

# Development Of A Social Network Measure Of Acculturation And Its Application To Immigrant Populations In South Florida And Northeastern Spain.

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## **Introduction**

The concept of acculturation has evolved during the past century, adapting to dramatic changes in population flows within and between countries and continents. Acculturation was originally conceived by turn-of-the-century anthropologists as a cross-cultural phenomenon explaining the similarities of cultural traits between relatively small and geographically defined groups. It was adopted by sociologists and social psychologists in the 1940s to explain the adaptation of primarily European migrants to the U.S. and Canada. Acculturation then became an independent variable in models to explain phenomena of interest to policy-makers, such as civic participation or risky and illegal behaviors.

No longer a broad concept used to study the fundamental underpinnings of the development of culture traits, it became a pragmatic tool used by researchers and policy-makers to understand how best to integrate migrants into a large host culture. This goal was at odds with its original usage by anthropologists to understand how culture was formed and compare cultures; those who studied acculturation were now more concerned with the contact between two specific cultures and the consequences of that contact. This resulted in context-dependent acculturation scales that were not used outside of the specific cultures and geographic context for which they were designed.

During the past decade, the world has witnessed yet another change in the pattern of international migration. Where migrants from developing countries once migrated to developed countries to stay, many now take advantage of low-cost and fast public transportation and (what were) looser border restrictions to move back and forth between their home and host countries. Many have observed migrants now often derive their identity from both countries simultaneously. While current scales of acculturation attempt to capture active influences from both origin and host countries using multidimensional scales, we are looking for ways to measure adjustment to a host culture that transcends individual cultural differences.

Personal network research is ideally suited to capture these influences as a complement to current acculturation scales. Indeed, personal networks were originally conceived by Radcliffe-Brown as the web of relations that surround an individual and seen as a sound alternative to traditional anthropological approaches when explaining cultural traits within African mining towns where members tended to travel frequently between their village community and the mining community. Rather than conceiving of a culture as only place-oriented, Radcliffe-Brown and others recognized people live within a social envelope of their own that is sometimes place-oriented, and other times not.

Given that the interaction of people with their network members has without question a large influence on forming attitudes and behaviors, adapting personal network methods to the existing advances of scales of acculturation is an ideal solution to understanding acculturation in the context of transnationalism. By understanding how personal network composition and structure affect attitudes and behaviors, and how patterns of composition and structure evolve across cultural and geographic contexts, we mark a return to the objective of anthropologists to understanding the fundamentals of culture formation, while retaining the value of acculturation as an independent variable to explain dependent variables of interest. In a time when culture is increasingly less identifiable by the place of origin or so-called race of people, and more by how they interact, a personal network approach that focuses on interaction is a logical extension of the concept of acculturation. Two research objectives suggest several testable hypotheses:

**Research Objective 1: Personal network composition and structure across cultures and geographic contexts will reveal similar evolutionary patterns during the process of acculturation.**

**Research Objective 2: Features of the composition and structure of the personal networks of migrants will explain a fraction of the variation in key dependent variables that is not explained by existing acculturation scales. If this is the case, then measures of personal network composition and structure will complement existing acculturation scales.**

The research proposed here will, at a minimum, provide a systematic examination of the relationship between acculturation and personal network composition and structure. The data generated from this study will be a shared resource for anthropologists, network analysts and other researchers who study acculturation. The data will also contribute to answering a fundamental question in social network analysis – does the collection of detailed and difficult-to-collect personal network data yield unique findings, above and beyond respondent-level data that may act as proxies for personal networks? We expect to find personal network data will yield patterns that transcend cultures and geography. This will mark a return to the concept of acculturation as it was originally proposed by anthropologists – that is, as a way to understand the similarities of cultural traits.

### Background – Acculturation

Diffusionist theory dominated anthropology at the beginning of the 20th century. The focus of anthropology at that time was the explanation of the origins of cultural traits and the similarities and differences of traits between cultures. To study this, anthropologists tended to study relatively small and often geographically isolated cultures. The observation that some cultures in spatial proximity to one another shared cultural traits led these anthropologists to conclude that diffusion of traits from one culture to another was a primary force, and innovation only secondary.

Acculturation as a concept arose during this time to describe the consequence of two cultures coming into contact. As Herskovits (1938) pointed out, acculturation was (and still is) used in very different ways. Some used it to describe how a cultural trait is adopted from one culture to another, or to describe the process by which one culture becomes more like another, implying a direction of influence. Others viewed it as the bidirectional consequence of two cultures coming together. As we will see, the concept of acculturation has evolved over time to incorporate the prevailing trends of culture contact as a consequence of population movements.

Although they did not explicitly use the term, studies of acculturation were conducted by anthropologists and sociologists in the 1920s and 1930s (Thurnwald 1932, Brown 1935). Redfield’s early work with Villa Rojas (1934) in Chan Kom (and the follow-up study in the 1940s) was pioneering. Linton (1940) edited a volume that described the variable effect of White culture contact on seven American Indian tribes. By the 1940s and 1950s, anthropologists of the Manchester school were conducting studies of culture change in Africa, particularly in new urban areas, such as Ndola, Broken Hill, and Lusaka, Zambia (Mitchell 1969, Kapferer 1969, Epstein 1969). In these early years the studies of acculturation might have focused on any of the quadrants in Table 1. As we will see, since the 1950s most studies of acculturation have been focused on quadrant C.

Table 1. Examples of different types of migration

		To Developed Country	To Developing Country
From Country	Developed	<b>A:</b> European migrants to the US in the 20 <sup>th</sup> century	<b>B:</b> Missionaries, traders and administrators to colonies
From Country	Developing	<b>C:</b> Mexican migrants to the US, African migrants to Spain	<b>D:</b> Contact between cultures due to resource scarcity and population growth, refugees

Redfield, Linton and Herskovits (1936), all of whom had used the notion of acculturation in some form or another in their own research, wrote a programmatic piece in the *American Anthropologist* in an attempt to define the boundaries of acculturation. This document was an attempt to stimulate a research agenda that would result in the identification of cultural patterns that emerged from acculturation. Such

patterns would most likely come, they said, from comparisons across linguistic and geographic contexts. The idea was to understand what happens when two cultures come into contact. In this piece, they explicitly distinguished acculturation from diffusion, culture change and assimilation, all which are possible consequences of acculturation, but none of which describes it completely.

Kroeber (1948) further crystallized this agenda in his popular anthropology textbook *Anthropology: Race, Language, Culture, Psychology, Prehistory* by defining acculturation as “those changes in a culture brought about by another culture.” Again, the complete assimilation of a migrant group into a host culture is not the inevitable consequence of acculturation. In cases where migrant groups are territorially or occupationally concentrated (such as the Cuban population in Miami-Dade county Florida) assimilation may never fully occur (Thompson 1996).

