

The Collection and Analysis of Social Network Data in Nang Rong, Thailand

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7.1 INTRODUCTION

In recent years, interest in social network approaches has increased substantially. Undoubtedly AIDS, with its intrinsic network aspects and inevitable fatal outcome, was the largest single contributor to this renewed interest in aspects of social networks among researchers interested in population and health issues. However, social network interest has also been generated among social demographers examining migration and fertility. Among migration researchers, social networks can provide crucial links between places of origin and potential destinations (e.g. Massey et al. 1987; Boyd 1989). Among fertility researchers, concerns with the evaluation of family planning programs along with the diffusion of ideas, information, and methods have led to considerable research using social network ideas, data, and methods (e.g. Watkins 1991; Kincaid et al. 1993; Montgomery and Casterline 1993; Jato et al. 1995; Mita and Simmons 1995; Entwisle et al. 1996). Indeed this interest has led to analyses of the data collected in Korea in the 1960s that linked social networks and reproductive behavior (Chung 1993; Valente 1995; Kohler 1997). Until recently, this rich Korean data had not been fully exploited.

In this chapter we describe our experiences collecting and analyzing social network data as part of a longitudinal study of general social and demographic

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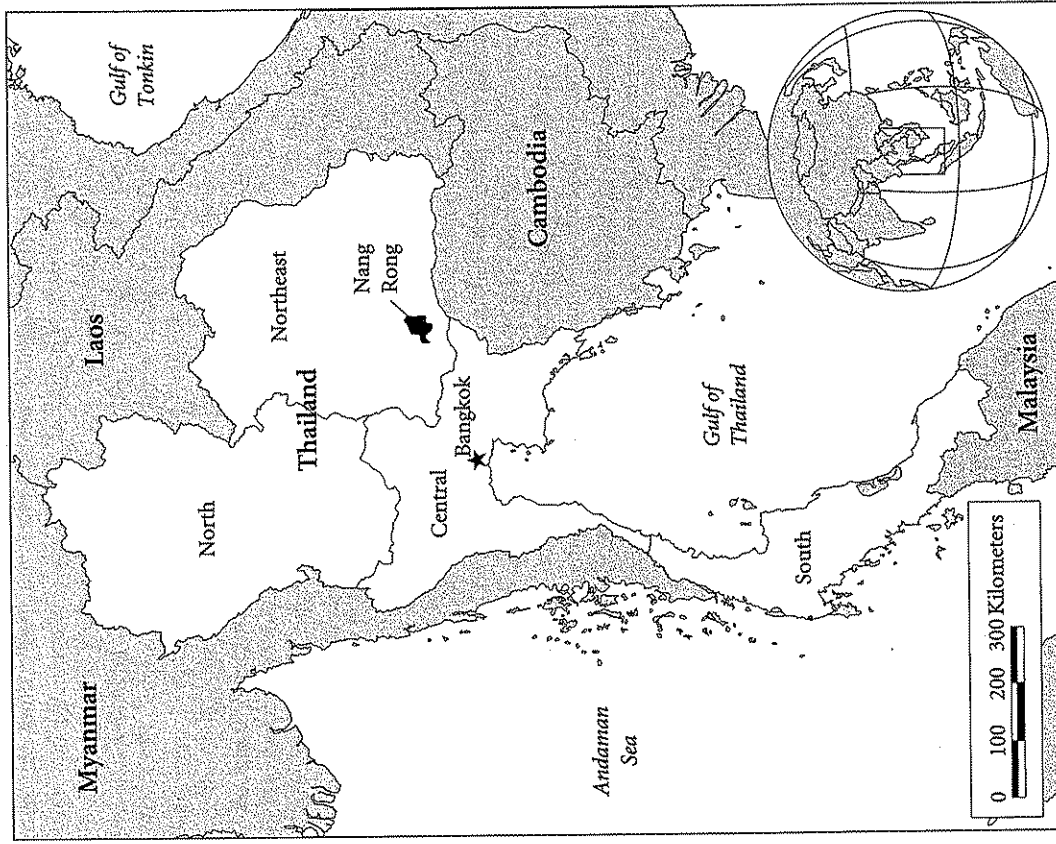
change in Nang Rong, Thailand. This longitudinal study began in 1984—prior to the recent revival of interest in social networks within the population field. Thus our motivation was not to do a social network study, but rather to add a network component to an ongoing study of social and economic change. While not directly concerned with the spread of AIDS or other infectious diseases, our experiences have relevance for those with such interests. For example, we obtain geographic coordinates for actors in social networks. This allows a geographic visualization of social network properties. It also permits comparison of social and geographic distance. The extension of this geographic-social network to disease models is a logical next step for those who study the transmission of AIDS and other infectious diseases. One could examine the spatial patterning of a disease in conjunction with the spatial pattern of social networks. Another example is our successful follow-up of out-migrants using known properties of social networks in our study area. Similar issues are likely to arise in attempting to trace sexual partners. In short, in the language of social networks, in the context of this volume, our chapter is a “bridge” chapter, linking ongoing efforts in the fertility and migration fields with those in the AIDS and infectious diseases fields. To date, our project has not specifically addressed the AIDS issue.

7.2 STUDY LOCATION: NANG RONG, THAILAND

To understand the nature and potential of the social network data we have collected, it is important to know key features of Nang Rong, our study site. These include size, economy, spatial organization, demographic history, and tradition of cooperation. Nang Rong district is located in Buriram province, in Northeast Thailand (see Map 7.1). The district is relatively small spatially, approximately 1300 square kilometers, about the size of an Eastern US county. It is also relatively small from a demographic perspective, containing 183,000 people in 1990 (National Statistics Office 1990). There were 310 rural villages in 1994 plus several market/administrative towns. Villages average about 100 households. Given this, saturated as opposed to ego-based networks are thinkable, both among households within villages and among villages within the district.

Nang Rong district is part of an area known as Isaan. Agriculture, especially rice cultivation, dominates the local economy. This area is among the poorest in Thailand, largely because of poor soils combined with low and unstable rainfall (Parnwell 1988). Over 80 percent of the average annual rain occurs during May to September, with soil moisture deficits common at other times (Rigg 1991). Floods and droughts are frequent (Fukui 1993). This means that households need to diversify risk, and a common approach is seasonal migration during the dry season. Households have network links to a number of places outside Nang Rong by virtue of migrant flows.

Within the Nang Rong villages, dwelling units are organized in a cluster, surrounded by agricultural land. Residents of the village know one another. The typical household uses two or three parcels of land, and these parcels tend not to be contiguous with one



Map 7.1. Study Area Location, Nang Rong District, Northeast Thailand

another. (See Fig. 7.1 for an illustration.) The parcels are fairly small and most agriculture in the district is rain fed rather than irrigated. This means that most households engaged in farming activities are dependent on the annual monsoon for the timing of the agricultural season and are likely to be engaged in agricultural activities at the same time as other households. Agricultural activities are occurring on small plots about the

agriculture, animal husbandry, and various cottage industries, such as raising silk worms, and (b) upgrade waste disposal facilities, increase year-round availability of drinking water, and promote health practices. PDA asked the Institute for Population and Social Research (IPSR) at Mahidol University to evaluate the success of the CBIRD project. IPSR designed and conducted a multilevel baseline survey in 1984. First, fifty villages were chosen. These were divided into forty villages chosen to receive the benefits of the CBIRD project (project villages) and ten that were to be non-project or control villages. By the time the fieldwork began one of the villages had administratively split into two, and so the number of villages in 1984 was fifty-one.

