaped men's attention even as they submitted to them. Kingsley Davis rooted his 1939 work on illegitimate childbearing in an institutional model of culture (Davis 1939). Similar models underpinned demographic transition theory (Notestein 1945; Coale 1973). The Caldwells (1976; 1987) relied on concepts of culture in their work on African fertility; Ron Lesthaeghe and Dirk van de Kaa in their theory of the second demographic transition (Lesthaeghe 1983; van de Kaa 1987; Lesthaeghe & Surkyn 1988). Many PAA presidents, including Larry Bumpass (1990), Etienne van de Valle (1992), Karen Mason (1997), Phil Morgan (2003), and Arland Thornton (2001), have drawn on cultural concepts and models in their presidential addresses. Even some economists have embraced culture: As Lundberg and Pollak (2007) have suggested, culture strongly influences the outcomes of household bargaining.

Demographers *need* culture because, as many of my distinguished colleagues have pointed out, culture and material conditions exert interdependent and complementary influence on the behaviors that drive demographic change (Lesthaeghe and Surkyn, 1988; Pollak and Watkins, 1993; Hirschman, 1994; Fricke, 1997). It is not structure *or* culture, but structure *and* culture that affect our outcomes.[1]

But at the same time, culture and demography have been reluctant bedfellows – like strangers forced to share a room in an inn, we have a necessary, but uncomfortable, relationship (Kertzer & Fricke 1997). To demographers, definitions of culture often seem vague, variable, and all-encompassing (Portes, 2006; Obermeyer, 1997). Kingsley Davis (1963) complained that cultural explanations were both circular and empty: to say that "tradition" causes something is meaningless. Pollak and Watkins (1993) tell us that culture fits poorly with rational choice models: you can't meaningfully model something that supplies both preferences and constraints. Demographic research often tends to background culture, perhaps because our methods provide an awkward fit to its analysis. In demography, we tend to look for the independent causal contributions of autonomous predictors in statistical models. But culture is not a collection of independent variables: as I will argue, it

---

[1]The term "structure" is used in this context to refer to patterned material and social arrangements such as economic systems and status hierarchies. This departs from Sewell's (1992) concept of structure as the dual product of material and ideational elements, but is consistent with common usage in demography.

is an interdependent web of meanings that is structured in consequential ways. We can measure and model pieces of it, but our efforts to do so may not fully capture the importance of culture for demographic outcomes.

In this essay, I argue that these conceptual and methodological challenges are tractable and that, by embracing them, we can move towards integrating culture more explicitly and meaningfully in demographic analysis. In other words, I argue that culture can stop being demography's reluctant bedfellow and develop a committed partnership. My argument proceeds in four steps. First, I set the stage by providing a basic definition of culture and a brief review of demographers' conceptual views of culture and cultural change. Second, I propose a set of criteria for an adequate conceptual model of culture and argue that the models we have fall short in relation to these criteria. Third, I propose a model of culture and develop a case for its adequacy and utility. Fourth and finally, I argue that developments in the social, cognitive and computational sciences offer the tools to move toward application of the model in demographic research.

Setting the stage

Demographers rarely define culture, but when they reference it in their work they often portray it as a shared set of norms, attitudes, beliefs and practices (e.g., Carlson et al 2004, Kalmijn and Tubergen 2010).[2] Anthropologists commonly define culture as a patterned set of meanings shared by a social group or population (Hannerz, 1969; Geertz, 1973; Fricke, 1997). The concept of meaning is essential in both definitions: Although norms and practices encompass broader features as well, they depend fundamentally on shared meanings.[3] I begin with the second definition for purposes of this essay and later address how norms, attitudes, and other constructs can be conceptualized in terms that flow from this definition.

Culture is also commonly defined (e.g., Hannerz 1992) as having both a cognitive dimension (e.g., meaning, attitudes, values) and a material dimension (observable practices or objects in the world). In this essay, I focus on the cognitive dimension of culture – the shared meanings given to objects and actions in the world. Both dimensions are necessary to culture, but, again, meaning is fundamental: worldly objects are of interest to cultural analysts primarily for the meanings they carry. It is in this attention to meaning, I argue, that demographers have been least successful in integrating culture in their work.

Finally, culture is not just a disordered collection of meanings, it has pattern – it is organized, given a relatively stable *structure*, through specific mechanisms (Fricke, 1997; Johnson-Hanks et al. 2011). Its organization is as important as its content in influencing demographic action. For example, culture includes not only the meanings of parenthood and

---

[2]Some demographers have also used other, less useful, definitions(Hammel 1990): for example equating culture with a country, region or group or the hodge-podge of "fuzzy, not clearly rational, or not readily amenable to inclusion in statistical models" causes of unexplained variance in our models (Obermeyer 1997).
[3]For example, the norm of bringing a small gift to a host or hostess rests on a shared interpretation – that the gift is an act of thanks rather than an implication that the hostess is apt to lack some important item the visitor wants. The norm itself – the idea that this is something you *should* do – is the result not only of the shared interpretation but also the widespread enactment of the script and the social processes that assign it value.

marriage, but how we relate them, and this relation has profound consequences for rates of premarital sex, abortion, and parenthood. The organization of culture also helps to explain why the same actions can take on different meanings in different contexts, why people are drawn to some cultural scripts and not others in particular situations,[4] and why some elements of culture are more vulnerable to change than others.

Developing a useful way of integrating culture in demographic research requires that we answer two questions. The first is how culture is constructed – that is, what elements comprise culture and how are they organized in relation to each other? The second is how culture works – that is, what mechanisms causally link culture to other phenomena, for example, to economic systems or individual behaviors, and what mechanisms produce cultural change? With a traditional focus on variation and change in demographic outcomes, it is no surprise that demographers have largely (and successfully) focused on the latter set of questions when addressing culture. After reviewing demographic views of how culture works, I will move on to a discussion of the first, less explicitly explored, question.

How does culture work?

Prevalent concepts within demography of how culture works have evolved over time. In the mid-twentieth century, most demographers viewed culture as highly stable and subject to change only when exogenous forces disrupted it. Grounded in structural-functionalist theory, this view conceptualized culture as internally coherent and invariable within the bounds of a society (Hammel 1990; Lockwood 1995). Members of a society were indoctrinated in childhood with cultural beliefs and norms (Ryder 1965) and were generally expected to adhere to cultural norms throughout their lives. Change occurred only when set in motion by substantial changes in economic systems, such as those accompanying economic development (Notestein 1945)[5].

In time, however, as economic drivers alone proved insufficient for explaining fertility declines, many demographers began to think about cultural change in terms of the spread of ideas. For example, Caldwell (1976:352) attributed the nucleation of elite Nigerian families to "the import of a different culture" from the West, while Freedman (1979) suggested that exposure to new cultural models and ideas permitted by literacy, communication, and transportation were playing a significant role in non-Western fertility declines. These accounts emphasized exogenous drivers of cultural change in the form of ideas that were exported from other cultures. In contrast, work on fertility decline in Europe has emphasized the spread of ideas driven jointly by economic circumstances and social structures: the spread of ideas about family limitation and birth control in the first demographic transition (Coale and Watkins 1986; Cleland and Wilson 1987) and the growth of individualism and postmaterialist values in the second (Lesthaeghe 1983, Lesthaeghe & Surkyn 1988).

The influence of this approach within demography increased with work that explored the role of social interaction in the spread of ideas and information (Bongaarts & Watkins 1996;

---

[4]As an example, Ridgeway (2011) notes that people are more likely to draw on gender beliefs in situations closely associated with gender (e.g., weddings) than in those less closely associated (e.g., work settings).
[5]Notestein was so sure of the power of economic structures when he wrote in 1945 that he predicted that it would take totalitarian measures to force US fertility to rise again.

Casterline 2001). Network models of diffusion provided a methodologically sophisticated approach to studying the effects on contraceptive and fertility behaviors of social learning and social influence (Behrman, Kohler & Watkins 2002; Kohler, Behrman & Watkins 2001) and expanded communications and media (Hornick & McAnany 2001). These new models nevertheless shared a common flaw with earlier work on diffusion: they tended to represent a "fax model" (Carley 2001) in which cultural elements were fixed entities transmitted unchanged across individuals.

More recently, some demographers have emphasized conceptualizations of cultural change that include endogenous processes that shape not only the spread of ideas but also the form those ideas take as they spread. For example, Johnson-Hanks and her colleagues (2011) argue that individual actors play a crucial role in reshaping both culture and material conditions through their interpretations of and responses to specific situations or events. Bledsoe and her colleagues provide an example of this process in their analysis of Gambian women's reinterpretation of the meaning of family planning through local cultural models of reproduction and health (Bledsoe et al., 1994). Watkins and her colleagues (Watkins 2000; Rutenberg & Watkins 1997) have examined the negotiation and redefinition of ideas promoted by Western governments and NGOs through clouds of commentary (Hammel 1990), communication, and gossip within local cultures. Thornton (2005) also points to local transformations of western family ideals in his work on developmental idealism.

This emergent model of cultural change as an endogenous, participatory and multi-level process has deep roots in sociological and anthropological theory. Figure 1 provides a summary. Cultural change is participatory because group members play an active role in influencing its course. It is multi-level because it involves action at the levels of cognition, individual behavior, social processes, and macro-environments. At the macro level, physical environments and social practices are structured: they tend to have relatively predictable patterns, and these are endowed with socially shared patterns of meaning. People learn these meanings through their engagement with the world, and then use what they have learned in interpreting the events and contexts of their everyday lives (Carter 1995; Johnson-Hanks 2007). Their interpretations lead them to act. Sometimes they act habitually, sometimes only after deliberation and conscious choice. Their actions become part of the social environment, where they may reinforce or challenge existing meanings at the macro level (Johnson-Hanks, et al., 2011). In this micro-macro model, exogenous events such as the marketing of the pill or a change in the economic structure can change culture, but this process is mediated by people's interpretation of new events through existing patterns of meaning (Kertzer 1995). Culture is also changed by endogenous social processes such as social interaction, social movements and the influence of power, all of which transform individual actions into new cultural landscapes (Watkins 2001).