As anthropologists struggled with questions surrounding the cultural similarities and differences of relatively small cultural groups (quadrant D), sociologists in the first half of the century were faced with massive migrations of Europeans to the U.S. and Canada (quadrant A). Whereas the focus of anthropologists studying acculturation was primarily to understand how cultures came about, sociologists studying acculturation were faced with the practical consequences of many different migrant groups moving to a large host culture. This marked a big change in the focus of acculturation studies and set the stage for the future. Because policymakers were in fact concerned with the practical consequences of migrant groups adapting to U.S. culture, funding for these studies far outpaced funding of traditional anthropological studies. Although these new acculturation studies were theory-driven, it was theory at a more micro and culture-specific level than had been typical of anthropological theory to that point. As a result, the focus of studies of acculturation increasingly fell into quadrant C of Table 1.

**Acculturation as a predictor variable.** In addition to becoming more directional, acculturation grew from being used as a dependent variable explained by the contact between cultures, to an independent variable that explained outcome variables of interest to policymakers. It was recognized that acculturation had many facets, and the best way to incorporate them and more fully discriminate between those who have adapted to a new physical and social environment and those who have not was to develop a scale. Overwhelmingly, acculturation studies are now scale-based, summarizing many aspects of the acculturation process into a single score.

These acculturation scores are used to predict outcome variables, like whether immigrants will engage in risky behaviors, such as needle-sharing (Zule, et al. 2001) or unsafe sex (Nyamathi, et al. 1993; Snowden and Hines 1998). Public health officials have identified lower levels of acculturation as contributors to depression (Gonzalez, Haan and Hinton 2001; Noh and Kaspar 2003), as impediments to adherence to treatment for contagious disease (Hovell, et al. 2003), and to rates of obesity (Gordon-Larsen, et al. 2003). Acculturation has also been identified as a contributing factor to immigrant decisions to become citizens of a host country (Aguirre and Saenz 2002).

Much of this research is now conducted by scholars trained in scale construction, often social psychologists. Good scale construction requires intimate knowledge of the language and culture of the populations being studied. Indeed, acculturation scales in recent years have been developed by scholars who have long-term and personal experience with the cultures they are studying. Thus, the emphasis has been away from phenomena that may exist across cultures and geography, and more toward the testing and application of valid, context-dependent scales that are useful as independent variables in explaining behaviors of interest. Ironically, improvement in context-dependent scales makes comparisons across cultures and contexts more difficult (Sue 2003).

For example, ARMSMA-II (Cuellar, Arnold, Maldonado 1995) is a modification of an existing and widely used Hispanic acculturation scale. The primary difference between ARMSMA I and II is that factors are measured differently for each Hispanic subculture in the more refined scale in an attempt to incorporate subtle cultural differences that may explain why respondents from one Hispanic group adjust better to life in the U.S. than do those from another. Some researchers in psychology, recognizing that the same social and physical setting within the same cultural group can still result in different responses caused by differences in personal experience, have moved to the individual level and are measuring personality and psychological factors in acculturation (Kelly, Azelton, Burzette and Mock 1994).

One important contribution of the Redfield, Linton and Herskovits definition of acculturation was the notion that assimilation is not the only possible result when cultures come into contact (Chun, Balls-Organista, Marin 2003). This was in part due to the variety of contexts of culture contact they had studied (see Table 1). Several currently used scales have a linear orientation, meaning as someone becomes more of one thing (e.g., American) he or she becomes less of another (e.g., Mexican). Examples of this approach include scales developed by Landrine and Klonoff (1994), Cortes et al. (1994), and Dawson et al. (1996). Some researchers have recognized this problem and have built multidimensional, orthogonal scales (Suinn et al. 1995, Berry 1970, Ryder, Alden and Paulhus 2000). This allows the measurement of, say, Mexicanness and Americanness on various dimensions (gastronomy, language, values, etc.) simultaneously. Interestingly, unidimensional scales tend to be used more in the U.S., where cultural norms promote the idea that assimilation is the proper goal for migrants. In Canada, scales tend to take a more multidimensional view, reflecting Canadian norms and public policies (Berry 1984, Taylor and Lambert 1996).

**Acculturation and transnationalism.** Related to this approach is the notion migrants can be categorized into outcome types based on different experiences. Some researchers describe these types as strategies, suggesting that respondents differ in their goals of adapting to their new social and physical environment (Berry 2003). In addition to the more linear extremes of separation and integration, other strategies include bi-cultural integration (where the respondent consciously maintains aspects of both cultures), and in some cases, marginalization (where they do not successfully adapt to either the old or the new culture). The prediction of these outcomes is also complicated by the overall willingness of the migrant's ethnic group to maintain their cultural heritage (Berry 2003). As we can see, even though these researchers study acculturation within a context, they see that increasingly migrants do not fit a directional model. In the case of Mexican migrants to the U.S., some strive to integrate into the larger American culture. Others choose to maintain their cultural identity by living in large Mexican-American enclaves that make it easier to keep their original cultural traits, both symbolic and instrumental. Others exhibit what has been identified during the past decade as a new adaptation. With the advent of cheap and efficient public transportation to most corners of the planet, and the ease with which capital is transferred across borders, migrants increasingly cross borders, or maintain communication across borders, and maintain social ties in both their origin and host countries. This trend toward transnationalism has long been recognized in anthropology (Kearney 1995).

Transnationalism (the concept that migrants maintain a culture and identity that incorporates aspects of more than one country) now competes with established theories of acculturation that are context-dependent. Some scholars suggest acculturation is a dated concept, given this trend toward globalization and transnationalism (Suarez-Orozco 2000). While the importance of incorporating transnationalism into studies of acculturation cannot be overstated, the notion that this is a new concept that has been ignored by those studying acculturation seems short-sighted. As we have seen, studies of acculturation have shifted focus in the past, based both on trends in migration and problems that capture the public eye and those of policymakers. Acculturation theory will evolve to capture the phenomena of transnationalism as well. Indeed, we suggest that the early conception of acculturation as the consequences of two cultures coming into contact better lends itself to the study of current trends in migration than the more recent context-dependent scales. Personal network composition and structure provide a solid foundation for understanding the consequences of cultures coming together, and the culture(s) that emerge as a result.