Once the CBIRD project began, it became clear that the idea of having control or non-project villages was not practical. People from the non-project villages stopped at CBIRD headquarters. Project and non-project villages interacted with one another. Hence, the distinction between project and non-project villages was dropped.¹

Community surveys² were conducted in these fifty-one villages, followed by a complete household census. The census obtained information on all household members. The 1984 round was not designed as a social network study, but its design lent itself to including network components. As is typical in surveys in rural Thailand conducted by university-based social scientists, the response rates were excellent. Nonresponse was such a non-issue that information was not kept on how many households refused. However, talking with those who were part of the staff in 1984, including interviewers, suggests that response rates were well in excess of 90 percent, and likely over 99 percent.³

The initial collaboration between the Carolina Population Center (CPC) and IPSR, which began after the 1984 data collection, focused on contraceptive use. The collaboration was subsequently broadened to include social networks, migration, and the environment. An expanded data collection took place in 1994/95, building on the earlier surveys and also reflecting these new interests.⁴ The 1994/95 data collection was the first time social network approaches were included in the Nang Rong longitudinal data sets. We describe this 1994/95 data collection in some detail, with particular emphasis on the collection of social network data.

There are three components to the 1994/95 data collection: A household survey, a migrant follow-up, and a community profile. Figure 7.2 shows how they interrelate, with each other and also with the 1984 and (planned⁵) 2000 surveys.

¹ In our multivariate analyses on a variety of topics we have tested for differences between project and non-project villages. We have not found it to be important, and so for all practical purposes we treat the two sets of villages in a similar fashion.

² The community surveys obtained contextual data for each village, including information on agricultural technology, electricity, and various social institutions.

³ Asking interviewers or supervisors about refusals usually brings a puzzled look to their face. If they think about it long enough, they might remember an occasion when a household refused. However, all the evidence is consistent with remarkably high response rates.

⁴ Between 1984 and 1988 there were a variety of small-scale data collection efforts aimed at answering specific and specialized questions. But there was no large-scale effort between 1984 and 1994/95.

⁵ Between the time this chapter was written and its publication, the 2000 data collection occurred successfully. The final section of this chapter provides a brief description.

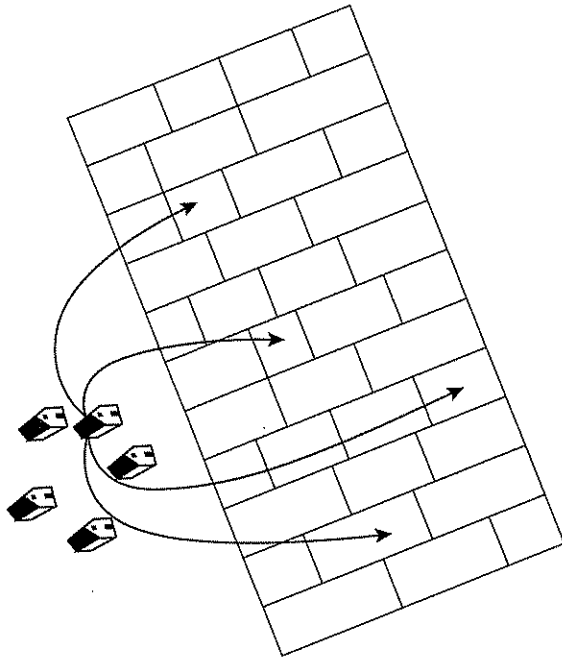


Figure 7.1. An Illustration of Nucleated Villages with Households Using Multiple Plots

same time so that interactions are also likely taking place during periods of field preparation, planting, transplanting, weeding, and harvesting.

The demographic history of the district is such that young adults now have unusually large numbers of living siblings. Those who were in their 20s and early 30s during the 1994/5 round of data collection were born after mortality had declined (and hence significantly more infants were surviving to adulthood) but before (or during) the time when fertility was declining. Thus, with large numbers being born and experiencing increased survival chances, the number of siblings is unusually large, and siblings are likely to have a more important role in each other's lives.

Finally, it should be noted that Thais in general are very cooperative with social science researchers, certainly more so than in the United States, and possibly more so than in many countries. Within Thailand, rural households are more cooperative than urban ones. During data collection times, our interviewers actually live in the villages where they are collecting data. They are known to members of the community and become trusted. The result is a remarkably high level of cooperation.

7.3 SAMPLE

The Nang Rong Surveys began as an evaluation. In 1984, the Population and Community Development Association (PDA) began a Community Based Integrated Rural Development (CBIRD) project in selected villages in Nang Rong district. The CBIRD project was designed to (a) improve skills and productive capacity in

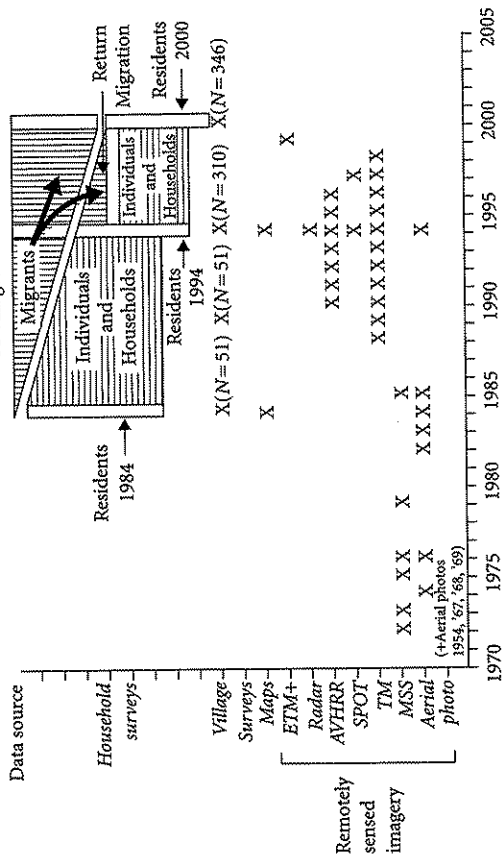


Figure 7.2. Nang Rong Data

The 1994 Household Survey was a complete census of all households in each of the fifty-one villages in the 1984 survey. Again cooperation was excellent, resulting in near universal coverage of all households in the fifty-one villages, and again exact response rates are not available. Data were collected between April and July 1994 from 7337 households. Information was obtained on 42,219 current and former members of these households.

An innovative feature of the 1994 round of data collection was the tracking and interviewing of migrants—individuals or households that were present in 1984 but were not present in 1994. The 1994/5 Migrant Follow-up collected data from out-migrants from twenty-two of the original fifty-one villages. Persons resident in 1984 but no longer resident in 1994 were candidates for follow-up if they had migrated to one of four destinations: Metropolitan Bangkok; the Eastern Seaboard (a focus of rapid growth and development), Korat (a regional city), or Buriram (the provincial capital). Migrants can be linked to their 1984 origin household, the successor to that household in 1994, and (at least in a limited way) to other migrants from the village.

The migrant survey began in September 1994 and continued through May 1995. Almost 1900 migrants were interviewed. Calculating follow-up rates is difficult for several reasons. First, for many migrants origin households did not know where they were, and hence we cannot be sure of the correct denominators. Our fieldwork procedures incorporated social network features. Whenever we found a migrant, we would show that migrant a list of migrants from her or his village and ask if they knew the whereabouts of any of them. If they did and we had not yet interviewed them, we would attempt to do so. This resulted in our interviewing some migrants

who were in our destination locations, but this was not reported by the origin households. There were also situations when the origin household reported they were in a non-target destination, and we actually found and interviewed them in a target destination. This could happen because they had moved between the time of the fieldwork in the fifty-one villages and the migrant follow-up fieldwork. Or it could simply be the case that the origin household was misinformed. The details of the follow-up rates are reported elsewhere (Rindfuss, Kaneda et al. 2003). But, in general, given the difficulty in following migrants after ten years, the fieldwork went remarkably well.