How should we conceptualize culture?

This dynamic model of how culture *works* is an important advance for demography and the many fields that have contributed to it. However, it has less to say about how culture *is constructed*: it does not tell us what this system of meaning we call culture looks like, what

it consists of, and how it is structured. Answering this second question is essential if we are going to integrate culture more meaningfully in demographic research.

What would an adequate conceptual model of culture look like? I propose six criteria: (1) An adequate model would build on existing scientific knowledge; (2) It would offer a simple vocabulary that allows us to characterize the elements of culture and capture the full range of cultural phenomena that are relevant to our outcomes; (3) It would specify how culture is constructed and organized; (4) It would be useful at both the micro- and macro-levels; (5) It would help us visualize and reason about culture. And, since demography depends heavily on quantitative models, (6) it would be useful to have a model of culture that is quantifiable.

In the past, culture has been conceptualized in three general ways. All of these represent important insights and have led to fruitful research, but none fully meet my criteria for adequacy. The first views culture as a seamless whole in which the parts are interconnected and inseparable from the whole. The second (and more recent) tool kit model of culture presents culture as a collection of values, scripts, skills, and symbols that people may or may not choose to use for strategic ends. The third is an institutional model which portrays culture as organized by institutions that serve societal goals.

The tendency to think of culture holistically, as a "seamless whole" (Caldwell & Caldwell 1987), has characterized much of the scholarly tradition in cultural anthropology (Boas 1940; Geertz 1973). Using terms such as "webs of significance" (Weber 1904, quoted in Geertz 1973), this view of culture emphasizes the interdependence of cultural elements. The basic elements of culture are meanings, woven together in a sphere apart from the institutional and social, to create a "shared background against which and in terms of which social life is carried out" (Fricke 1997: 252). This focus on culture as a whole means that when anthropologists analyze particular elements within cultural systems, they see them as deeply embedded in, and inseparable from, a larger framework of meaning (Levine and Scrimshaw, 1983; Bledsoe 2001). The "seamless whole" model fails my adequacy test because, despite the important insight that meanings arise out of the interrelations among cultural elements and their place within the whole, it fails to tell us how culture is organized. The model doesn't adequately allow us to examine the principles that govern how individual cultural elements interrelate and combine to form an integrated whole.

The tool kit model presents culture as an internally inconsistent and incoherently organized collection of values, scripts, skills, and symbols that people deploy for strategic ends (Hannerz 1969; Swidler 2001). In the words of anthropological demographers, culture is "a spice rack of ideas and practices" (Greenhalgh 1988) or "a fluid set of resources people can draw on" (Bledsoe 2001). The tool kit model has been an important advance in conceptualizing culture because it rejects the idea that culture is necessarily internally consistent and coherent and because it endows individuals with the ability to choose among cultural elements to motivate or justify their actions.[6] Few demographers outside of anthropology have explicitly drawn this model into their work (for exceptions, see Cherlin

---

[6] In an example provided by Cherlin (2009), individuals in an unhappy marriage can base a decision to remain married on the cultural belief that marriage should be enduring or choose to divorce following the belief that marriage should be fulfilling.

2009; Harding 2010). However, demographic research that examines variation in attitudes and values implicitly endorses the model's rejection of cultural homogeneity within a population. Despite its many strengths, the tool kit model fails my adequacy test because it gives little attention to the structure or organization of cultural elements.

Of the three conceptualizations of culture, the institutional model is the one that has most dominated scholarship in demography. In sociology, an institution is "a complex of positions, roles, norms and values lodged in particular types of social structures and organising relatively stable patterns of human activity" related to some societal purpose (Turner 1997: 6). Institutions provide a cultural "blueprint" for actual organizations (e.g., schools, markets, and families). As depicted in Figure 2 (adapted from Portes 2006), this blueprint has a hierarchical structure: roles are grounded in norms for behavior and skills or repertoires needed for the roles; and these are in turn grounded in values, which Portes (2006) defines as "general moral principles." The institution of the family, for example, organizes roles for mothers, husbands, children and grandparents and establishes norms and repertoires that guide the performance of these roles. Values such as love, responsibility, and cooperation provide the basis for the entire structure.

Like theories of how culture works, this model has evolved considerably in the last half-century. Demographers of the mid-twentieth century (Notestein 1945; Davis & Blake 1956; Davis 1963) were strongly influenced by the structural-functionalist view that cultures are tightly organized to serve society's ends, making culture, social structure, and institutions barely distinguishable from each other. As in the seamless whole perspective, cultures were seen as coherent and cohesive, with individual elements reinforcing each other to create a monolithic whole (Watkins 2001; Lockwood 1995). For example, Notestein (1953) described the "arrangements" supporting high fertility as "strongly supported by popular beliefs, formalized in religious doctrine, and enforced by community sanctions. They are deeply woven into the social fabric and are slow to change." The Caldwells (1976, 1987) viewed sub-Saharan African cultures in similar terms.

However, by the time demographers were analyzing the European fertility decline this notion of a unified coherent culture began to fall apart. The growth of new economic, educational, recreational and social control institutions created an expanded set of domains within which values, norms and roles could arise, thus expanding the potential for conflicting norms and values across different institutional orders (McNicoll 1980; Thornton, Ocasio & Lounsbury 2012). The concept that cultures were dependent on institutional structures was challenged as we entered the second demographic transition. Ron Lesthaeghe and his colleagues attributed the new changes in family behaviors to the spread of postmaterialist cultural models dominated by the growth of a core value, individualism, and desecularization – the lessening control of institutions (mainly the church) over personal behavior (Lesthaeghe & Surkyn 1988). Both imply the idea of *freedom* from institutional norms (Preston 1986; Cherlin 2009).

Lesthaeghe's use of survey, vital registration, and other data to trace the rise and regional patterns of postmaterialist values in Europe and North America does not undermine the institutional model itself: values, norms, skills and repertoires, and roles continue to provide

the constitutive elements that shape institutions. However, it elevates values such as self-fulfillment and tolerance and gives them the power to affect behaviors directly, independent of any effects through institutional frames. Nevertheless, many elements of the institutional model persist in this body of work. Values, norms and roles remain prominent as elements of culture; family behaviors are viewed as part of the "institutionally regulated... spheres" (Lesthaeghe & Meekers 1986:225) and culture, while seen as partially autonomous from economic and social structures, is also seen as shaped by them (Lesthaeghe & Surkyn 1988).

Most current work that examines cultural influence on demographic outcomes continues to bear some imprint of the institutional model, albeit much transformed from its early conceptualization. The concept of a norm continues to play a major role in the literature[7], albeit often in ambiguous ways (Mason 1983)[8] or with an uncertain empirical basis (Liefbroer & Billari 2010).[9] Values are also given a central role, but one that tends to be disconnected from institutional frameworks. Today's discourse about cultural influence has been shaped by the expansion of demographic research that investigates cultural effects through survey measures of attitudes and values. Survey methods, by their very nature, tend to focus attention away from norms and toward individual-level preferences and identifications; they are predicated on the idea that people's identification with norms and roles vary across individuals and population groups. The influence of the institutional model is still revealed by the questions we ask, which focus on roles and normative behaviors, but the concept of a widely shared and sanctioned norm is lost. However, as Liefbroer and Billari (2010) argue, it may be premature to abandon the concept of norms. Where norms exist, as in the timing of certain life events, their effects on behavior remain powerful.

Unlike the holistic and tool kit models of culture, the institutional model provides a valuable model of how culture can be organized. However, it fails my adequacy test because its scope is too limited. The model works well for those parts of culture which are clearly structured by societal institutions (e.g., schooling), but gives us little to work with when institutional structures don't exist (e.g., for step-parenting; Cherlin 1978). The model works well when cultural norms and roles are widely shared, but not when norms and roles are challenged and lose their social support. It doesn't work so well when institutions become "de-institutionalized", as Cherlin (2004) has characterized marriage. The model also can't account for a direct impact of values on behaviors; it only allows for influence that operates through norms and roles.

A network model of culture

The three models reviewed above all provide distinct insights about the nature of culture and have proven useful in decades of research. I do not propose that we discard any of them. I argue, however, that conceptualizing the elements and organization of culture at a more

---

[7]This claim is based on a scan of a 1 in 8 sample of the 229 articles with abstracts that referenced "culture" or "cultural" in JStor's population domain with publication dates since 2002.
[8]Norms need not be linked to institutions (Mason 1983) but may arise out of group processes; much current research invokes norms without explicit attention to their possible relation to institutions.
[9]Most studies measure individual attitudes rather than shared norms. Some studies have attempted to use survey attitude data to measure norms at the neighborhood or group level (e.g., Warner et al. 2011; Musick et al. 2008); earlier work relied on neighborhood structural characteristics as proxies for normative climates (e.g., Brewster 1994; Browning et al. 2008).

basic level can provide tools – a basic set of mechanisms and a common vocabulary – in terms of which all three models can be understood and integrated. It can provide the basis for a unified model of culture that can capture its holistic and organized characteristics as well as its variability and less-than-perfect coherence. Because meaning is so central to culture, and meaning is fundamentally cognitive, I draw on concepts and mechanisms in cognitive science for this more basic model.