### **Background – Social Networks**

**Personal networks.** We begin with the assumption that the interaction between migrants and the people they encounter is a key element in the acquisition of new attitudes and behaviors. Measuring differences in the structure and content of that interaction across time and space should provide the data on which to judge the extent to which migrants' values, attitudes and behaviors change over time. The interaction doubtless provokes changes in the behaviors and attitudes of members of the host population as well. In this proposal we will focus primarily on members of the migrant population.

Social Network Analysis (SNA) focuses on the measurement of relationships between people. By quantifying the relationships between people, network analysts can apply models and techniques commonly used across the social and natural sciences. Two distinct approaches to SNA arose from two distinct historical traditions. The whole (or sociocentric) network approach comes from sociology and was heavily influenced by the work of Georg Simmel. Whole network analysis involves the quantification of relationships between people within a defined group – a classroom of children, a board of directors, the residents of a village or town, the trading partners in a bloc of nations. By representing relations as numbers, methods of matrix algebra, graph theory and statistical analyses can be applied to identify structural patterns and measure the association of patterns with various outcomes, like the concentration of power or other resources, within the group.

The personal (or egocentric) network approach has its roots in the work of A. R. Radcliffe-Brown and others, particularly Clyde Mitchell, John Barnes and Elizabeth Bott (Scott 2000). These anthropologists sought alternatives to sociological theory that emphasized the placement of individuals within formal institutions as a way of understanding culture and behavior. For example, the institution of kinship had served well as the basis for analysis of highly circumscribed, isolated communities, but as anthropologists began studying the growing towns of the Copper Belt of Rhodesia (Mitchell 1956), villages in Norway (Barnes 1954) and Malta (Boissevain (1973), and families in London (Bott 1957), they generalized Radcliffe-Brown's idea (1940) that the structure of society grew from the actual relations among people. As cultures came into contact with increased migration, particularly from rural to urban areas, institutions such as kinship became insufficient to explain attitudes and behavior. Instead these anthropologists focused on the individual networks of people – including kin and non-kin – and how the content of those networks affected life outcomes.

One problem faced by these researchers was the lack of technical support for managing and analyzing the data collected on personal networks. Ironically, although the study of culture change was among the motivations of anthropologists who studied personal networks, the network approach was not adopted by the sociologists and social psychologists who operationalized acculturation at the same time.

Of course, an interest in personal networks never completely disappeared in sociology. Wellman (1979) studied the networks of people in East York (in Toronto) Laumann, et al. (1974, 1977) studied organizational hierarchy, and Fischer (1982) studied how people mobilize their network connections in the mechanics of everyday living. Recently, interest in personal networks has renewed, with studies of variations in social support following a disaster (Beggs, Haines and Hurlbert, 1996), network influences on gun-carrying behavior among Black adolescents (Myers, et al., 1997), the relationship between IV-drug use and the transmission of HIV (Neaigus, et al., 1994), the effect of personal networks on voting behavior (Nieuwbeerta and Flap, 2000), and the role of personal network composition on maintaining patterns of social isolation among the urban poor (Elliott, 1999).

**Personal networks and acculturation.** The personal network methods developed by the Manchester anthropologists would have been an ideal approach to the acculturation focus of the early anthropologists and sociologists studying the topic, had they had the computer technology to take advantage of the methods. Now, such technology exists and we propose here to develop and test a new method for measuring acculturation using personal networks. Such a method, if successful, could be adapted for use in many societies today in conjunction with existing context-dependent scales.

In fact, scholars of international migration acknowledge personal networks play a key role (Lim 1987, Boyd 1989, Fawcett 1989, Massey et. al 1994). Those who migrate often follow a path taken by others in their family or community. Some researchers have calculated the multiplier effect of new migrants, based on these existing network ties, with estimates ranging from 1.2 to 1.5 for each new migrant (Jasso and Rosenzweig 1988, Arnold, et al. 1989). Although the role of personal networks is recognized in various aspects of migration (choice of destination, finding work and housing after arrival, etc.), we have found no published studies in which the composition and structure of migrants' personal networks have been measured. (An M.A. student of the PI has recently completed an as-yet unpublished personal network study of highly educated Jamaicans who are contemplating migration to the U.S. and Europe. The PI is also on the Ph.D. committee of a student at UCLA who plans to use this method to

study the relationship between acculturation, social networks and risky behavior among Latino teen immigrants.)

The study of personal networks involves, at a minimum, acquiring a list of a person's network members – called “alters” in the jargon of the field. In studies of social support, for example, people are asked to name some number of alters (three, five, ten) on whom they rely for advice or material help (Burt 1984, Wellman and Wortley 1990). Respondents may be asked to think of five people they talk to about important matters, or three people they talk to about health-care decisions. In studies of support that involve weak ties (acquaintances, rather than relatives or close friends or co-workers) respondents may be asked to list up to 60 people they know (McCarty 2002). The method for sampling respondents varies greatly depending on the study. A balance must be achieved between the number of respondents, the number of alters they will be asked about, the amount of information elicited about each alter, and the method of data collection (face-to-face, mail or telephone). Some network studies have only a handful of respondents, while others have thousands.

Most analyses of personal network data summarize the composition of the network as a set of variables that become attributes of the respondent (Fischer 1982, Schweizer et al. 1998). Along with the age, education and income-level of a respondent, the researcher may have the average age of their alters, the average strength of their ties with alters, the proportion of their network that is family or co-workers, or the proportion of their network from whom people say they can borrow money or get a ride to the doctor (Campbell and Lee 1991, McCarty et al. 1997). These measures may, in turn, be used as independent variables to predict things like scores on acculturation scales, or the dependent variables that acculturation is used to predict.

Some personal network researchers also try to measure structure within each respondent's network (McCarty 2002). To do this, the researcher must ask respondents to report not only on their relationship with each alter, but also on the relationships of all pairs of alters. The number of ties grows geometrically as alters are added. For a network of 10 alters a respondent must report on 45 ties. For a network of 50 alters they must report on 1,225 ties. The burden on informants surely explains the fact that few personal network studies have involved asking informants about the ties among all pairs of, say, 50 alters. Pair-wise tie data about the alters in a personal network can, however, be analyzed with many of the measures developed for the study of whole networks. For example, a researcher may want to test hypotheses about variability in network measures, like betweenness centrality, as a function of age or race. This has been very difficult to do, absent the kind of computer support that we have now developed and will use in this study.

The study of personal network structure is not new. Many sociologists examine the density of small, close networks on large-scale survey data (Wellman 1979). Burt created measures based on egocentric network structure within organizations (Burt 1992). However, due to the complexity of collecting structural data (adjacency matrices) of large numbers of alters across respondents, no tradition of applying other structural measures to personal network data has emerged.