There is one final comment we would like to make about the design of the migrant follow-up. Originally, we planned to find and interview migrants in their places of destination, but it became clear that this was a difficult, time-consuming, and expensive strategy. During the migrant fieldwork we began to interview migrants in their home villages when they returned for holidays (New Year, Chinese New Year, Songkran) and this turned out to be cost-effective. More than a quarter of the migrant interviews occurred in the origin villages.

The third and final component of the 1994/95 data collection was the community survey. Interviews were conducted between March and June 1994. Information was collected about the size and composition of the village, cropping patterns, water sources, agricultural technology, electrification, transportation and communication, health and family planning services, village groups and committees, and perceptions about deforestation. In contrast to the 1984 community survey, which focused on the same fifty-one villages included in the household survey, the 1994 community survey covered all villages in Nang Rong district (310), including but not limited to the original fifty-one.

For all phases of the fieldwork, small gifts were given to respondents. These were not meant as inducements to participate. Rather they were meant as a way to say thank you for participating. For example, in the household interview, respondents were given a plastic shopping bag decorated with elephants (with elephants symbolizing the magnitude of the data collection undertaking).

7.4 DATA COLLECTION AND MANAGEMENT

7.4.1 Questionnaire design

The actual questionnaires used in the interviewing can be found on our web site, www.cpc.unc.edu/projects/nangrong/nangrong_home.html, both in Thai and English. Here we simply provide an overview, beginning with the household questionnaires. They obtained social and demographic facts about current members; yearly life history data for those between 18 and 35, including information about work and migration patterns; sibling ties for those between 18 and 35; household characteristics, including plots of land owned and rented, use of agricultural equipment, crop mix, planting and harvesting of rice, cassava, and sugar cane, which rice mill the household used, and household debts; the whereabouts and current characteristics of 1984 household members no longer residing in the household; and visits and exchanges of goods and money with former household members.

An innovative feature of the household survey was the collection of complete household networks within villages. Using a household list obtained from village headmen and updated as needed during the course of the fieldwork, ties to other households in the village due to sibling relationships, help with the most recent rice harvest, and the renting, hiring, and sharing of agricultural equipment (tractors and water pumps) were coded.⁶ With data for complete household networks in fifty-one villages, it is possible to compare networks across those fifty-one villages. For ties outside of the village, we coded the village number if the village was in Nang Rong district, the district number if the link was outside Nang Rong district but in Buriram Province, and the province number otherwise. The availability of information on ties to other villages makes it possible to investigate the salience of village boundaries to the network structure. We need not assume that social networks within villages are closed. Information about membership in the most active local group (determined as part of the village survey, which preceded household data collection), where household members lived at age 10, and use of local rice mills was also collected in the household survey—information that can be used to infer social networks. A complete list of specific questions included in the household survey that are relevant to social networks is contained in the Appendix to this chapter.

The migrant follow-up obtained information about actual migration experience, contact with other migrants from the origin village, visits and exchanges of goods and money with the origin household in Nang Rong, yearly life history data for the migrant and for others between 18 and 35 living in the migrant's household, sibling ties, and household characteristics. A substantial amount of social network data was collected, including some ego-based questions about potential help finding a job or borrowing money in the place of destination. The Appendix lists the specific questions included in the Migrant Follow-up.

The community questionnaire also contained social network information. Complete networks based on sharing temples, schools, water sources, bus routes, and access to major highways as well as those arising directly from labor exchanges and equipment rental are part of the village data. One can also consider ties outside Nang Rong district. By design, the household network data are embedded within village networks. Thus, social ties can be viewed from a multilevel perspective. The Appendix lists the social network generators included in the village survey.

All the questionnaires were interviewer administered, typically in a group setting. For example, in the household interviews, frequently multiple members of the household were present, and sometimes neighbors. Since we did not ask any sensitive questions or attitudinal items, this group interview approach worked quite well. Frequently, if the primary respondent did not know the answer to a question, another household member would supply the information. Further, the group interview approach also made the participants feel more comfortable and relaxed.

⁶ The design of these questions was based on prior qualitative fieldwork, which suggested that considerable social interaction occurred while women were milling rice and while members of different households were helping each other with agricultural activities.

7.4.2 Fieldwork

During the fieldwork in the villages, interviewers stayed in the village and got to know villagers. This developed trust between the interviewers and village residents, and thus respondents were more likely to give the interviewers the locations of migrant household members. There were seven teams of interviewers, and each team had one assistant supervisor and four or five interviewers.

Supervisors were full time researchers of IPSR. Assistant supervisors were recruited specifically for the project, in Bangkok, and they had at least a Bachelors degree. They participated in questionnaire pre-testing in Nang Rong prior to the actual fieldwork. Interviewers were recruited from Buriram province, the province where Nang Rong is located. We wanted interviewers who would be familiar with local dialects. They were recruited through contacts that IPSR had with the local teachers college (Rachapadith Institute). All had just graduated. After the interviewing was completed, some of the interviewers were retained for the data entry phase of the project.

Interviews lasted about 1 hour or so. However, there was considerable variation depending on the size and composition of the family. Once the interviewers were proficient with the intricacies of the questionnaire, length of interview was not problematic for either the respondents or the interviewers. The social network questions were among those that were the most difficult. Respondents usually needed time to think about members of the various networks. People present at the interview (not the main respondent) were often helpful recalling who helped with the rice harvest or providing information on the sibling networks of in-laws.

Perhaps the most problematic aspect of the social network data collection was using the list of all households. Consider the help with rice harvest network question. In the household surveys people were asked whether or not they planted rice in the last year. If "yes," they were asked

Q. 6.24 Did anyone from this village help to harvest rice in the last year? Record Ban Lek Ti,⁷ number of people, number of days, type of labor (hire or help without pay), and the wage.

In practice, respondents remembered names of individuals, not households that helped with the rice harvest. The interviewer and the respondent then had to determine to which household that person belonged. This involved looking at the list of all households in the village, which was organized by Ban Lek Ti numbers. This entire process was facilitated because the interviewers lived in the village during the interviewing, and became quite familiar with the names of people in the village. Nevertheless, this was undoubtedly the most difficult aspect of our collection of social network data.

7.4.3 Confidentiality and the public release of data

The cost of collecting most social science data sets has escalated faster than the resources available for social science research have increased. Taking a census

⁷ "Ban Lek Ti" can be thought of as the equivalent of a street address or apartment number. It is the number assigned to a dwelling unit by the village headman.

approach to the collection of social network data, as we have done in the 1994/95 Nang Rong survey for multiple relations and for multiple social units, is more expensive than taking an ego-based approach. Cost is one factor that has led to pressure on data collectors to make data available to the broad social science research community. Peer reviews of follow-up components of longitudinal studies typically ask about the extent to which the data have been used, both by the investigators who designed the data and also by others. The greater the use, the higher the chance that a further round of data collection will be funded. Another factor creating pressure for public release is the general utility and potential insight provided by the data. Since the days of Weber, Durkheim, and Simmel, researchers have been interested in capturing aspects of the social, physical, and ideational worlds in which individuals live their lives. Social network data speak to questions at the heart of sociology and social demography, and the relative rarity of social network data, especially linked to other information about individuals, households, and communities, only serves to increase interest in making the data public.