The model I propose takes the form of a network. Culture is a network of meanings (rather than people, as in social networks). Demographers have sometimes used network imagery in talking about culture – for example, in saying that the meaning of marriage has changed because being married is no longer *tied* closely to sex and reproduction (e.g., Carlson et al. 2004). Networks are holistic, but also permit the analysis of components and structure. They are familiar terrain for social scientists and they lend themselves to quantification.

A cognitive basis

There is a deeper rationale for thinking of culture as a network: networks represent meanings in the brains of individuals (Strauss & Quinn 1997). The basic element of a network model of culture is a schema, a concept from cognitive science. A schema is a relatively stable and abstract representation of the meaning of an object or event (Mandler 1984; Strauss & Quinn 1997). Individuals store information about their cultural environments, and all aspects of their experience, as schemas represented in the brain's neural networks.[10] A network model conceptualizes an individual's cognitive model of the world as a set of schemas, structured through the presence or absence – and nature – of ties among them.

Schemas themselves can be conceptualized as networks. Even the very simplest of schemas is a network connecting micro-bits of meaning. Figure 3 illustrates a schema of a wedding ring by using words to convey the bits of information (the network nodes) that are linked together (depicted by network edges or connecting lines) to form the schema. Those nodes that are more strongly linked are placed closer together. I use this highly stylized heuristic device for representing schemas throughout this discussion – I do not mean to suggest that schemas are fully linguistic or that an actual network representation of a wedding ring would be structured in exactly this way.

Schemas can be simple, representing a single type of object like a ring, or they can be networked to other schemas to produce schemas for action, like sliding a ring onto a finger. They can be combined with many other schemas to produce complex structures that still function as schemas, but are often referred to as *models* because of their size and complexity.[11] A model of marriage might tie together schemas relating to love, mutual

---

[10]We are wired to do this. Neurons have evolved to connect in durable patterns that represent the patterns of features and associations we repeatedly encounter as we experience objects and events in the world (Damasio 2010).
[11]Using the concept of schema to encompass such a broad range of phenomena often raises questions: shouldn't we have different terms to differentiate schemas of different kinds? One answer is, we do: we have concepts, scripts, models, values, prototypes, worldviews, beliefs, and many other terms useful to cultural analysis. Schema is not a substitute for these terms but a basic element underpinning all of these. A second answer is that simple and complex schemas share a common name because they arise and become organized through a common set of mechanisms and serve a common function of representing meaning. There is no clear boundary between a simple schema and a complex one, and thus no logic to guide a distinction on the basis of size or complexity.

fulfillment, sex, weddings, rings, commitment, and much more (Figure 4). These webs of connectivity are real – real enough that, if you see a woman standing outside a church in a long white gown, you can bring to mind not only what this woman is doing but also a great many intuitions about what her future life will be like.

Schemas do not simply represent cold facts or definitions (Ignatow 2007; Damasio 2010). They incorporate evaluative meanings as well, rooted in the visceral and emotional feelings that we experience when we think about a concept, object or event.[12] When social scientists speak of values, they are referring to schemas that evoke strong positive or negative feelings in us. For example, we may express as a "general moral principle" that all individuals deserve respect. However, the motivating force of the schema that links "individuals", "deserve" and "respect" comes from the emotions that we feel when it is activated in the brain (LeDoux 2002; Vaisey 2009).

Using schemas to represent culture

The idea that schemas can be viewed as basic elements of *cultural* meaning is not new. It was suggested in the late 1990s by two cognitive anthropologists, Claudia Strauss and Naomi Quinn (1997) and by sociologist Paul DiMaggio (1997). Several demographers have suggested its potential for demographic research (Bledsoe 2001; Kennedy 2004; Bernardi & Hutter 2007). If a schema represents an object's typical features and associations for an individual, then a cultural schema represents the meaning that is shared across members of the group.

Culture as a whole can be viewed as a massive and multiply nested network of schemas. At the highest level we can think of culture as a network linking different cultural *models* more or less closely together. For example, in Figure 5 the model for marriage is more closely tied to the model for homeownership than it is to the model for citizenship. Each cultural model is a network of schemas representing action, objects, and simple concepts relating to a particular domain. The individual schemas within the model are themselves networks of micro-bits of meanings expressed in language as basic features like "shiny" or "round." The schemas in a network model of culture need not be mutually compatible. Just as members of a social network can have positive or negative relations with each other, the meanings in a network model of culture can be consistent or inconsistent and compatible or opposed. However, just as in social networks, network structures will tend towards patterns of organization that permit these discordant elements to co-exist.

Two primary mechanisms organize the structure of the network. First, just as an individual's own experience organizes knowledge structures in the brain, a group's shared experience structures shared schemas and models. Shared meanings arise because members of a group tend to inhabit similar worlds and have similar experiences (Strauss & Quinn 1997). They learn similar schemas through the observable things in their shared world: physical objects like wedding rings, real estate brochures, and Supreme Court decisions; people's actions and speech; and even subtle forms of body language that signal approval or disapproval. Second,

---

[12]As Basu (2006) argues, emotions play a basic role in demographic behaviors such as condom use in sexual relationships, marriage, and childbearing. They do so through embodied emotional responses linked to schemas in the brain.

a group's shared culture is organized by its members. This is happening when group members reproduce or reframe conventional meaning structures in their thoughts and behaviors; it is also happening when divergent meanings become aligned through social interaction (Ridgeway & Smith-Lovin 1994) or when group processes influence whether innovative interpretations and actions become shared (and integrated into material experience) or discarded.

If culture were perfectly shared, a network model of culture would look exactly like the cognitive model of the world held by any one individual in a population. But culture is *not* perfectly shared. People have different experiences and they think about their experiences in different ways, so the ways in which individuals organize their knowledge of the world differ (Lockwood 1995; Strauss & Quinn 1997). For example, as Harding (2010) documents, people in disadvantaged neighborhoods vary in their attachment to alternative models of parenthood grounded in mainstream and "subcultural" values. Within large populations, many such alternative cultural models can exist. At the same time, without a significant amount of overlap among the cognitive models of interacting individuals, social life would be impossible. Even in Harding's disadvantaged neighborhoods, residents do share massive amounts of knowledge and meaning. A model of culture needs to capture both cultural sharing and diversity within a population.

Modeling this semi-shared nature of culture is messy but doable. Picture culture as the aggregated sum of the cognitive models of individual members of a population. Those parts of the network that are fully shared can be weighted more heavily and those parts that are contested or unshared, less heavily. Figure 6 illustrates this with darker shaded nodes for elements that are more widely shared than others and thicker edges for associations between elements that are more commonly shared. In this example, most group members agree that marriage is linked to sex and fidelity, but some differ on its linkages with heterosexuality and male authority.

As population scientists with interests in behavior, this representation works well. It aggregates cultural knowledge as it exists across the minds of individuals in a population, where it sets the stage for behaviors in response to situational cues (Johnson-Hanks et al. 2011). But individual cognitive models change gradually (Gazzaniga 2011) and so this representation may lag behind the cutting edges of cultural change. One can also examine the networks of meaning implicit in key material drivers of cultural change that exist in the world –for example, media content (Wilmoth & Ball 1992). A network model of culture accommodates both culture "in mind" and culture "in the world," both of which are essential elements of a multi-level model of culture (Figure 1).

The conceptualization of culture as a network provides a common set of concepts and mechanisms that bridge the three models of culture I discussed in the previous section. The concept of schema provides a simple vocabulary for conceptualizing virtually all of the terms we now use to refer to culture. For example, a role can be conceptualized as a set of schemas – for behaviors, relations to others, and motivations – associated with a particular position. A norm is a schema for action that is shared and valued highly and widely enough to motivate sanctions for its violation. A value is a schema that carries a shared consistent

positive or negative association. An institution is a cultural model composed of relations among schemas, as in the model of marriage in Figure 4. The concept of schema can also capture the meaning of worldview, script, code, belief, attitude, and many other terms that populate current discussions of culture. This term also allows us to talk about ideas or values that transcend specific institutions, for example individualism, and about behavioral scripts that no longer have normative force but remain active elements in a cultural field – like female domesticity.

A model of culture that links schemas to form a network permits the representation of culture in a holistic fashion, but with explicit attention to how elements are organized in relation to each other. It incorporates the relations among schemas basic to the institutional model but allows for a much broader and more flexible set of structural arrangements. It is similar to the tool kit model in conceptualizing culture as a diverse set of ideas and scripts, but its focus on how these are organized in relation to each other recognizes the reality that individuals' cultural choices tend to be structured by experience.

An Illustration

To summarize my argument so far, conceptualizing culture as a network of schemas achieves some of the criteria I have proposed for an adequate model. It builds on existing scientific knowledge, offers a simple vocabulary that addresses the full range of relevant cultural elements, describes how culture is organized, and is useful at both micro and macro levels. In this section, I illustrate how a network model can aid in visualizing and reasoning about culture by making explicit the relations among schemas. My example translates into network form the narrative explanations that demographers and social historians (Thornton, Axinn & Xie 2007; Cherlin 2009; Coontz 2005) have offered to explain the cultural underpinnings of changes in marriage in the United States over the last half century. It illustrates how we can model changes in cultural landscapes as changing relations among schemas caused by external events and social action and how the initial structure of the model influences the evolution of those changes.