**Structural analysis** There is, however, a tradition of applying structural measures in whole network analysis. Indeed, what many consider to be social network analysis is the application of structural analyses to bounded networks, such as classrooms, villages, company offices and so on. Measures such as degree centrality, structural equivalence, and components are often applied to these data. Some scholars consider it odd to apply structural measures to personal network data, a few going so far as to say researchers who do so are trying to turn personal network data into whole network data. This is not so.

Structural measures are tools or lenses for understanding data, each providing a unique perspective. The ability of some structural measures to be applied to personal network studies as well as whole network studies is merely a reflection of the usefulness of the structural measure and the existence of certain similarities between whole networks and personal networks – not an attempt to turn the latter into the former. The evolution of personal network analysis to include the application of these measures, given the validity and reliability of the data, is a natural consequence of the great advances of matrix-based analyses achieved in whole network research.

Structural measures are not synonymous with whole networks. Many measures used by whole network analysts, such as cluster analysis and multidimensional scaling, were not developed by network analysts at all. Mage, a program often used in whole network research to visualize networks, was developed by biochemists to visualize proteins. Graph theory, fundamental to many network measures, was developed prior to 1900, before its application to whole networks was recognized by Mitchell, an anthropologist with a keen interest in personal networks as well as whole networks. Whole network studies have a long and fruitful tradition of borrowing approaches pioneered in other disciplines.

There are conceptual and empirical issues surrounding the application of structural measures to personal network data (McCarty and Wulich, 2004), specifically, whether to include or exclude ego for a given measure. We will focus on eight structural measures as complements to personal network composition and acculturation-scale data (density, degree centrality, closeness centrality, betweenness centrality, eigenvector centrality, components greater than size 2, cliques greater than size 3, core-periphery and network redundancy).

### Data-Collection Methods

**Field Sites.** We have selected two locales, Miami-Dade County, U.S.A. and Catalonia, Spain, because of the extensive and diverse migrant communities in each place and because of our local contacts. The sample for this research will consist of 700 respondents – 100 Cuban, 100 Nicaraguan, 100 Puerto Rican and 100 Haitian migrants living in Miami-Dade County, Fla., and 100 Berber, 100 Gambian and 100 Equatorial Guinean migrants living in Catalonia, Spain. A power analysis based on the variance of compositional and structural measures of personal networks from a pilot study suggests a sample size of 100 will give a tolerable margin of error while maximizing the number of cultural groups to test the hypothesis of culture-specific influences (see Table 2). Network differences between groups and between respondents at different stages of the acculturation process should be detectable with these sample sizes.

Table 2. Selected compositional and structural measures from pilot study.

Measure	Mean	Stand. Dev.	Coefficient of variation	Margin of error n=100
Percent men in network	48	13	27	2.5
Average age of alters	32	10	31	1.96
Average tie strength	3.2	.65	20	.13
Degree centrality	28	17	61	3.3
Closeness centrality	37	24	65	4.7
Betweenness centrality	2	.97	49	.19
Size of network core	20	10	50	1.96
Number of components	1.3	.66	51	.13

The Miami-Dade County area is well known for its Hispanic enclave communities. According to the 2000 Census, of the 2.25 million inhabitants of Miami-Dade county, nearly 1.3 million (57 percent) are Hispanic (as defined by the census and self-reports by respondents). Half of this Hispanic population (650,000) are Cuban or of Cuban descent. A wave of Cuban migration to Florida occurred during the Spanish-American War, but most of the migration has occurred since the early 1960s. Cubans are the largest migrant population in South Florida – so large that Cuban migrants are involved in all sectors of manufacturing, while most migrant communities specialize in a few areas.

Puerto Rican migrations to the U.S. are just as well-established. Although Florida has not been a common primary migration site for Puerto Ricans, migrations from established Puerto Rican communities in New York have resulted in increasing representation in many areas of Florida. The 2000 Census estimates approximately 80,000 Puerto Ricans live in Miami-Dade County. This combination of established communities in the U.S., but relatively recent migration to Florida, represents an important contrast to the Cuban migration in terms of acculturation.

In contrast to both Cuban and Puerto Rican migrants, migrations from Nicaragua are far more recent and the communities not as well established. The 2000 Census lists roughly 84,000 Nicaraguans in Miami-Dade County. Recent telephone survey work conducted in Miami-Dade County by the PI suggests Nicaraguan households are clustered into small neighborhoods.

The Haitian Creole population of Miami-Dade County is estimated at approximately 71,000. While more recent than the Cuban migration, Haitians are more established than newer migrants, such as those from Nicaragua. Haitians are culturally distinct from Hispanic migrants in many ways, not the least of which is they are not native speakers of Spanish. A sample from this group is an important contrast to the three Hispanic groups, particularly given the large Hispanic enclave within south Florida.

The work in South Florida will be assisted by Antonio Tovar, a Latino graduate student in anthropology at the University of Florida who is studying health-care choices among Hispanic immigrants in Miami-Dade County. We anticipate hiring one other graduate student, either from the University of Florida or Florida International University, to assist with data collection.

During the last decade there has been an influx of African migrants to Catalonia, Spain. The majority are Berber immigrants from Morocco (Torres 2000), and immigrants from several sub-Saharan countries, primarily The Gambia, Senegal and Equatorial Guinea (Rodriguez, unpublished paper). As of 1996, estimates are that roughly 98,000 African immigrants are living in Spain (Comisión Interministerial de Extranjería 1997). Extrapolating from these data, that number should now be more than 275,000, especially given the recent addition of African boat people to the influx. With Barcelona as a gateway to the rest of Europe, many of these immigrants have settled there and in the rest of Catalonia. Equatorial Guineans have been migrating to Spain since Spain's occupation of the small West African country in 1778, but most have come to Spain in recent decades as the demand for low-end labor increased in Spain with its participation in the European Union. The migration of the other two groups, Moroccans and Gambians, is more recent.

The African immigrants to Catalonia are culturally very different from Hispanic immigrants to Florida. Similarities in the compositional and structural properties of the personal networks across these groups (particularly as immigrants become more acculturated based on independent scale measures), will indicate patterns that can be expected across cultures and geographic contexts – that is, the consequences of cultures coming into contact. The work in Spain will be in collaboration with Dr. Jose Luis Molina, an anthropologist at the Universitat Autònoma de Barcelona. Dr. Molina has worked with a community of Berber immigrants in Vic, a Catalonian town, for several years. His colleagues at the university have also worked with West African immigrants in other parts of Catalonia. The PI will spend three months working with Dr. Molina in Spain, conducting interviews and collecting ethnographic data on acculturation. This will be the beginning of an ongoing collaboration with Dr. Molina, who has established a personal network research program at UAB. Two local graduate students will be recruited by Dr. Molina from the Universitat Autònoma de Barcelona and his research program.