And yet, in potential conflict with the desirability of public release is the promise made to respondents that the information they provide will be kept confidential. Our ability to better capture the context within which individuals and households exist has increased the ability of those who wish to discover the identity of respondents to do so. Social network data are problematic in this regard. The most obvious example is a locational social network component that was being introduced in our next wave of data collection: Taking GPS readings for each household's dwelling unit. If we divulge the physical location of someone's house, we are very clearly and unequivocally releasing the identity of our respondents.

The potential for confidentiality to be breached exists even with seemingly more benign forms of social network data. Indeed, social network data are like other contextual data. Once the identity of the village (or other relatively small sampling unit) is known, it is not difficult to locate individual respondents. Consider the social network data we have for households in the Nang Rong data sets. These data feature connections between households within villages and thus provide a key to the linking of households to specific villages. In our data, once households in a particular village are identified, it is possible to identify the village by aggregating the characteristics of the households. Again, once the village is identified, respondents can also be identified. The fewer the villages, and the denser the networks within them, the easier it will be.

In short, releasing social network data of the type we have collected in Nang Rong, along with the individual and household data, is tantamount to breaching the confidentiality that was promised to respondents. We, and others involved in social science data collection, have taken the position that when there is a conflict between publicly releasing data and protecting the confidentiality of respondents that it is imperative to protect the confidentiality of respondents even if it means that a substantial amount of data is not released. We have released household and individual level data but not the social network data. We have, however, also released computed measures of household network position. While this will not satisfy all who are interested in social network analyses, it will at least satisfy the needs of some.

7.4.4 Distinctive features of the Nang Rong data from a social network perspective

What are the distinguishing features of the 1994/95 Nang Rong social network data? The most striking is that we have measured networks at multiple levels of social organization: Villages in the district, households in villages, and individual migrants. At the most general level, we have economic and social relations among the 310 villages in Nang Rong District. Then, for fifty-one villages we have census networks on kinship and economic ties. Finally, for a subset of the sampled villages, information about migrants' networks in the destination and their linkages to their origin villages were measured. It is important to note that the social units (network "actors") differ across the networks: Individual migrants, households, or villages. These are nested: Individual migrants within households, and households within villages.

For each level, multiple relations were measured. For villages, we have economic ties (movement of temporary laborers both into and out of the villages, renting large agricultural equipment—notably tractors—from other villages, and where crops are marketed), social ties (shared temples, movement of students to elementary and secondary schools), and infrastructure linkages (bus routes, road linkages, and shared water sources). At the household level, we have economic relations (help with the rice harvest and renting, hiring or sharing agricultural equipment—water pump, thresher, large tractor, tiller, or electric generator), kinship relations (sibling ties), potential social interactions (through use of the same rice mill or membership in the most important group in the village), and some information about movement between households (where people lived at age 10).

Our relations measure social or economic contact, or the potential for such contact, rather than discussion of "important" matters, or affective ties (e.g. friendship). In part this is a consequence of the kinds of units that we are studying (villages and households). Friendship or other affective ties are not well defined for these aggregate units. Also, it is theoretically and methodologically important to avoid endogeneity problems when using social network variables to understand outcomes such as contraceptive choice or migration. Had we asked people with whom they discussed contraception or migration, our ability to draw conclusions about network effects would have been severely limited. Also, our interest in social network effects has focused on the potential for the flow of information and on normative pressures on behaviors through social contacts, rather than on affective states (friendship) or perception of social support.

At both the village level and the household level our networks are census networks rather than ego-centered networks. This gives us considerable leverage to describe and model community level (rather than simply individual level) network properties. For example, we can look at households linked through indirect ties via paths including other households and we can study cohesive subsets of households in villages.

In contrast to most social network studies that are case studies of only a single group or community, we have the same measurement in numerous villages. For households in fifty-one villages and for migrants from twenty-two villages we have measured the same relations in each village. Therefore, we need not assume that all

villages have the same social organization. We can compare networks across villages to see whether or not villages have similar patterns. We can also study the relationship between variation in network patterns across villages and other (non-network) characteristics of villages, such as land use.

Boundary definition is an important issue in social network studies. The problem is to delineate which actors (individuals, households, villages, or other social entities) are included in the group or community. In the Nang Rong projects our units are administratively defined (the district of Nang Rong for the village network, and the village boundaries for the household networks), but network ties might extend beyond these administrative boundaries. We can examine the extent to which social and economic relations overlap with administratively defined boundaries and the extent to which village boundaries are permeable.

7.4.5 From survey responses to social networks

Responses to the network questions in the household survey, migrant follow-up, and community questionnaires were initially recorded as variables in a SAS data file. However, there is considerable data processing involved in going from these variables to measurements of social network properties. Analyzing the social networks required constructing sociomatrices for the different relations and then calculating network properties using existing social network software (Borgatti et al. 1999) and custom written computer programs. We should note that some simple network measures, such as the number of others named on a given relation, can be calculated directly, but other network properties, such as identification of subgroups or patterns of connectedness, require the entire network or sociomatrix.

In the SAS data files, the general coding of responses to the network questions was similar for most relations, and for both household and village networks. Responses to the migrant questionnaires are more limited since the identities of those named in response to the network questions were not recorded. For the household and village networks, each relation was initially coded as a set of variables recording the identification numbers of the others (households, villages, districts, or provinces) that had been nominated in response to the question. To illustrate, consider the question in the community questionnaire that asked where residents go for temporary labor. Villages could name up to ten different locations, and hence there are ten variables. Each variable recorded the identification number of the location (the village identification number if a village in Nang Rong district was named, or the district identification number or province number if a location outside Nang Rong district was named). From these responses we constructed three sociomatrices, one with ties from villages to other villages in Nang Rong district, the second with ties from villages to other districts within the province, and the third with ties from villages to other provinces or more distant locations (i.e. abroad). The first of these sociomatrices has 310 villages as rows and 310 villages as columns. This is the sociomatrix for the village network within Nang Rong district, and was used to find network properties such as subgroups and patterns of connectedness within the village.

For household networks the procedure was similar, with two notable differences. First separate sociomatrices were constructed for each of the fifty-one villages, on each relation. Second there were four sociomatrices for each relation in each village: Ties from households to other households within the village, ties from households to villages (within Nang Rong district), ties from households to districts (within the province), and ties from households to provinces or other more distant locations (ties outside the province or abroad). For both the village and household networks, sociomatrices were then imported into a standard network analysis program or used in specially written programs to calculate network measures such as centralities, network subgroups, and network centralization.

7.4.6 Integration into Geographic Information System

The georeferencing of social networks within a Geographic Information System (GIS) is another distinguishing feature of the Nang Rong projects more generally. A GIS is an automated system for the capture, storage, retrieval, analysis, and display of spatial data (Clarke 1990). It consists of a relational database linking the geographic proportion of feature elements to their attributes and the integration of hardware, software, and geospatial information. The construction of a GIS database requires considerable investment of time and resources, and, as such, tends to only make sense when a given case or study area will be the focus of intensive research activity over a long period. We expect, however, that this will change as more spatial data becomes available in digital form and as GIS software becomes easier to use.

The starting point for the Nang Rong GIS was a set of high-quality composite maps from the early 1980s at a scale of 1:50,000, which were prepared by the Thai Ministry of Defense. We digitized these maps to create a base coverage of the study area, hydrography, transportation (including trails and foot paths), topographic contours and point elevations, village centers, market towns, and district boundaries. Building on this foundation, we subsequently added other digitized maps; additional coverages derived from the manipulation of the base coverage; aerial photographs; satellite imagery; and village characteristics (either aggregated from household data or measured in the community survey). Through the cumulation of demographic, social, economic, and environmental information over several projects, Nang Rong has become a "laboratory" for the study of social and environmental change, broadly conceived.