I start with a stylized network representation of the dominant model of marriage during the first half of the twentieth century, up through the 1950s (Figure 7a). This model centered on three interrelated sets of schemas. One set linked love and companionship to the idea of mutual support between partners. A second focused on the economic foundation of marriage: the idea of separate spheres in which women depended on husbands for financial support and men for on wives for domestic labor. A third set of schemas, partially linked to both love and separate spheres, focused on sex, childbearing and childrearing. Security and commitment played a unifying role in linking all three sets of schemas together.

A "perfect storm" of events provoked changes to this model in the second half of the twentieth century. The civil rights movement brought schemas of individual rights and equality forcefully into the public sphere. Increasing material affluence propelled schemas of self-fulfillment to the forefront and fed increasing standards of consumption, while subsequent economic change challenged the ability of couples to satisfy these on a single

income. The arrival of the pill and abortion rights delinked sex from the risk of pregnancy and parenthood in the popular imagination.

How did the model of marriage evolve in response to these changes and why did it take the course it did? I argue that the structure of the cultural model as it existed in the 1950s was consequential for whether and how these external events changed marriage. For example, when the women's movement appropriated schemas of equality and rights to frame discussion of women's roles, they did so in the context of a model of marriage that valorized mutual support and companionship between partners. Parallels between female domestic servitude and the denial of rights and self-determination to black men created tension within the marriage model: how could the same model endorse love and mutual support in marriage and a female role that deprived wives of their rights (Figure 7b)? Affect Control Theory, a theory in social psychology (Ridgeway & Smith-Lovin 1994), suggests that when ideas with discordant affective values are brought together, something has to happen to restore equilibrium. In this case, some women began to devalue marriage (Thornton & Freedman 1982) while others moved to change gender roles within marriage.

The challenge to separate spheres was also supported by the existence of other schemas within the culture. Experience during World War II powerfully demonstrated women's capabilities to contribute outside the home while scripts legitimizing women's work as "helping to make ends meet" had evolved in working class culture (Figure 7c). These schemas were largely avoided in popular culture valorizing the ideal of separate spheres during the 1950s (Coontz 2011), but were available to women reframing the discussion of women's roles and increasingly important as rising consumption standards and declining real wages for less-educated men drove women into the workforce.

The arrival of the pill and abortion rights both changed the model of marriage and made it less necessary. These developments made possible a new model of singlehood that incorporated elements initially tied only to marriage – first sex, and then reproduction and childrearing as well (Figure 7d). Although sex, reproduction, and childrearing activities remained elements of the cultural model of marriage, their associations with marriage were weakened by the competing model. With society tolerating alternative approaches to family formation, women no longer needed to marry.

With two of the three sets of schemas that were initially central to marriage seriously challenged, why didn't the model simply disintegrate or fade away? And how did its initial structure allow it to survive, albeit in an altered form? Cherlin (2009) makes a convincing argument that marriage has remained strong because it has become a means to self-fulfillment. This was possible because, by the time that the perfect storm of events undercut the dominant model of marriage, marriage was already linked to self-fulfillment, experienced as love, companionship, mutual support, and sexual satisfaction. If this core had not been central to marriage (e.g., if marriage had been seen as primarily an economic arrangement), the changes of the 1960s and 1970s might well have made marriage obsolete. Instead, a new model of marriage has evolved, one focused around these high-value schemas (Figure 8) and the schema of commitment and security central to the initial model. A new economic foundation that retains the male breadwinner script but makes women's economic

contributions increasingly central draws in schemas of equality and fulfillment, expands the meaning of mutual support, and integrates more comfortably with schemas related to love and companionship. Links to sex, childbearing, childrearing and female domesticity are still active in the culture but their links to marriage are attenuated.[13]

The illustration above is limited to showing, in principle, how one could translate existing accounts of cultural change into network form and relate network structure to evolution in the cultural underpinnings of demographic change. Going further depends on my final criterion for an adequate model of culture – that it permit quantification.

Quantification, measurement, and integration

Demographers have long been quantifying elements of culture through the use of surveys to measure and analyze attitudes, values, beliefs, subjective norms, and behaviors (e.g., Thornton, Axinn & Xie 2007; Martinez et al. 2006). This approach has served us well, providing not only important descriptive information about cultural trends but also evidence for the influence of cultural factors in demographic behaviors. For many of our purposes, these existing methods may provide an optimal approach.

However, by making the elements of culture explicit and opening the door to analyzing their ties and structures, a network model may take us further in three ways. First, it makes the assumptions implicit in our current approach both explicit and open to investigation. We assume that our measures are capturing the key schemas that drive our demographic outcomes; that they have equivalent meaning across groups; and that they can be understood apart from the structure of the cognitive or cultural models from which they are drawn. Second, the network model also focuses attention on measuring meanings as well as attitudes – so that we can tell not only that two groups value marriage equally but also that they hold similar cultural models of what it entails.

Third, a network model offers up new quantitative measures of the structure of cultural models that could be used as independent or dependent variables. For example, if we are interested in understanding cross-national variation in the linkage between female labor force participation and low fertility, we might develop network *distance* measures for the relation between work and motherhood schemas in cultural models of female adulthood. We could measure the levels of *centrality*[14] of filial and conjugal bonds in cultural models of the family, as a step towards testing Livi-Bacci's (2001) hypothesis that it is the filial dimension of familism that has led to low fertility in Italy and Spain.

Deriving valid empirical measures of schemas and their network structure is a challenge. The best way to measure the schemas people carry in their heads is to make them use them. This is what attitude and belief items familiar in demographic surveys do; it can also be

---

[13]This new model is now being transformed in new ways. With the framing of gay marriage as an issue of rights and equality, the solid association of heterosexuality with marriage in traditional marriage models was challenged and is being progressively undermined (Baunach 2011). At the same time, many aspects of traditional marriage models – e.g., mutual support, love, exclusivity, childrearing, commitment – are adopted in same-sex relationships.
[14]*Distance is defined as the minimum number of ties required to connect two particular nodes in a network; centrality is a measure of the importance or influence of a particular node within a network. A simple measure of centrality is the number of ties a node has.*

accomplished through card sorts (Shweder 2003; Brown et al. 2006), vignettes (Nock, Kingston, & Holian 2006), open-ended nondirective probing (D'Andrade 1995), and a host of well-developed ethnographic methods. Laboratory methods that assess emotional reactions to stimuli, attentional focus, and reaction times may provide new windows into the structure and affective content of schemas. These are beginning to move out of the lab into web-based research and even personal interviews. For example, the Implicit Association Test, which is now implemented on the Web, has provided evidence that racism shapes Americans' cognitive responses even when they are completely unaware of having racist feelings (Greenwald, et al. 1998).

Other new methods provide powerful ways of measuring how schemas are organized in relation to one another. Data mining techniques for textual data – in various media, and in people's stories and conversations – draw out the relationships among ideas, the distribution of ideas across social space, and the affective meanings associated with people and events (e.g., Carley 1994; Hopkins & King 2010). For example, Rackin (2013), analyzing qualitative interview data, shows that meanings of marriage and childbearing are deeply intertwined among young African-American men and women who are not yet parents. Her conclusion is based on a computational analysis of how relevant terms are used in relation to each other in the interviews.[15]

Tools like this may enrich our ability to describe cultural variation within and across populations. With the massive expansion of "big data" – which I define as the electronic capture of the trillions of transactions, posts, calls, and movements that populations generate each day – material for mapping cultural sharing and variation is more accessible than ever. [16] New tools and data could also allow us to study how these patterns emerge by relating measures of cultural network sharing and variation to group members' social network patterns, status hierarchies and institutional ties. Some anthropologists have done similar analyses in semantic domains such as kinship and emotion and in behavioral domains like game-playing. They are able to show empirically that meanings are shared, and that the degree of sharing is structured by shared language and nationality (Romney & Moore 2001).

How could we integrate a network model of culture into demographic research? For conventional comparative or trend analyses, quantitative measures of cultural models could serve as variables in regression equations. However, a network model of culture also invites new kinds of modeling. Regression models provide an awkward fit to modeling culture because culture so rarely acts as an exogenous independent variable.[17] However, dynamic systems (Sterman 2001) and agent-based modeling (Epstein 2006) represent endogenous processes well; they can be used to examine hypotheses about processes of cultural change and their relationship to demographic outcomes. For example, such models might be used to explore whether and how internet dating has affected marriage (Slater 2013). By embedding

---

[15]Moody (2013) conducts a similar analysis using essays on personal beliefs posted to a website called "This I Believe."
[16]The validity of these measures has yet to be carefully established and many lessons remain to be learned about their use in context of theoretically informed demographic studies. Bringing demographic perspectives to bear on these issues is vitally important.
[17]Cultural variables are not uniquely subject to the problem of endogeneity, but because cultural schemas and their material expressions are interdependent, the threat of endogeneity is more commonly perceived in this domain. That is not to say that cultural variables cannot act in exogenous ways, as in the exportation of new ideas from one culture to another.

network models of marriage in a multi-level dynamic model, we might trace the impact of this newer technology shock on marriage behavior by analyzing how cultural meanings have evolved around it.

A network model also invites new kinds of questions. Too often, demographers limit themselves to asking questions that our existing tools and data can answer. Investing in new tools and data may enable us to ask, and answer, more of the "how and why" questions critical to understanding population change:

- Do models of gender vary across sub-Saharan Africa and do these variations affect variation in the slowing pace of fertility declines?

- How does the fit between new immigrants' cultural models and those in their destination communities affect their adaptation? What kinds of misfit are most damaging to immigrants' well-being?, and

- How do dominant American schemas of individualism and freedom affect health behaviors, the health care system, and, perhaps ultimately, the U.S. disadvantage in health and mortality relative to other advanced economies?