Respondents for both sites will be recruited using a combination of random selection of households in specific neighborhoods and snowball sampling to find qualifying respondents (assuming IRB approval). This method has been used in the study of IV-drug communities in Holland, where it is believed an interacting community exists but where no sampling frame exists for the selection of respondents (Frank and Snidjers 1994). This method serves to randomly select nodes throughout the structure, but to focus on locally structurally important nodes within the whole network (community). Respondents will be paid \$35 (approximately 28 euros) for participation in the study. This research will be supported by a four-month sabbatical provided to the PI by the University of Florida.

**Personal Network Data Collection.** We will use Egonet (developed by the PI), to collect personal networks for this study. This program allows us to treat summaries of alter variables – like the average age of alters or the mean-point centrality score of alters – as if they were variables of the respondent. This, in turn, allows us to statistically analyze the relation between the scores of alters on various measures and the scores of respondents on acculturation (using one of the traditional scales), income, and so on. With Egonet, the researcher enters the questions he or she wants to ask; the respondent interacts with the program and answers the questions; and the program produces a data set

where the unit of analysis is the respondent. The program also generates an adjacency matrix for each respondent (a matrix where each cell represents the tie, or lack thereof, between all pairs of alters) that can be imported into conventional network analysis packages, like UCINET (Borgatti, Freeman, and Martin 2002) and visualization packages, like Netdraw and Mage. The newest version of Egonet incorporates a visualization routine that can be used to interview respondents without exporting data to another package. It is anticipated that modifications to this program prior to data collection will incorporate all of the structural measures listed above as well as modifications to the visualization program to allow for coloring based on alter characteristics, such as whether they live in the origin or host country. Egonet consists of two Java programs, one for creating a study and the other for running the study. A study has four modules: 1) questions asked of the respondents about themselves, 2) a network elicitation module, 3) questions asked of the respondent about each alter and 4) a module asking respondents about the relationship between each unique pair of alters.

Following the programmed data collection, the data will be visualized for the respondent in Egonet. The “View Statistics” module will identify key alters based on the structural measures listed above as well as the visualization itself. In a pilot study in 2002, of 160 respondents in Gainesville, Fla., African American and White respondents from various socioeconomic levels were intrigued by the ability to see the structure of their networks and very willing to describe the groupings and bridges. Figures 1 and 2 show two sample personal networks generated by the pilot study with two very different structures. Respondent 1 was able to describe how her network consisted almost exclusively of family and neighbors who all knew each other and who offered both tangible and emotional support. Respondent 2 described a less cohesive network formed around her two jobs, family members who lived elsewhere, and smaller groups of friends. In our experience, these data are impossible to get from direct questions and probes about network connections in the abstract (that is, without the visualizations), and provide a depth to our understanding of acculturation that cannot be achieved with simple questionnaires. Visualizations based on adjacency matrices from Egonet have also been used as interviewing tools in as-yet-unpublished studies of Berber migrants in Spain, crack-addicted women in rural North Florida, Bosnian Serb and Muslims, and community leaders in the Amazon.

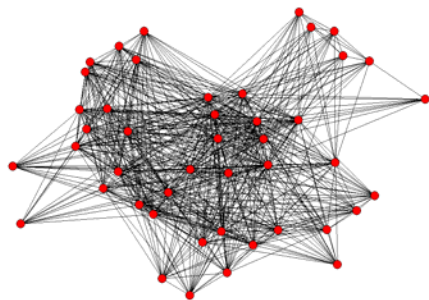


Figure 1

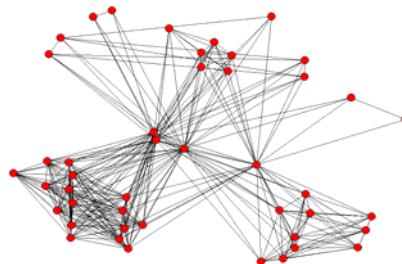


Figure 2

In the study of migrants, an extended open-ended interview using this visualization of personal network structure (coloring nodes based on alter characteristics), will allow us to explore the process of acculturation, and how that process varies in ways previously unavailable. For key informants, we will directly observe interactions with a subset of alters. And, if key informants consent, we will interview their key network alters about their interactions with the informants, including alters who are members of the host culture. Most of the ethnographic work will be conducted by McCarty and Molina.

Within each cultural group we will attempt to stratify the sample by sex, age and generation (whether the respondent was born in the host country or not) – variables the literature suggests may play an important part in explaining variability in acculturation. We expect to collect data from 87 informants in each of eight categories: roughly half men and half women, half over 30 and half less than 30, three-

quarters who were born in a different country and one-quarter who are second generation (born and raised in Florida or Spain). Our ability to achieve balance across these strata may be compromised by the demographics of those who tend to migrate. For example, most Berber migrants tend to be younger men.

**Questions Asked of Respondents About Themselves.** We recognize that translating questions into different languages is never perfect. The PI has experience in translating questionnaires from English to Spanish for large-scale surveys in the state of Florida. Molina has similar experience translating instruments for African migrant groups in Spain. We will use a combination of methods (a committee approach and back translation) to minimize errors in translating the questions asked in English and Spanish. In fact, the Spanish version of our questionnaire may reflect differences for the Spanish-speaking populations of Miami and Barcelona (particularly as the primary language spoken in Catalonia is Catalan). We will pilot-test our instruments before launching each survey.

The set of structured questions asked of respondents about themselves will include standard demographic questions (age, employment, sex, etc.) as well as an appropriate acculturation scale for the particular language group and geographic context. For the Hispanic population in South Florida we will use the ARMSMA-II. Unfortunately no validated scales exist for African immigrants. However examples of modified scales have been used with Arab migrants to the U.S. and Europe. For this study we will create Berber-specific and West African-specific scales based on scales used by Alkhazi J, et al (1997) and Tuma Hanania (2002). This process will be facilitated by Dr. Molina, his colleagues and key informants. These acculturation scales will be used in the analysis to understand the relationship between acculturation and personal network composition and structure.