Social networks represented as linkages between spatially referenced points can be incorporated into a GIS database in a straightforward manner. Linkages among units of social organization located in cartographic space can be represented in this way. Thus far, our use of the GIS in social network research has focused on villages. Village locations were obtained from maps and corrected using readings taken with Global Positioning System (GPS) devices in the field. Linkage information has come largely from the 1994 community survey. Our discussion here draws on what we have learned from our work with the village networks, first presented in Faust et al. (1999). The 2000 data collection includes spatial representation of social networks at

the household as well as village level. This and other features of the 2000 data collection are described later in the chapter.

The GIS serves as a key tool for integrating and analyzing data from diverse sources. Our research on village networks has combined data from the 1994 community survey; the base map (and updates from the field); and land cover classifications derived from remote images (satellite data). The flexibility of the GIS is important to interrelating such different kinds of data. The social network and village location data are spatially discrete; information about rivers, roads, and trails is in the form of lines and polygons; and the land cover classifications are spatially continuous. While it may be obvious, it is important to note that geographic location serves as a type of ID number that permits linking information from a variety of sources.

Visual display is an important capability of the GIS. Mapping has been key to describing the spatial orientation of village networks in Nang Rong. A specific example of how maps shed new light on the interpretation of network data is given in Illustration #1, below. However, presenting graphs of relations using correct locations for villages raises important problems for preserving confidentiality. If we were to present the social networks overlaid on a map of the entire district of Nang Rong with correct village locations and district boundaries indicated on the map, responses to village survey questions could be traced to specific villages. This, in turn, conflicts with the need to maintain confidentiality based on assurances given to respondents in the village survey. There are several ways to guard against a breach of confidentiality. One approach is to alter the map in some way, e.g., by transposing and reorienting it. Another approach, the one we have followed, is to present graphs for sub-regions of the district without specifying their exact location within the district.

The spatial analytic capabilities of the GIS have also been important to our work, allowing us to examine relationships between spatial properties and social network features. We have used the spatial analytic capabilities to measure distances between villages, to locate rivers, perennial streams and bridges between villages, to measure the distance from each village to the district boundary, and to characterize land cover in the territory surrounding each village.

We have calculated and compared the average Euclidean distance traversed by ties between villages on different social network relations. Sharing of elementary schools and temples is more local than renting agricultural equipment and hiring temporary labor, for example. Distance estimates are also important to the consideration of error in the social network data, as illustrated below. Outliers—that is, ties spanning an unusual distance—suggest possible reporting and recording problems in the data. Ties between villages sharing an elementary school are 2.11 km on average and those linking villages sharing a temple are 1.48 km. Whereas, ties based on agricultural equipment and temporary labor are 4.77 and 5.28 km, respectively (Faust et al. 1999, page 326).

Distance to the district boundary allows us to see whether villages in close proximity to the district boundary have more ties to villages outside Nang Rong district than villages far from the district boundary. If so, we might want to re-consider the assumption that the district boundary coincides with the village network boundary. We have found that distance to the district boundary was not correlated with the

volume of shared temples and elementary schools, but that villages close to the district boundary had significantly more secondary schools and temporary labor ties to villages outside the district. Surprisingly, villages close to the boundary were less likely to have tractor hiring ties outside the district.

Land cover classifications derived from satellite data were used to consider the association between cropping and the movement of equipment and labor among villages. For example, we have found that the cultivation of upland crops (such as cassava, corn, and sugar cane) coincides with the hiring of large tractors between villages. The greater the percent of a 1.5 km buffer around a village that consists of upland agriculture, the more active the village is in both sending and receiving large tractors.

As in Laumann et al.'s Chapter 1 in this volume, we found that spatial proximity influences network interactions, though the effect of proximity varies by type of relation. Social relations, such as sharing elementary schools and temples, are quite local and are more likely to be disrupted by geographic barriers such as perennial streams and rivers. Economic relations, such as hiring large tractors and movement of labor, cover longer distances and are less likely to be disrupted by geographic barriers. Finally, we found that the presence of a perennial stream between two villages greatly reduces the likelihood of a tie between them, though the effect is somewhat reduced by the presence of a bridge.

7.5 ILLUSTRATIVE FINDINGS

We are still analyzing the social network data from the Nang Rong surveys. So rather than attempt to summarize all the key findings, we present three illustrations from ongoing research. The first shows how the georeferencing of social network data within the GIS has shed new light on the interpretation of the data. The second relates experience from an analysis of contraceptive choice that shows the importance of boundary definition. The third uses comparable social network questions in fifty-one villages to describe variation in patterns of social organization across villages.

7.5.1 Visualization and error

In addition to the GIS results noted above, visualization through the GIS turned out to be of assistance in identifying problems with the lists used to record ties between villages, and with coding based on those lists. Drawing on results reported in Faust et al. (1999), we present two examples, one illustrating problems associated with an incomplete list and the other, problems with duplicate names on the list. In hindsight, it is easy to see how to handle each of these problems, and we have done so in the 2000 round of data collection. We were not aware of them at the time of the 1994/95 data collection, however. Further, we might never have suspected them if we had not incorporated the 1994 community data into the GIS and mapped ties between villages. To provide a clear understanding of the problems, we first describe more specifically the organization and use of village lists in the 1994 community survey, the source of the data for the two examples.

Community data were collected in a group interview of the village headman and other village leaders. Questions were asked about ties to other villages. Interviewers had a list of all the villages in Nang Rong against which they could check and code responses. The list of villages was organized by subdistrict, the administrative units of which districts are composed. There were two problems with this list. First, village names were not unique. There are nineteen instances in which two villages have the same name, eight instances in which three villages share a name, and four instances in which four, five, six, or seven villages have the same name (involving a total of 84 from the 310 villages). Responses to the village network questions often were coded after the interview was complete. Duplicate names could have posed a problem. Interviewers might not know which of a pair or triplet of villages was intended, or may have been unaware or forgotten that a given name might refer to more than one village. Second, the list only included villages, and therefore it omitted other administrative units such as towns where schools or temples could be located.

In our analyses we incorporated the village networks into the GIS using georeferenced village locations. Ties were then displayed as directed arrows between linked villages with a separate map for each relation. We suspected errors when lines between villages seemed to violate an otherwise orderly pattern. For example, the temple and elementary school networks are generally local, but there are some instances of villages more than ten kilometers apart apparently linked through a shared temple or elementary school. Those ties could be based on kinship relations or prior residences of villagers, but we also wondered about the possibility of data coding error involving duplicate village names. Two pairs of villages more than ten kilometers apart apparently share a temple, and seven pairs of villages more than ten kilometers apart apparently share an elementary school, according to the survey data. For temple sharing, for both pairs, one of the villages involved in the pair has a name duplicated somewhere else in the data set. For elementary schools, this is true for four of the seven pairs of distant villages. Thus, it seems quite likely that duplicate names lie behind coding error. The presence of such suspect ties would not be apparent without taking spatial location into account.

Another kind of data problem could be seen in the spatial patterning of isolates in one of the networks. In the secondary school network, there is a concentration of isolates in the middle of the district. The absence of arrows to and from villages in this region appears to show that these villages do not send children to secondary school. This led us to consider more carefully how data on schools were collected. In the community questionnaire, villagers were asked to name other *villages* to which children went for secondary school. The question format and recording of responses inadvertently omitted the secondary school located in the district *town*, located roughly in the center of the district.