Conclusion

I have argued that culture should stop being demography's reluctant bedfellow and develop a committed partnership. Culture has always been a necessary element in thinking about population change and variation, even if we have not always recognized its implications for the subjects we address and the tools we use. Many demographers have contributed to our understanding of culture and its relationship to population phenomena: anthropological demographers and qualitative sociologists who have conducted ethnographic studies of family, fertility, migration, and mortality and quantitative analysts who have exploited survey measures to understand variation and change in attitudes and beliefs across populations and their impact on demographic behavior at the individual level.

My goal in this essay has been to underscore the potential for improving the conceptualization, measurement, and integration of culture in demographic research. I suggest that a network model of culture, grounded in cognitive science, may provide a useful tool. I focus on the cognitive dimension of culture, not because material culture is unimportant, but because meaning is central to both material and nonmaterial culture. My model develops a conceptualization of what culture consists of (schemas) and how it is organized (a network structure) at a more basic level than other models that have been used in research on culture. In doing so it provides a means to bridge existing models. It captures the holistic nature of culture. It embraces the institutional model of culture but allows us to address aspects of culture that are not easily captured within an institutional framework. It recognizes the tool kit model's insight that cultures often provide a multiplicity of beliefs, worldviews, and scripts that may not be coherent or consistent, but insists that these are nevertheless organized in relation to each other and that this organization is consequential for people's use of culture.

For demographers, the model may provide a way to explicitly model the organization of cultural schemas and to develop quantitative measures that capture features of that organization. These, in turn, could be used to enrich our understanding of how cultural attributes are distributed within and across populations and the ways in which distributions, in combination with material opportunities and constraints, contribute to demographic outcomes.

The next step in pursuing a network model is to use existing data and methods to develop an empirically-based example, a task that I did not attempt in this essay. Depending on the precise question to be explored, existing survey measures of attitudes, beliefs, and values could be used for this, as could the many burgeoning forms of "big data." The development of empirical examples will be facilitated by continuing innovation in methods for measurement and modeling.

Demographic data on marriage and divorce testify plainly to the challenges involved in building and maintaining committed partnerships. This essay undoubtedly leaves many unanswered questions and doubts about the value and feasibility of the network model I have proposed. My intention has been to offer one possible pathway towards improving the integration of culture in demographic research as a way of inspiring others to take on the task.

Acknowledgments

References

Abma, JC.; Sonenstein, FL. Vital Health Stat. Vol. 23. National Center for Health Statistics; 2001. Sexual activity and contraceptive practices among teenagers in the United States, 1988 and 1995..

Akerlof GA, Yellen J, Katz LF. An analysis of out-of-wedlock childbearing in the United States.". Quarterly Journal of Economics. 1996; 111(2):277–317.

Basu AM. The emotions and reproductive health. Population and Development Review. 2006; 32(1): 107–121.

Baunach DM. Decomposing trends in attitudes toward gay marriage, 1988–2006. Social Science Quarterly. 2011; 92(2):346–363. [PubMed: 21919270]

Behrman JR, Kohler H-P, Watkins SC. Social networks and changes in contraceptive use over time: Evidence from a longitudinal study in rural Kenya. Demography. 2002; 39(4):713–738. [PubMed: 12471851]

Bernardi L, Hutter I. The anthropological demography of Europe. Demographic Research. 2007; 17:541–566.

Bledsoe, CH. Fertility and culture: Anthropological insights.. In: Smelser, NJ.; Baltes, PB., editors. International Encyclopedia of the Social & Behavioral Sciences. Elsevier; New York: 2001. p. 5517-5522.

Bledsoe CH, Hill AG, d'Alessandro U, Langerock P. Constructing natural fertility: The use of Western contraceptive technologies in rural Gambia. Population and Development Review. 1994; 20(1):81–113.

Boas, F. Race, Language, and Culture. Free Press; Chicago: 1940.

Bongaarts J, Watkins SC. Social interactions and contemporary fertility transitions. Population and Development Review. 1996; 22(4):639–682.

Bourdieu, P. The Logic of Practice. Stanford University Press; Stanford: 1990.

Brewster KL. Neighborhood context and the transition to sexual activity among young black women. Demography. 1994; 31(4):603–614. [PubMed: 7890095]

Brown RA, Worthman CM, Costello EJ, et al. The Life Trajectory Interview for Youth (LTI-Y): Method development and psychometric properties of an instrument to assess life-course models and achievement. International Journal of Methods in Psychiatric Research. 2006; 15(4):192–206. [PubMed: 17266015]

Browning CR, Burrington L, Leventhal T, Brooks-Gunn J. Neighborhood structural inequality, collective efficacy, and sexual risk behavior among urban youth. Journal of Health and Social Behavior. 2008; 49(3):269–285. [PubMed: 18771063]

Bumpass LL. What's happening to the family? Interactions between demographic and institutional change. Demography. 1990; 27:483–498. [PubMed: 2249741]

Caldwell JC. Toward a restatement of demographic transition theory. Population and Development Review. 1976; 2:321–366.

Caldwell JC, Caldwell P. The cultural context of high fertility in sub-Saharan Africa. Population and Development Review. 1987; 13:409–437.

Carley KM. Extracting culture through text analysis. Poetics. 1994; 22:291–312.

Carley, KM. Learning and using new ideas: A sociocognitive perspective.. In: Casterline, JB., editor. Diffusion Processes and Fertility Transition: Selected Perspectives. National Academy Press; Washington, D.C.: 2001. p. 179-207.

Carlson M, McLanahan S, England P. Union formation in fragile families. Demography. 2004; 41(2): 237–261. [PubMed: 15209039]

Carter, AT. Agency and fertility: For an ethnography of practice.. In: Greenhalgh, S., editor. Situating Fertility. Cambridge University Press; New York: 1995. p. 55-85.

Casterline, John B., editor. Diffusion Processes and Fertility Transition: Selected Perspectives. National Academy Press; Washington, D.C.: 2001.

Cherlin AJ. Remarriage as an incomplete institution. American Journal of Sociology. 1978:634–650.

Cherlin AJ. The deinstitutionalization of American marriage. Journal of Marriage and Family. 2004; 66(4):848–861.

Cherlin, AJ. Marriage-Go-Round: The State of Marriage and the Family in America Today. Vintage Books; New York: 2009.

Cleland J, Wilson C. Demand theories of the fertility transition: an iconoclastic view. Population Studies. 1987; 41(1):5–30.

Coale, AJ. The demographic transition reconsidered.. [Proceedings of the] International Population Conference; Liege. 1973; Liege: International Union for the Scientific Study of Population; 1973. p. 53-72.

Coale, AJ.; Watkins, SC., editors. The Decline of Fertility in Europe. Princeton University Press; Princeton: 1986.

Coontz, S. Marriage, A History: How Love Conquered Marriage. Penguin; New York: 2005.

Coontz, S. A Strange Stirring: The Feminine Mystique and American Women at the Dawn of the 1960s. Basic Books; New York: 2011.

D'Andrade, RG. The Development of Cognitive Anthropology. Cambridge University Press; Cambridge: 1995.

Damasio, A. Self Comes to Mind: Constructing the Conscious Brain. Pantheon; New York: 2010.

Davis K. The forms of illegitimacy. Social Forces. 1939:1,77–89+114.

Davis K. The theory of change and response in modern demographic history. Population Index. 1963; 29(4):345–366. [PubMed: 12335951]

Davis K, Blake J. Social structure and fertility: An analytic framework. Economic Development and Cultural Change. 1956; 4(3):211–235.

DiMaggio P. Culture and cognition. Annual Review of Sociology. 1997; 23:263–287.

Epstein, JM. Generative Social Science: Studies in Agent-Based Computational Modeling. Princeton University Press; Princeton, NJ: 2006.

Freedman R. Theories of fertility decline: A reappraisal. Social Forces. 1979; 58(1):1–17.

Fricke, T. Culture theory and demographic process: Toward a thicker demography.. In: Kertzer, DI.; Fricke, T., editors. Anthropological Demography: Toward a New Synthesis. University of Chicago Press; Chicago: 1997. p. 248-277.

Gazzaniga, M. Who's in Charge?: Free Will and the Science of the Brain. Ecco; New York: 2011.

Geertz, C. The Interpretation of Cultures: Selected Essays. Basic; New York: 1973.

Greenhalgh S. Fertility as mobility: Sinic transitions. Population and Development Review. 1988; 14(4):629–674.

Greenwald AG, McGhee DE, Schwartz JLK. Measuring individual differences in implicit cognition: The Implicit Association Test. Journal of Personality and Social Psychology. 1998; 74(6):1464–1480. [PubMed: 9654756]

Hammel EA. A Theory of Culture for Demography. Population and Development Review. 1990; 16(3):455–485.

Hannerz, U. Soulside: Inquiries into Ghetto Culture and Community. Columbia University Press; New York: 1969.

Hannerz, U. Cultural Complexity: Studies in the Social Organization of Meaning. Columbia University Press; New York: 1992.

Harding, DJ. Living the Drama: Community, Conflict, and Culture among Inner-City Boys. University of Chicago Press; Chicago: 2010.

Hirschman C. Why fertility changes. Annual Review of Sociology. 1994; 20:203–233.

Hopkins D, King G. A method of automated nonparametric content analysis for social science. American Journal of Political Science. 2010; 54(1):229–247.

Hornick, R.; McAnany, E. Mass media and fertility change.. In: Casterline, JB., editor. Diffusion Processes and Fertility Transition: Selected Perspectives. National Academy Press; Washington, D.C.: 2001. p. 208-239.