To test the hypothesis that personal network composition and structure explain variability in dependent variables of interest while controlling for acculturation, we will include questions shown to be related to acculturation in previous studies. These variables were also selected because they are expected to occur commonly in a random sample of migrants. (We will not, for example, collect information about condom use or IV-drug use because, while related to acculturation, studying these outcomes would require a more targeted sampling strategy.) The dependent variables will be physician utilization/health-screening (Yu, et al. 2003; Juon, Seung-Lee and Klassen 2003; O'Malley, et al. 1999), exercise (Evenson, et al. 2003), career development (Flores and O'Brien 2002), depression (Noh and Kaspar 2003), behaviors that lead to obesity (Gordon-Larsen, et al. 2003), smoking (Kaplan et al. 2001) and fertility (Lendale and Huan 1996; Carter 2000). Questions will be adapted from instruments used in the cited studies.

Assuming that different experiences in the process of acculturation are important, we will ask a set of questions to probe this experience. These will include the year respondents first migrated, frequency and duration of visits to their country of origin, number and type of jobs held in both countries and method of arrival to the host country. It is also important to control for the effects of media exposure. Although it is intuitive that interaction with network members will affect the acculturation process, exposure to the host and home cultures through radio, TV, newspapers, flyers and organized group exposure (such as festivals) can play an enormous role as well. Indeed, for those who are introverted or cautious by nature, such influences can be more important than social interaction, although we doubt this is typical. As a control, for each respondent we will do an inventory of the type of media they are exposed to (particularly in the past month), and test the extent to which this is associated with their acculturation scores. Most scales of acculturation include some component of this, but not to the extent of detail we plan to use.

**Questions Asked of Respondents to Elicit Network Alters.** In each location, respondents will be asked to list 50 people whom they know. Although several network-elicitation questions have been used in previous studies, these tend to be biased towards very close alters. In this study we specifically want to focus on both strong and weak ties. Some studies have shown weak ties serve specific purposes that strong ties do not (Grannovetter 1973). We chose to fix the sample at 50 alters for two reasons. We know the way respondents recall alters is not random (Brewer 2000, Brewer and Webster 1999). However, several studies suggest the active personal network of respondents (those alters who actively affect their attitudes and behaviors) average between 250 and 300 (McCarty, et al. 2000; Killworth,

Bernard and McCarty, 1984). While a free list of 50 will not be random, it will comprise between 15 and 20 percent of the average person's active network, where active network means people with whom one has had contact in the past two years and whose names one can recall (McCarty et al. 2000). We believe a sample of alters of this size will capture most of the important structural features of the respondent's personal network, particularly if they are instructed to focus on close alters first. From other research, we do not believe the number of alters freely listed is a good measure of network size. Respondents stop listing alters for many reasons, such as fatigue, inability to recall or flagging interest. Network size can be estimated using other techniques that provide reliable estimates of relative network size (McCarty, et al. 2000). Additionally, by fixing the number of alters, structural measures are immediately comparable and do not have to be normalized.

**Questions Asked of Respondents About Each Alter.** The questions we ask respondents about alters will be more limited than those we ask respondents about themselves. Again, these must be questions a respondent can reasonably answer about people in his or her own network. Clearly this varies. From our experience in conducting such studies, we believe respondents can tell us accurately the sex and race (White, Black, Asian) of alters. We also believe they can tell us about some behaviors they observe when interacting with alters (e.g. language typically spoken with alter, duration of relation, frequency of contact, distance from respondent's home, mode of contact). And we believe respondents can report an opinion about the type of support they get from alters (e.g. monetary, emotional) and strength of tie on a 1-to-5 scale, as well as the type of relation (e.g. family, work, religious organization). We are less convinced respondents can tell us facts about alters that they may not have observed (e.g. exact age, length of time in host country, risky behaviors). We will ask questions from all of these categories, but will provide a "Don't Know" response as a valid alternative for these questions. These data will be used to color nodes in the interviews using network visualizations.

**Questions Asked of Respondents About the Relations Between Their Alters.** Some people may have trouble answering questions about ties among members of their networks, thus wording will be extremely important. The question used to define ties between alters is critical. We plan to use at least two definitions of a tie. The more broad definition will be whether the two alters know each other on a scale of 0 to 2 (0=not at all, 1=weak tie, 2=strong tie). For those with positive ties, we will ask a follow-up question: What is the probability that these two people interact outside of your presence (0=not at all probable, 1=somewhat probable and 2=very probable)? This second tie question is a better proxy for the exchange of information than simply knowing one another. Clearly these will have to be translated appropriately for a given cultural group. This will be done using several speakers of the same language (the committee approach), as well as back-translation. The PI directs a survey lab that employs approximately 50 Spanish-speaking interviewers, as well as a team of three instrument translators. We expect the two tie-definition questions to yield different structural features in many cases.

#### Analysis

**Research Objective 1: There are regularities across cultures and geography in personal network composition and structure.** This objective will be met by testing a series of hypotheses in which we treat personal network compositional and structural variables as attributes of respondents, and compare the means of those attributes across independent variables. The independent variables in these tests will be a) the seven cultural groups (Cuban, Puerto Rican, Nicaraguan, Haitian, Equatorial Guinean, Berber, Gambian) and the two field sites, (Miami-Dade County, Catalonia); and b) personal attributes of informants, including sex, whether the migrant is first- or second-generation, employment, length of time in country, and frequency of travel to origin country. Current acculturation theory suggests that cultural groups are important explanatory variables. This results in culture-dependent acculturation scales. Our hypothesis is that some features of personal network composition and structure vary less by cultural group than by features of acculturation that can be measured across cultures.

For example, among the compositional variables, we predict that **the proportion of network alters who live in the host country rises with other predictors of acculturation, and that this is the case across cultures, controlling for variables that transcend context, such as frequency of visits to origin country.** These predicted regularities may seem obvious, but they have not been operationalized at

this level of detail, nor tested across cultural groups and field sites. We will also test: the proportion of alters who are women; the proportion who are first-generation; who speak the native language with the respondent; who provide support for the respondent (e.g. monetary support, job opportunities, emotional support); who are co-workers, family, co-religionists; and so on.

Among the structural measures, we will test whether similarities in centrality measures, in core-periphery measures, in components, cliques and network redundancy vary by context or by attributes of the respondent. Burt has focused on the concept of bridging in egocentric networks within organizations as an indicator of social capital (2002). Johnston (2003) identified differences in bridging between urban Chinese men and women, pointing to the importance of measuring personal network attributes. Regardless of the country or culture, we hypothesize that bridging will also increase with acculturation. Specifically: **mean point betweenness centrality will be significantly higher for second-generation versus first-generation migrants, but will not differ based on cultural group and field site while controlling for generation.** This is the same concept that forms the basis of several survey-based measures of social capital. Several other such tests on structural measures will be conducted.