7.5.2 Open versus closed networks

This illustration considers the question of whether village position within a network of labor hiring affected women's contraceptive choices. Movements of temporary labor between villages provided potential bridges between otherwise unconnected

social groups, and as such, could increase exposure to new information, not only of those who traveled for work but also of others in the home village. We were interested in whether village centrality in networks of labor hiring affected choice of injection, a relatively new method in the Nang Rong context. Our key hypothesis was: The more central the village, the more likely and the earlier that women who live there will hear about and adopt injection. To test this hypothesis, we specified a simplified multilevel model of temporary method choice (pill, IUD, injection, none). Entwistle and Godley (1999) report the findings. Here, we discuss the measurement of village centrality, specifically whether the focus is on ties between villages within Nang Rong or also includes ties beyond the district boundaries, and consequences for the results obtained (Entwistle and Godley 1999).

Information about labor exchange between villages was collected in the community survey:

“Go To”

Q. 69. Sometimes, do villagers in this village go to other villages to work as daily wage laborers?

Q. 70. To which villages do they most often go to work?

“Come From”

Q. 74. Sometimes, does this village require laborers from other villages?

Q. 75. From which villages do they mostly come?

Both sets of questions generate networks of labor exchange between villages. We refer to the first as the “go to” network, and the second as the “come from” network.

Our first approach to the measurement of village position used the complete network of ties within the district. All 310 administratively defined villages in Nang Rong district were part of the village survey in 1994. We organized answers to the labor hiring questions into two 310×310 sociomatrices, one for “go to” and the other for “come from.” We analyzed these matrices calculating measures of centrality, centralization, and component size and membership. Both networks consisted of a handful of components, which altogether included about 80 percent of the villages. The components in the “go to” network were 236, 10, 2, and 2 in size; the components in the “come from” network were 229, 6, 2, and 2 in size. Only twenty-three of the 310 villages neither sent nor received workers. Labor hiring within Nang Rong district thus linked most of the villages, directly or indirectly. Of interest for the analysis of temporary method choice were measures of degree centrality based on these sociomatrices.

We hypothesized that village centrality within a network of labor hiring would have a positive effect on choice of injection relative to other temporary methods or no method at all. In the multilevel analysis of contraceptive choice, both centrality measures (“go to” and “come from”) had significant effects. Surprisingly, one of the measures had a negative rather than a positive effect on injection use. We considered possible reasons why the results failed to confirm our hypothesis: (a) village position in a network of temporary labor hiring was poorly measured; (b) labor hiring networks were unstable, changing from 1 year to the next; (c) these networks form in

response to economic factors not controlled in the analysis; (d) another set of ties between villages was more relevant to contraceptive choice. We also considered the consequences of ignoring ties to villages outside of the district.

It turns out that villages send ("go to") short-term workers to an average of 3.9 villages: 1.6 villages within Nang Rong district; 1.3 outside the district but in the province; and 1.0 outside the province. All villages are connected to at least one other village in this way—there are no isolates. This interconnectedness may be a feature of modern Nang Rong, coinciding with a greater integration of the region into the national economy. The villages in our sample receive short-term workers from an average of 2.0 other villages: 1.8 within and 0.2 outside the district. Although most hire in workers for temporary help with seasonal agricultural activities, a substantial minority (37 percent) do not. In contrast to the "go to" network, the "come from" network involves fewer and more local ties.

We reanalyzed the data, using counts of ties to other villages, and distinguishing between ties to villages within and outside the district. It turns out that the connection to other villages by virtue of outward short-term labor movements enhanced use of injection, and also of the pill. The number of "go to" ties has a positive and statistically significant effect on both. In contrast, connections to other villages by virtue of the hiring of labor had no effect on temporary method choice. We believe that the contrast between these results shows the importance of ties spanning a long distance. To further confirm this, we disaggregated the "go to" ties, distinguishing between ties to other villages in Nang Rong district, ties to villages outside the district but within Buriram Province, and ties outside the province. Ties to other provinces are especially important for injection use. There are many reasons why use of injection in Nang Rong quadrupled between 1984 and 1994. Nevertheless, our results suggest a role for the diffusion of information (and perhaps the provision of services) along ties defined by the movement of short-term labor. Recently married women are more likely to choose injection if they live in villages central in labor-hiring networks, especially those with ties to villages in other provinces. A more general lesson is that it can be quite misleading to look at network effects within a limited bounded community, a potential problem with the "sociocentric" approach (Laumann et al., Chapter 1, this volume) that studies network ties within a fixed population of actors. Such an approach would likely miss "bridge" actors who link communities and can be critical in disease transmission.

7.5.3 Variation in household networks across villages

Replication across settings is an important feature of many of the studies in this volume. The study of Rothenberg et al. (Chapter 5, this volume) contrasts networks in Flagstaff and Atlanta using a methodology developed in the Colorado Springs study (Potterat et al., Chapter 4, this volume). Though focused in Chicago, the CHSLS study by Laumann, Mahay, Paik, and Youm compares patterns of sexual relations between neighborhoods (Laumann and Youm 1999), and the AddHealth study includes multiple high schools. Our final illustration also draws on replicated networks. Having the same network measurement strategy across fifty-one villages allows us to consider whether

patterns of social organization are similar or different across villages. An often implicit assumption of network case studies is that a single group or community is representative of other communities or groups. In other words, that results can be generalized to similar settings. However, without replication, this is a critical assumption, which is untested.

In this section, we describe some of the variability among villages in patterns of network ties among households, using two villages and two relations for illustration. We selected these two villages to contrast the patterns and level of ties across households. We also look at two relations, one economic and one kinship. The first relation is help with the rice harvest, and the way this social network was generated was discussed above in Section 7.4.2. The second relation consists of sibling ties between households. For household members aged 18–35 years old, locations of their siblings were recorded. The question asked was:

Q. 4.5. Does this person have other siblings besides the ones [living in the household] that are still living? If they do, record their current location: In this village, in another village in Nang Rong, in another district in Buriram, or in another province.

Figure 7.3 shows the help with the rice harvest networks for two villages. Clearly there are notable differences between these two villages. In village A, households are much more actively involved in helping with the rice harvest than they are in village B. On average, households in village A mentioned receiving help from 2.06 households, as compared with an average of 0.51 mentioned in village B. In Fig. 7.3, the "star" pattern in village A shows that there are a small number of households that are receiving a great deal of help. One household in this village mentioned receiving help from forty-nine other households, and eight mentioned receiving help from more than ten households. In village B the maximum number of households mentioned is five. This difference among households in the amount of help received shows differential centralization of the two villages, as reflected in the variance of the number of households from which help was received. The variances in the number of households from which help was received are 51.18 in village A and 1.10 in village B. Clearly village A is not only more active but also more centralized. This centralization suggests a great deal of variation within the village in the extent to which households are involved in rice cultivation or variation in the amount of land cultivated. We might speculate that this is related to economic or occupational variation in the village.

The pattern of network subgroups also differs between the two villages on this relation. In village B there are eight components ranging in size from two to twenty-five households and involving 57 percent of the households in the village.⁸ In village A there is a single component containing 98 percent of the households. There is a clear difference between these two villages in how "connected" households are through rice harvest help ties.

⁸ A component is a connected subgraph. All actors within a component can be reached via paths of ties between other actors. We report "weak" components. The paths between actors may include ties going in either direction—either to or from the other actors.