Ignatow G. Theories of embodied knowledge: New directions for cultural and cognitive sociology? Journal for the Theory of Social Behaviour. 2007; 37(2):115–135.

Johnson-Hanks J. What kind of theory for demographic anthropology? Demographic Research. 2007; 16(1):1–26.

Johnson-Hanks, J.; Bachrach, CA.; Kohler, H-P.; Morgan, SP. Understanding Family Change and Variation: Towards a Theory of Conjunctural Action. Springer; New York: 2011.

Kalmijn M, Tubergen FV. A comparative perspective on intermarriage: Explaining differences among national-origin groups in the United States. Demography. 2010; 47(2):459–479. [PubMed: 20608106]

Kennedy D. Cognitive models of fertility decline in Oaxaca City, Mexico. Population and Environment. 2004; 25(3):243–274.

Kertzer, D. Political-economic and cultural explanations of demographic behavior.. In: Greenhalgh, S., editor. Situating Fertility. Cambridge University Press; New York: 1995. p. 29-52.

Kertzer, D.; Fricke, T. Towards an anthropological demography.. In: Kertzer, DI.; Fricke, T., editors. Anthropological Demography: Toward a New Synthesis. University of Chicago Press; Chicago: 1997. p. 1-35.

Kohler H-P, Behrman JR, Watkins SC. The density of social networks and fertility decisions: Evidence from South Nyanza District, Kenya. Demography. 2001; 38(1):43–58. [PubMed: 11227844]

LeDoux, J. Synaptic Self: How Our Brains Become Who We Are. Penguin; New York: 2002.

Lesthaeghe RJ. A century of demographic and cultural change in Western Europe: An exploration of underlying dimensions. Population and Development Review. 1983; 9(3):411–435.

Lesthaeghe RJ, Meekers D. Value changes and the dimensions of familism in the European Community. European Journal of Population. 1986; 2:225–268.

Lesthaeghe R, Surkyn J. Cultural dynamics and economic theories of fertility change. Population and Development Review. 1988; 24(1):1–45.

LeVine, R.; Scrimshaw, SCM. Effects of culture on fertility: Anthropological contributions.. In: Bulatao, R, A.; Lee, RD., editors. Determinants of Fertility in Developing Countries: Supply and Demand for Children. Vol. II. Academic Press; New York: 1983. p. 666-695.

Liefbroer AC, Billari FC. Bringing norms back in: A theoretical and empirical discussion of their importance for understanding demographic behavior. Population, Space, and Place. 2010; 16:287–305.

Livi Bacci M. Too few children and too much family. Daedalus. 2001; 130:139–155.

Lockwood M. Structure and behavior in the social demography of Africa. Population and Development Review. 1995; 21(1):1–32.

Lundberg S, Pollak RA. The American family and family economics. Journal of Economic Perspectives. 2007; 21:3–26. [PubMed: 19728419]

Malthus, T. [6/10/2013] An Essay on the Principle of Population.. Electronic Scholarly Publishing Project. 1798. 1998 http://www.esp.org/books/malthus/population/malthus.pdf.

Mandler, G. Mind and Body: The Psychology of Emotion and Stress. Norton; New York: 1984.

Martinez, GM.; Chandra, A.; Abma, JC.; Jones, J.; Mosher, WD. Vital Health Stat. Vol. 23. National Center for Health Statistics; 2006. Fertility, contraception, and fatherhood: Data on men and women from Cycle 6 (2002) of the National Survey of Family Growth..

Mason, KO. Norms relating to the desire for children.. In: Bulatao, RA.; Lee, RD., editors. Determinants of Fertility in Developing Countries: Supply and Demand for Children. Vol. I. Academic Press; New York: 1983. p. 388-428.

Mason KO. Explaining fertility transitions. Demography. 1997; 34(4):443–454. [PubMed: 9545624]

McNicoll G. Institutional determinants of fertility change. Population and Development Review. 1980; 6(3):441–462.

Moody, J. This We Believe: Collective Representations of Belief Statements. Duke University; 2013. Unpublished manuscript

Morgan SP. Is low fertility a twenty-first-century demographic crisis? Demography. 2003; 40:589–603. [PubMed: 14686132]

Musick K, Seltzer JA, Schwartz CR. Neighborhood norms and substance use among teens. Social Science Research. 2008; 37:138–155. [PubMed: 18496598]

Nock, SL.; Kingston, PW.; Holian, LM. Psychological perspectives on the distribution of obligations.. In: Booth, A.; Crouter, A.; Bianchi, S.; Seltzer, J., editors. Intergenerational Caregiving. Urban Institute; Washington, D.C.: 2006. p. 333-350.

Notestein, FW. Population--The long view.. In: Schultz, TW., editor. Food for the World. University of Chicago Press; Chicago: 1945. p. 36-57.

Notestein, FW. Economic problems of population change.. Proceedings of the Eighth International Conference of Agricultural Economists; London: Oxford University Press; 1953. p. 13-31.

Obermeyer CM. Qualitative methods: A key to a better understanding of demographic behavior? Population and Development Review. 1997; 23(4):813–818.

Pollak RA, Watkins SC. Cultural and economic approaches to fertility: Proper marriage or mesalliance? Population and Development Review. 1993; 19(3):467–496.

Portes A. Institutions and development: A conceptual reanalysis. Population and Development Review. 2006; 32:233–262.

Preston SH. Changing values and falling birth rates. Population and Development Review 12, Supplement: Below-Replacement Fertility in Industrial Societies: Causes, Consequences, Policies. 1986:176–195..

Quetelet, A. Physique Sociale, ou Essai sur le Développement des Facultés de l'Homme. Vol. 1. Brussels: 1869.

Rackin, H. Dissertation. Duke University; 2013. Where Should Babies Come From? Measuring Schemas of Fertility and Family Formation Using Novel Theory and Methods..

Ridgeway, CL. Framed by Gender. How Gender Inequality Persists in the Modern World. Oxford University Press; New York: 2011.

Ridgeway CL, Smith-Lovin L. Structure, culture and interaction: Comparing two generative theories. Adv. Group Process. 1994; 11:213–39.

Romney AK, Moore CC. Systemic culture patterns as basic units of cultural transmission and evolution. Cross-Cultural Research. 2001; 35:154–178.

Rutenberg N, Watkins SC. The buzz outside the clinics: Conversations and contraception in Nyanza Province, Kenya. Studies in Family Planning. 1997; 28(4):290–307. [PubMed: 9431650]

Ryder NB. The cohort as a concept in the study of social change. American Sociological Review. 1965; 30(6):843–861. [PubMed: 5846306]

Sewell WH Jr. A theory of structure: Duality, agency, and transformation.". American Journal of Sociology. 1992; 98:1–20.

Shweder, R. Why Do Men Barbeque?: Recipes for Cultural Psychology. Harvard University Press; Cambridge: 2003.

Slater, D. A million first dates: How online romance is threatening monogamy. The Atlantic: Jan 2. 2013 http://www.theatlantic.com/magazine/archive/2013/01/a-million-first-dates/309195/. [6/10/2013]

Sterman JD. System dynamics modeling: Tools for learning in a complex world. California Management Review. 2001; 43(4):8–25.

Strauss, C.; Quinn, N. A Cognitive Theory of Cultural Meaning. Cambridge University Press; Cambridge: 1997.

Swidler, A. Talk of Love: How Culture Matters. University of Chicago Press; Chicago: 2001.

Thornton A. The developmental paradigm, reading history sideways, and family change. Demography. 2001; 38:449–465. [PubMed: 11723944]

Thornton, A. Reading History Sideways: The Fallacy and Enduring Inpact of the Developmental Paradigm on Family Life. University of Chicago Press; Chicago: 2005.

Thornton, A.; Axinn, W.; Xie, Y. Marriage and Cohabitation. University of Chicago Press; Chicago: 2007.

Thornton A, Freedman D. Changing attitudes towards marriage and single life. Family Planning Perspectives. 1982; 14(6):297–303. [PubMed: 7151986]

Thornton, PH.; Ocasio, W.; Lounsbury, M. The Institutional Logics Perspective. Oxford University Press; New York: 2012.

Turner, J. The Institutional Order. Longman; New York: 1997.

Tyler EB. Quetelet on the science of man. Popular Science Monthly. 1872; 1:45–55.

Vaisey S. Motivation and justification: A dual-process model of culture in action. American Journal of Sociology. 2009; 114(6):1675–1715.

van de Kaa DJ. Europe's second demographic transition. Population Bulletin. 1987; 42(1):1–59. [PubMed: 12268395]

van de Walle E. Fertility transition, conscious choice, and numeracy. Demography. 1992; 29:487–502. [PubMed: 1483538]

Warner TD, Giordano PC, Manning WD, Longmore MA. Everybody's doin' it (right?): Neighborhood norms and sexual activity. Social Science Research. 2011; 40:1676–1690. [PubMed: 22427712]

Watkins SC. Local and foreign models of reproduction in Nyanza Province, Kenya, 1930-1998. Population and Development Review. 2000; 26(4):725–759. [PubMed: 18348360]

Watkins, SC. Fertility transition: Cultural explanations.. In: Smelser, NJ.; Baltes, PB., editors. International Encyclopedia of the Social & Behavioral Sciences. Elsevier; New York: 2001. p. 5572-5575.