We also expect **those who are more acculturated will have a higher proportion of structurally important alters who are non-migrants** (a variable that combines network composition and structure). It will be particularly interesting to examine the distribution of these structurally important alters between the host and origin countries. These hypotheses will also be tested using t-tests where there are two groups, ANOVA where there are multiple groups and in regression models that measure the explanatory power of all variables simultaneously, using dummy variables to represent the cultural groups. A sample of 700 gives us sufficient statistical power to accommodate the degrees of freedom associated with several independent variables. We will explore transformations of independent variables, such as logs and quadratics, where appropriate.

We expect this level of detail about personal network composition and structure will suggest new theories of how acculturation works and new hypotheses that can be tested across cultures.

**Research Objective 2: Personal network composition and structure explain a significant fraction of variance in the behavioral and attitudinal outcomes of acculturation that are not accounted for by acculturation scores alone.** The outcomes we will test include smoking, physician utilization/health-screening, presence of depression, behaviors that lead to obesity, level of physical activity, career development and level of fertility. Variability in these outcomes has been shown to be explained, in part, by acculturation scores.

Smoking Kaplan et al. (2001) demonstrate that levels of acculturation explain a measurable fraction of the variability in smoking among Latinas ages 14-24 in the U.S.. The literature on smoking among U.S. adolescents makes clear the role of peer influences in moving from experimental to regular smoking, despite the difficulty of measuring it properly or designing interventions based on social influences (Peterson et al. 2000). By expanding the measure of the social environment to include personal network composition and structure, we amplify the signal from social influences specifically and separate it from other aspects of acculturation, such as language use.

Indeed, we believe some of the fraction of variability in these outcomes explained by acculturation scales is really the social network proxy variables used in those scales. In the case of smoking among migrant adolescents, we hypothesize that **the structural placement of alters who smoke (and particularly the most point-central alter) in their network will explain a significant fraction of the variability in smoking that is not explained by attributes of the informant.** (The PI is currently implementing a project funded by the Florida Department of Health to develop a social network intervention for adolescent-smoking prevention).

Physician utilization/health-screening A long-standing problem among migrants has been their hesitation to use physicians, and particularly preventive health care such as cancer-screening, until their health conditions become severe. One explanation for this is those who are less acculturated are not familiar with the workings of the health-care system in their host country, or that low levels of acculturation lead to fear of the consequences of contact with the system. O'Malley et al. (1999) showed that Hispanic women in Los Angeles (Columbian, Ecuadorian, Puerto Rican and Dominican) were much

more likely to have a breast exam if their level of acculturation was high. We believe that health-care access, or education about that access, is often mediated by certain types of alters and their position within the network. This has been documented among the homeless (Hatton 2001). We hypothesize that **for respondents who are women, the higher the proportion of non-migrant women in the network the more likely they are to have had health-care screening.** We will examine other forms of health-care screening and physician utilization with both men and women.

Depression Noh and Kaspar (2003) examined how migrants cope with discrimination and its related depression. Using cross-sectional data from Korean immigrants, they specifically attempted to separate the effects of cultural norms (acculturation) and social context (personal networks). Not surprisingly, they found in coping with depression, social context played a stronger role than did cultural norms in explaining successful coping strategies. This again points to the potential benefit of complementing existing scales of acculturation with more detailed and replicable measures of personal network composition and structure. We hypothesize that **the higher the proportion of alters with whom the respondent can discuss personal problems, the lower the depression scores.** Alternatively, **the structural placement in a key bridging position of alters with whom the respondent cannot talk to about personal matters will result in higher depression scores.**

Behaviors that lead to obesity Gordon-Larsen et al. (2003) point to the dramatic increase in obesity between first- and second-generation migrants. Their study of Hispanic migrants showed large differences associated with acculturation variables among foreign-born migrants, but little among U.S.-born migrants. We hypothesize that **among U.S.-born migrants, the habits of members of their personal networks affect eating habits more than do the cultural norms of their foreign-born parents. As second-generation migrants add non-migrant and U.S.-born migrants to their network, overweight behaviors will increase.**

Level of physical activity Evenson et al. (2003) interviewed 671 first-generation Latina migrants in North Carolina about their level of physical activity. They concluded the level of acculturation played a role in the level of physical activity of respondents, however they attributed a large fraction of the variability in physical activity to knowing other people who exercise. We hypothesize that **the proportion of alters within the personal network whom the respondents know to exercise will explain physical activity more than will the overall acculturation score as measured by the scale.**

Career development Flores and O'Brien (2002) found that acculturation scores partially predicted the traditionality of career choice among Mexican-American adolescents. None of the variables tested predicted non-traditional career choices. Attributes of personal networks have long been known to influence career choices (Granovetter 1973), and have been found to be important in job choices cross-culturally (Zang 2003). We hypothesize that **attributes of personal network composition (such as the proportion of alters who are employed) and structure (such as the level of bridging as operationalized by average point betweenness centrality) will be more associated with level of employment and career choice than with scores on acculturation scales alone.**

Fertility Carter (2000) measured a temporary downturn in fertility among migrant groups shortly after they migrate. Assimilation was identified as a key factor in first and second births following arrival. Landale and Ogena (1995) attributed the lack of strong social ties and social support of recent Puerto Rican migrants to union dissolution. We believe the lack of social support contributes directly to decisions to have children, and indirectly through effects such as union dissolution. We hypothesize that **higher proportions of network alters on whom migrants can rely for instrumental support will explain variability in fertility above that explained by acculturation scales alone.**

We want to point out that current acculturation scales use proxy questions for personal network composition (e.g. how many of your friends are Hispanic?), but these proxies do not fully capture the predictive power attained by measuring a sample of both strong and weak ties. These proxy questions do not address personal network structure, and the combination of composition and structure.

**Exploratory Data Analysis.** In addition to the hypothesis tests listed above, we will conduct exploratory analyses of the composition and structure of the personal networks of migrants. We will pay particular attention to the combination of the structural position of alters (e.g. the most between central)

and attributes of those alters (e.g. tie strength, relation to respondent, language spoken with respondent). We believe by combining composition and structure systematically, we will develop new ways to operationalize the web of relations that contribute to the development of attitudes and behaviors.

QAP analysis will be performed on both adjacency matrices and matrices of summarized respondent level, compositional and structural measures to determine similarities and differences between respondents. (QAP, or quadratic assignment program, computes a correlation between two or more proximity matrices and uses permutation statistics to evaluate whether the correlation is larger or smaller than what is expected by chance.) A separate analysis will use the scores from traditional acculturation scales as a dependent variable regressed against compositional and structural features of the network.