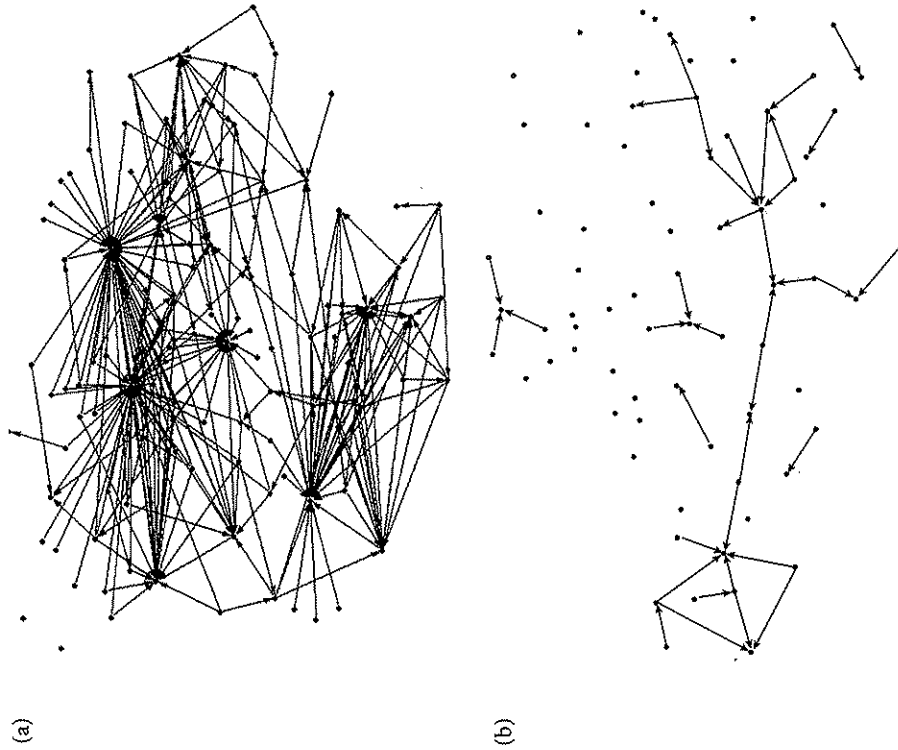


Figure 7.3. Help with the Rice Harvest in Two Villages

In comparing these agricultural or economic ties in these two villages, it is important to note that there is considerable variation across Nang Rong district in types of agricultural activity. Some villages are heavily involved in rice cultivation, whereas others cultivate upland crops (cassava, corn, and sugar cane). We might expect that the level of rice harvest help in the villages is related to differences in agricultural activity. We can investigate this using information from the GIS. For each village, a 1.5-km buffer around the village was defined, and the percent of land in rice cultivation, forest, and upland agriculture was calculated (Evans 1998). In village A, 83 percent of the land is in rice cultivation, 8 percent in forest, and the remaining 9 percent in upland agriculture. In contrast, village B has only 52 percent in rice cultivation, 25 percent in forest, and 22 percent in upland agriculture. This pattern is consistent with the different levels of rice harvest help.

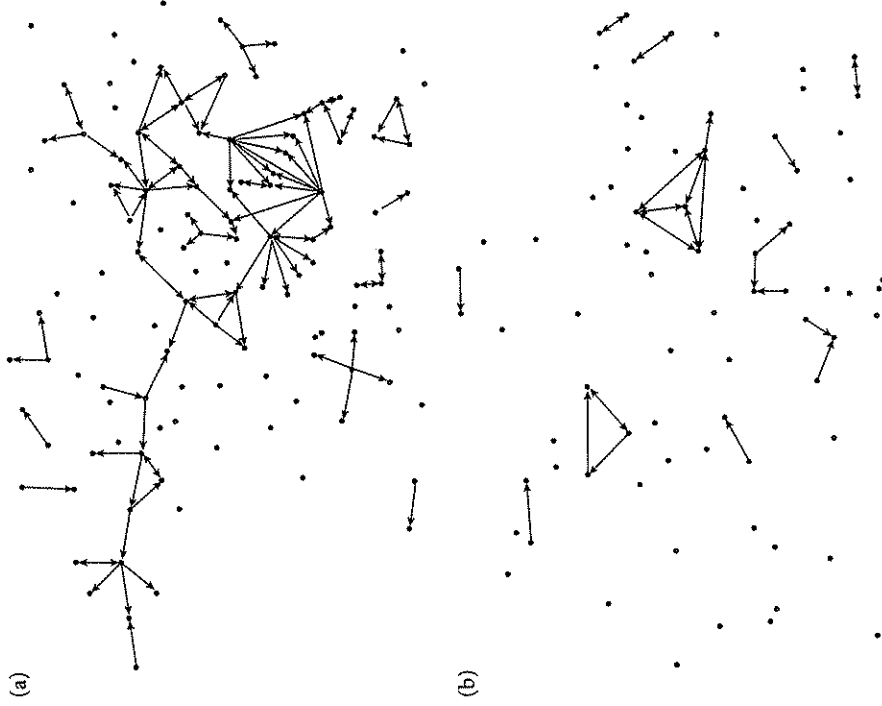


Figure 7.4. Sibling Ties in Two Villages

Figure 7.4 shows graphs of the sibling networks. These networks also differ from each other in the two villages, though not as dramatically as help with the rice harvest. The most notable difference between the two villages is a very low level of sibling ties in village B. In this village, 62 percent of households do not have sibling ties to other households in the village; they are "isolates." In village A, 30 percent of households are isolates on the sibling relation. The average number of ties per household also differs between the villages. Households nominated 0.53 other households, on average, in village B and nominated 1.07 in village A. The subgroup patterns also differ. In village B there are eight components, ranging in size from two to five households. In village A there are ten components, ranging in size from two to 57.

Households in village A are more densely tied to one another on both help with the rice harvest and on sibling relationships than is the case in village B. Nevertheless,

it is interesting to note that in neither village does rice harvest help go along with sibling ties. In village B there are no instances in which a household nominated another as providing rice harvest help and also as the location of a sibling. In village A there are only eight such instances (0.06 percent of all possible pairs of households). In neither village is it the case that kinship relations, through sibling ties, are the basis for provision of help with the rice harvest. We expect that the links are intergenerational—a hypothesis that we plan to investigate with more recent data.

In sum, only with social networks measured comparably across settings can we investigate the extent of variability in network patterns. In the example described here there are large differences, especially in networks of economic cooperation. In our ongoing work, we are investigating this variability across all fifty-one villages, and to study how variation in network patterns is related to other characteristics of the villages, such as agricultural activity and village history.

7.6 SOCIAL NETWORK DATA IN THE 2000/2001 SURVEYS

By way of conclusion we discuss the social network components of the 2000 round of data collection, which incorporated changes in life styles in Nang Rong, changes in technology that can be used in data gathering, and changes in administrative infrastructure in Nang Rong. We capture more aspects of interaction opportunities in Nang Rong villages and we take advantage of developments since the 1994 round of data collection. In so doing, we opted to retain as many of the social network components as possible from the 1994 round in order to look at change over time. In some cases this is likely to mean that some of the relations will be sparser than in 1994 because of ongoing changes in the villages. For example, anecdotal evidence suggests that as the economy continues to move from subsistence to market the role of local rice mills as a gathering place has changed. Increasingly, villagers are selling their rice harvest to merchants who then take the rice out of the village to be milled at larger, more efficient mills. Villagers then buy the rice they consume at stores. We have decided to keep the rice mill questions to see if the anecdotal evidence is correct, to be able to document how social change affects the nature of social interaction, and to see who the leaders and laggards are.