Weber, M. The Methodology of the Social Sciences. Shils, EA.; Finch, HA., editors. Free Press; New York: 1949. 1904

Wilmoth JR, Ball P. The population debate in American popular magazines, 1946-90. Population and Development Review. 1992; 18(4):631–668.
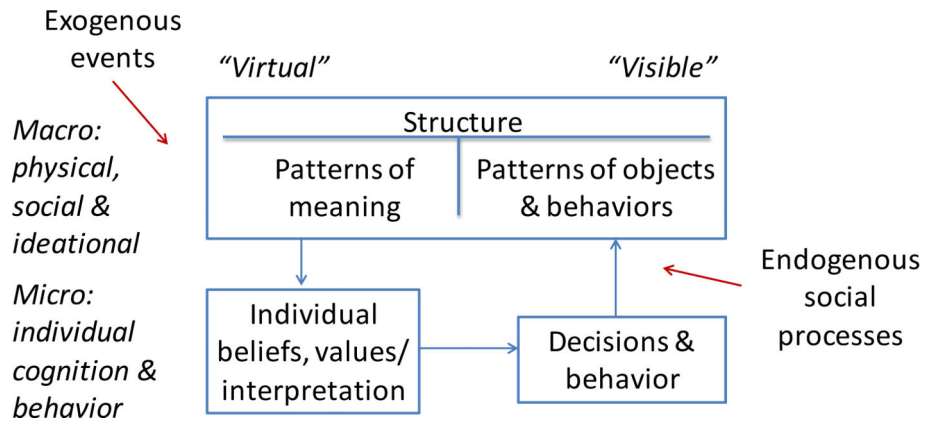
Fig 1.
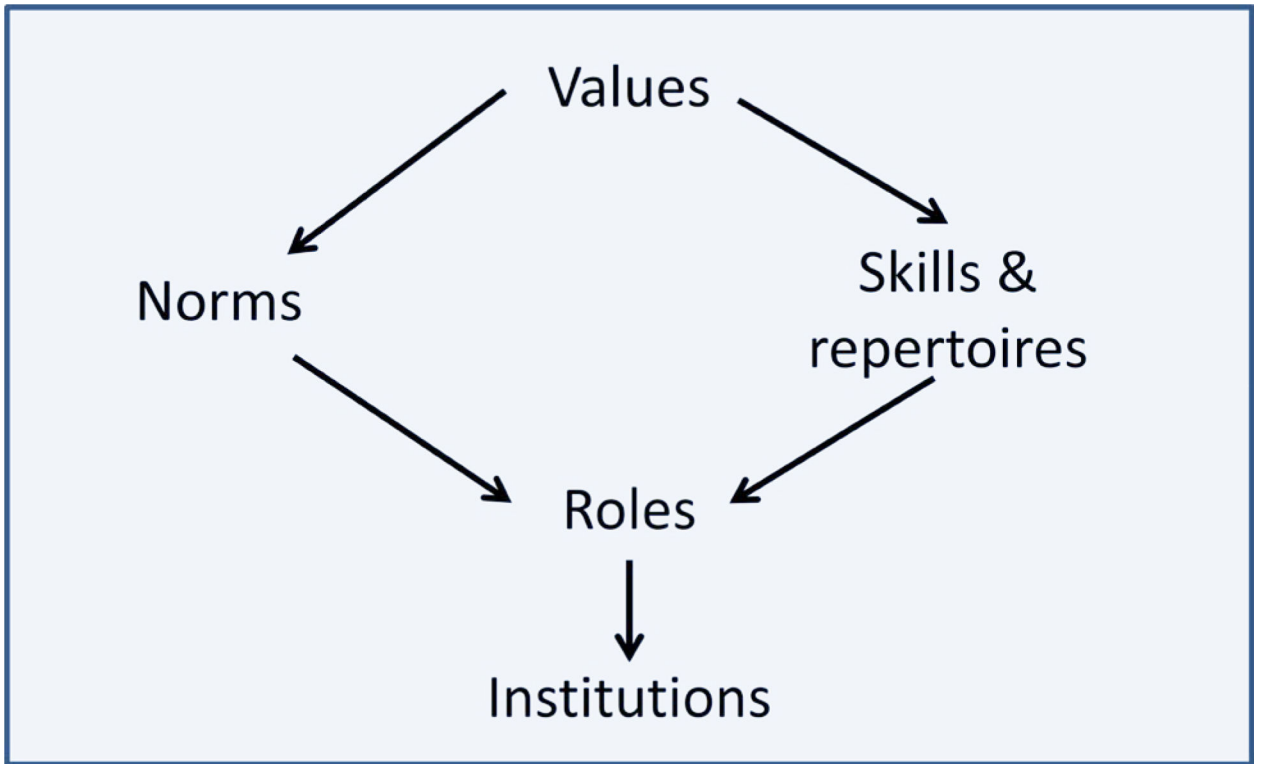Culture: A participatory and multi-level process
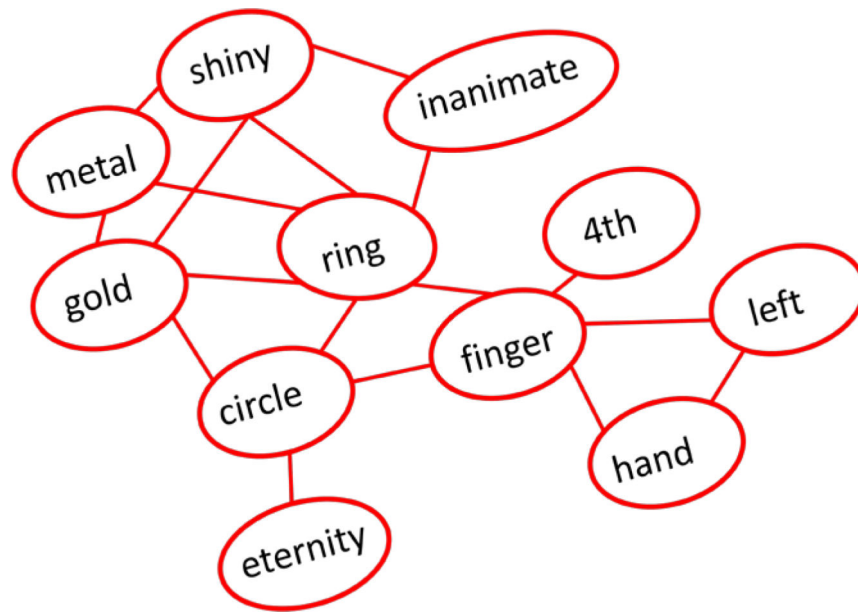
Fig. 2.
An institutional model of culture

Fig. 3.
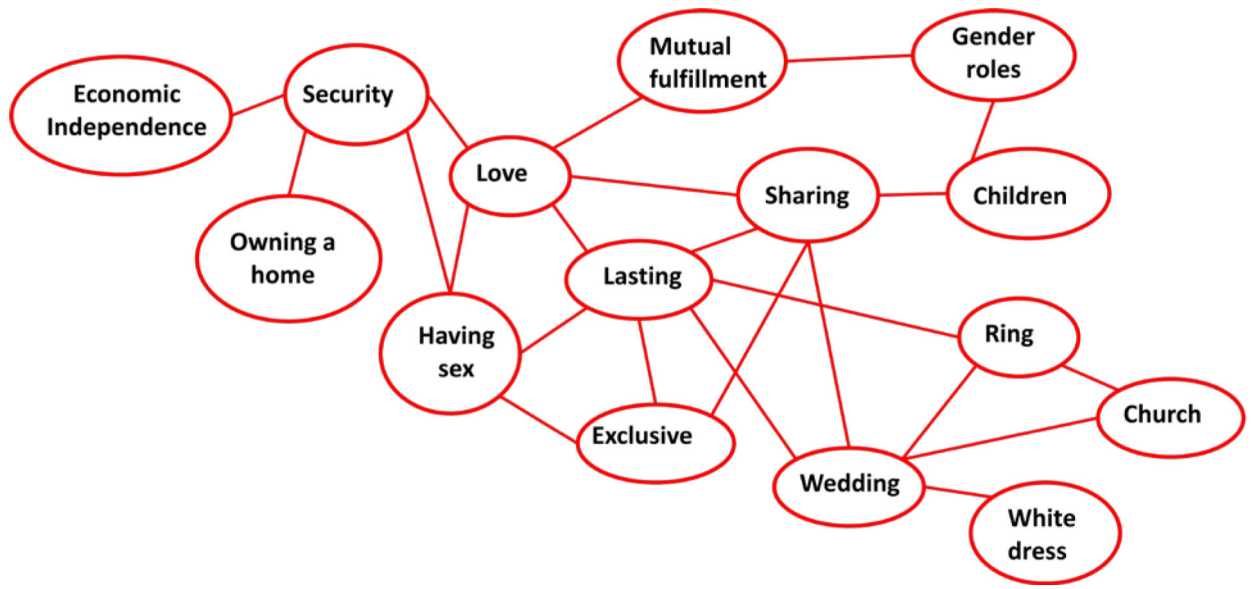A heuristic network diagram of a wedding ring schema