We will also use the E-I (external-internal) index, initially developed by Krackhardt and Stern (1988), to better understand the process migrants go through in developing ties outside of their group of fellow migrants. An E-I index offers interesting possibilities, as it is founded on the assumption that ties to others require resources, and that the structure of the relations within sub-groups (internal relations) affect one's ability to foster relations outside of that group (external relations). Application of an E-I index to these data may have ramifications for understanding other social phenomena, such as the social isolation experienced by African Americans (Elliott 1999). This may help explain why some migrant groups are able to maintain enclave communities that insulate them from forces that would otherwise foster assimilation into the host society.

**Qualitative Data Analysis.** The qualitative data will come primarily from interviews with respondents following the structured data collection as described above. We will present respondents with visualizations of their networks, using a visualization package built into Egonet. The PI, along with the graduate students, will ask respondents about clusters of network alters and bridging alters and how those bridging alters help or hinder the respondents' interaction with members of their own cultural group and those outside of it. The network-visualization software also allows nodes (alters) to be colored based on characteristics. For example, the interviewer can quickly display the network nodes in two colors, one for those who are migrants and another for those who are not. These colors can quickly be changed to show men versus women, age distributions, relation distributions, and overlays of these attributes with structural characteristics. This ability to interact with the visualization and ask respondents for explanations has proven to be valuable in pilot studies. Patterns that are visually apparent are often difficult to detect using summary quantitative measures, or through interactions with respondents without the network visual-aid.

We also hope to select a small set of alters within a respondent's network, but outside of the migrant group. We do not intend to conduct a personal network analysis of those alters, but with the approval of the respondent, we will interview them about the process of acculturation and their interactions with other members of the migrant community, using the respondent who mentioned them as a basis for the interview. All interviews will be transcribed and analyzed using Atlas/ti. We will use open-coding to develop a codebook for these texts. The Atlas/ti coding will be based on this codebook.

As mentioned, we also intend to conduct ethnographic observations with selected respondents, with a focus on their interactions with those within and outside of the migrant community. These observations, in the form of field notes, will also be analyzed using Atlas/ti, to understand the way that personal networks mediate or impede the process of acculturation.

**Timeline.** Data collection and analysis will take two years. Eighteen months will be devoted to data collection in Spain and Florida. Data collection will begin in Spain to maximize the contribution of Dr. Molina and his colleagues to the entire study. Data will be collected concurrently by graduate students in both Spain and Florida. From the pilot study, we know that, using Egonet, a respondent can complete a personal network survey with 50 alters in roughly two to three hours. Most of the time is consumed by the questions asked about respondents and alters, not the alter-tie questions. The software is designed so the interview can be exited and will start up at the point where it left off. Graduate students will take laptops with the program installed to respondents' homes, or to whatever location is convenient and comfortable for respondents. A total of 700 interviews will require approximately 2,100 hours – 900 hours in Spain and 1,200 hours in Florida. The project calls for two graduate students for each site at half

time for a full year. In Spain, each graduate student would require 450 hours in a year, and in Florida they would require 600.

### **Benefit to Society**

The development of a social network measure of acculturation will provide a complementary method to scaling that is both quantifiable and replicable and that can be used to compare migrant groups. Although the method is immediately applicable to anthropologists, it is anticipated that it will be useful to acculturation researchers from a variety of disciplines. If our hypotheses are confirmed, then the social network component of acculturation will be manifest. An understanding of the structural basis of these social networks and how they relate to the acculturation strategies of migrant groups will be beneficial at a variety of levels, including predicting the ease of acculturation of a particular group and determining the type of social support likely to be most beneficial. In addition, the method could be used to evaluate the outcome of interventions to assist migrant groups in acculturation.

We also anticipate this research will be a milestone in understanding the intricacies of personal network composition, structure and the combination of the two. To date, no such data set exists. These data would be shared with other researchers in the field worldwide. Many advances in social network analysis have come from reuse of primary data shared across research organizations.

We expect the collaboration between the University of Florida and the Universitat Autònoma de Barcelona represents the beginning of a center of study on personal networks. The issues that can be addressed by the personal network approach are many and of interest not only to anthropologists, but to other social scientists and public health researchers. Ultimately such a center of research will involve scholars from many countries, including developing countries in Asia, Africa and Latin America.

### **Results from Prior NSF support**

(a) NSF grant number SBR-9710353 \$174,000 (co-PI, H. Russell Bernard) 24 months

(b) Counting the Uncountable: Investigations into Social Networks

(c) Summary of Results

We developed the network scale-up method for estimating the size of populations whose size cannot be estimated using the usual sampling methods. Our method assumes a simple relationship between four quantities:  $t$ , the size of the entire population (e.g., the U.S.);  $e$ , the size of a subpopulation within the larger population;  $c$ , the number of people known to a respondent; and  $m$ , the number of people known by the respondent in the subpopulation. Provided that the distribution of the subpopulation is random, the probability that any member of a respondent's network is in the subpopulation is  $e/t$ . Thus the expected number of people known in the subpopulation by that respondent would be  $m = c * (e/t)$ .

Our method involves asking people how many people they know in 20–30 populations for which we have accurate counts. From these data we back-estimate the number of people whom our respondents know in general—that is, the size of their social networks. We call this the estimation method for  $c$ . Then we use all the data to solve for  $e$ , the population whose size is unknown. Many things can distort this simple relationship and our recent efforts have been to test several of these. We call the two most common problems “barrier” and “transmission” effects. Barrier effects occur when respondents simply cannot know people in some subpopulation members for various reasons (e.g., people in the subpopulation all live on a remote island). Transmission effects occur because all information about any person is not transmitted to everyone in that person's network. One of our most important findings concerns the relationship between reports of people known in given subpopulations and their actual size. These numbers, averaged over large representative samples, should vary proportionally to the size of the subpopulations. In fact, they do not. Our most recent efforts have been to develop a procedure for removing transmission effects using a model that describes how this information is recalled by respondents.

(d) Publications from the NSF Award

Christopher McCarty, Peter D. Killworth, H. Russell Bernard, Eugene Johnsen and Gene A. Shelley.

“Comparing Two Methods for Estimating Network Size”, *Human Organization* 60:28-39. (2000).

Peter D. Killworth, Christopher McCarty, H. Russell Bernard, Eugene Johnsen, John Domini and Gene A. Shelley “Two interpretations of reports of knowledge of subpopulation sizes.” Forthcoming Social Networks.

(e) Research projects that are ongoing as a result of the NSF award

- The correlates of network size: What does network size predict and what predicts network size?
- A comparison of network size and respondent characteristics between Mexico and the U.S.