Fig 4.
A heuristic network model of a complex schema (model) of marriage
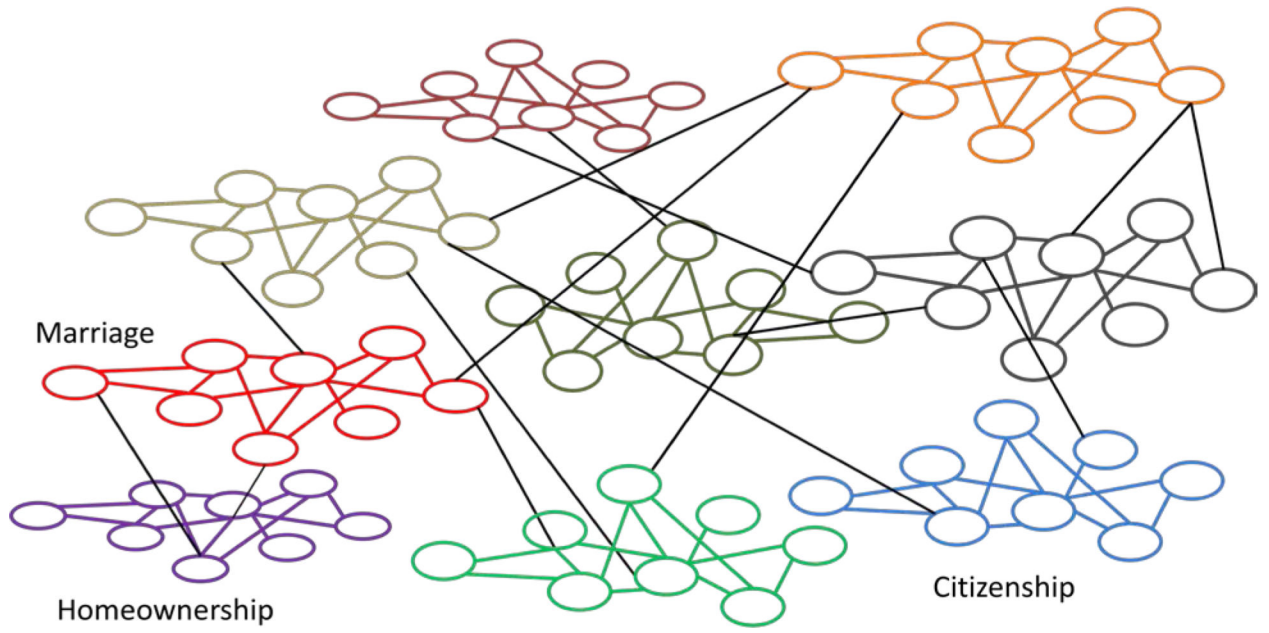
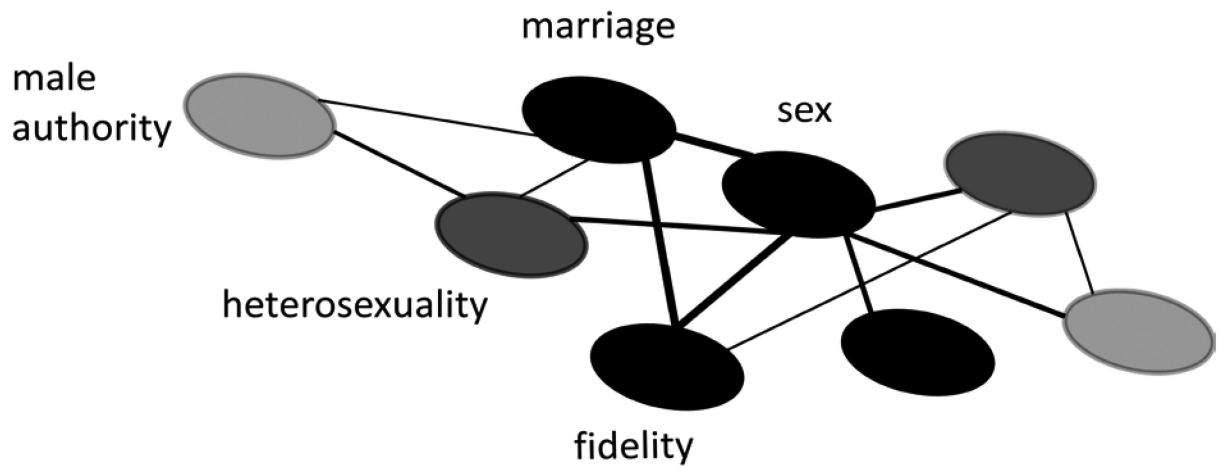**Fig 5.**
Envisioning culture as a network of complex cultural models

Fig 6.
Network representation of a cultural model that is partially shared within a population
Schemas that are more widely shared as elements of the model are represented by darker
nodes; those less widely shared by lighter nodes. Similarly, associations between elements
that are more commonly shared are represented by heavier edges and those less commonly
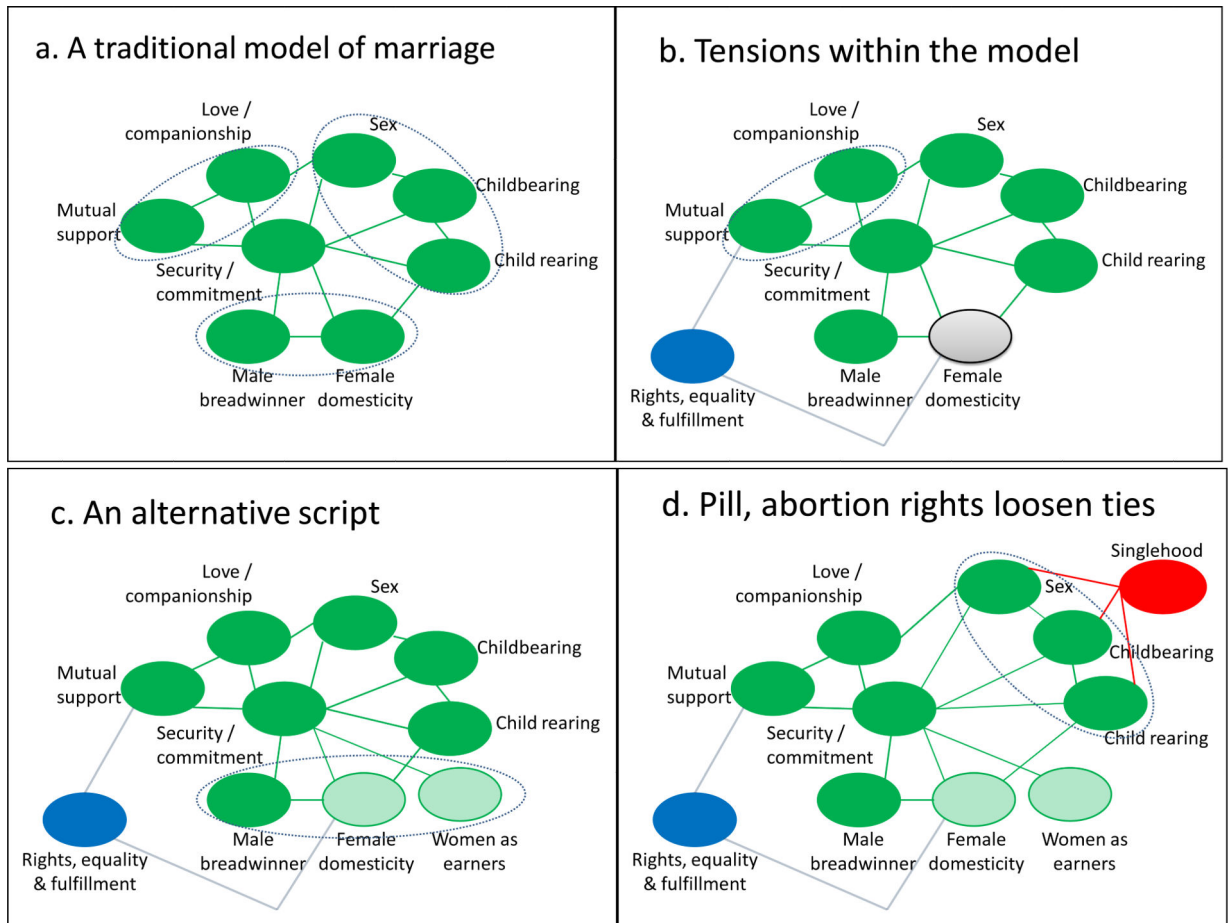shared by lighter edges.

Fig 7.
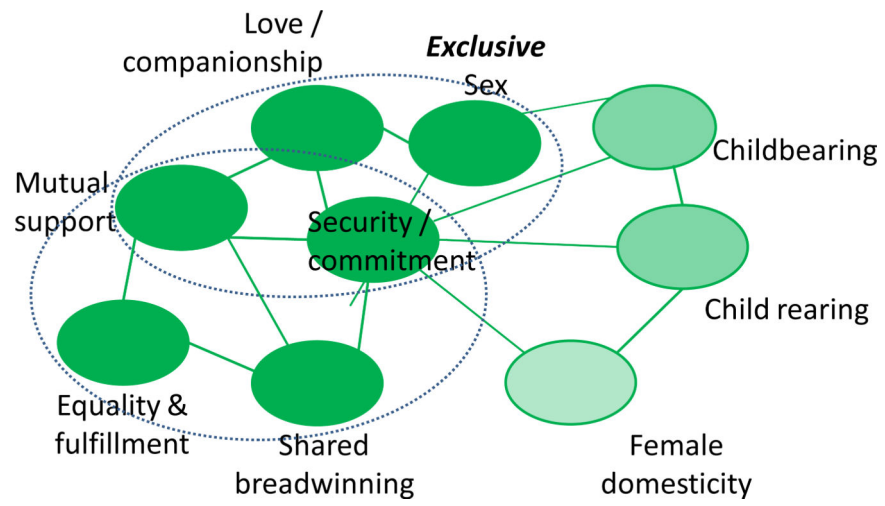A stylized network model of change in the cultural model of marriage in the U.S.

Fig 8.
Network representation of an emerging model of marriage