Three new social network generators are based on propinquity and advances in our ability to measure it. Since our last round of data collection, it has become easier to measure geographic location and include this information in a Geographic Information System. We use official records to obtain the locations and names of owners for all land in Nang Rong that has been recorded in one of the two agencies charged with overseeing land claims and ownership. The locations were digitized into a GIS, along with ID numbers unique to each plot. The list of names of owners, along with the same unique plot specific ID numbers will be merged, by name,⁹

⁹ There are a number of reasons why Thai names are much more likely to be unique than American, European, Korean, or Chinese names. Put differently, in Thailand the John Smith problem is less likely to arise. Surnames were not used in Thailand until King Rama VI decreed that they should be used. This decree came out about 1920, and thus family names have only been used for a few generations.

with data collected in the household interviews. This procedure provides adjacencies of land owned by villagers. Once we have this, a wide variety of social network measures can be constructed. For example, for any given pair of households that owns land, we can measure the number of parcels that lie between them (or the distance or travel time between them), as well as whether their parcels are adjacent. We can also see how these adjacencies intersect other relations, such as kinship or help with the rice harvest.

While owners of adjacent properties are likely to interact with one another, users of adjacent properties are even more likely to interact as they go through the normal routines of planting, weeding, and harvesting crops. This is particularly likely in Nang Rong where plots tend to be small, there is relatively little mechanization of agricultural tasks, and the planting of most plots is tied to the timing of the annual monsoon.

We are using the social networks that exist in Nang Rong to measure plot use adjacencies. At the community level, we ask knowledgeable informants where households in the village are farming. The emphasis is on use and not ownership. Using maps that have aerial photographs as background, these knowledgeable individuals draw the outlines of plots used by villagers, and put in each plot a running ID number. While they are drawing these plot lines, we also maintain a list with the same running numbers and the names of the household heads that use the plots. If there is an adjacent plot that is used by someone from some other village, their name and village number is recorded. Then during the household interview, respondents are asked about the agricultural plots that they use, including the names and village numbers of their neighbors for the four cardinal directions. Households know their farming neighbors and there are knowledgeable individuals within a village who can draw the plot lines while providing us with the names of those who use those plots.¹⁰ By matching, we are able to link households to the plots

Further, when families were registering their surnames, there were checks to make sure that there were no duplicates. Thus in principle in the 1920s each family had a unique surname. While the checking for duplicates at registration time was by hand, and hence not perfect, the overall effect was to have the vast majority of surnames be unique. Today, if you want to change your surname, you have to go to the registrar's office and they will check to see if your proposed new surname duplicates the surname of anyone else in the country. If it is a duplicate, they have to pick another one.

Unlike many Western countries, there is no tendency for fathers to give their first names to their son or mothers to give their first name to their daughter. Instead, sometimes a syllable from the mother's name and a syllable from the father's name might be joined to create a name for the child. In short, frequently first names are made up, and thus have a higher probability of being unique.

The Thai alphabet has forty-four consonants, twenty-one vowels and five intonations. Hence, there is a greater possibility for creating a wide range of unique names than in the Western alphabet.

A computerized file exists containing the names of approximately 40,000 individuals who were listed in the household rosters of the 1994 data collection. In this file, there were only 130 cases where more than one person had the same first and last name.

¹⁰ Village headmen, assistant headmen, and village committee members tend to know where people in the village farm. In addition, in recent work in rice growing areas, we have found that hunters are also a reliable source of information. These are individuals who hunt for frogs, field rats, or crabs. In order to hunt on someone's field, they need their permission, and hence they know who uses which fields. The same is the case for those who fish in the rice growing areas during the times when they are flooded.

they use, and do so both within our GIS and in our regular SAS data management file. (This procedure is discussed in considerable detail in Rindfuss et al. 2003) Again, we can construct a variety of social network measures from this data, including whether pairs of households use adjacent plots, the distances between the plots they use, and the number of other plots intermediate between their plots.

The third proximity measure involves obtaining the location of all dwelling units within our study villages. The social network argument is that households that are physically closer to one another will be more likely to interact. Since the 1994 round of data collection, the GPS became fully operational. This is a system of twenty-four satellites that orbit the earth. With a handheld GPS device, as long as one can read at least three of these satellites, one can obtain a reading from the GPS device that indicates the present location, and which, in turn, can be corrected for the error that is in the GPS and then incorporated into an existing GIS. Once the data are in the GIS, a wide variety of social network measures can be calculated.

We also obtain the name of the school attended by all household members. Both primary and secondary schools have names that are unique within the district. The idea is to be able to determine who within the village were classmates, on the assumption that classmates will be more likely to interact with one another. In addition, since many primary and secondary schools have catchments that span more than one village, the social networks formed in school will likely link across villages. After they leave school these ties get reinforced when they see each other at fairs, markets, and so forth. Over time, the catchments for secondary schools have become smaller as more secondary schools are built, and hence the geographic areas networked will decrease.

Finally, while not strictly a social network variable, we collect information about the dwelling unit where households live with an eye toward the architecture, whether it is likely to facilitate or hinder social interactions with non-household members. A traditional dwelling unit in this part of Thailand was made of wood resting on pilings that raised the structure approximately one story above ground level. See panel A of Fig. 7.5. The ground level was typically open, sometimes with a secure area to keep animals at night. Cooking was done outside, underneath the house. Given the tropical climate, a substantial amount of living and socializing took place in the shade underneath the house. Examples of activities that would have typically occurred under the house include food preparation, silk weaving, and basket making. Houses are clustered close together within villages, and with many daily activities occurring outdoors, underneath the house, conversations with neighbors can happen easily.

As Nang Rong becomes more affluent, housing styles are changing. One of the first steps is to enclose part of the area underneath the house, and this becomes the kitchen (panel B of Fig. 7.5). Then at some stage the entire area underneath the house is enclosed, typically using cinder block (panel C of Fig. 7.5). At this point, more of everyday life is taking place within the confines of the dwelling unit. Unless there is a porch or some other outdoor gathering place, the type of casual conversations that used to take place become less likely. Further, some dwelling units now

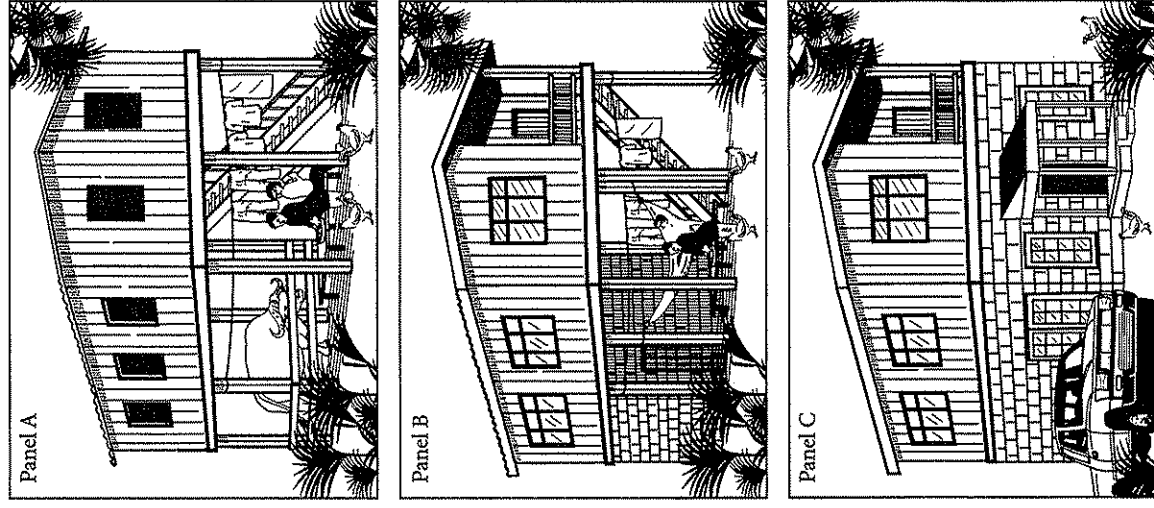


Figure 7.5. Examples of Nang Rong Housing Styles

have an air conditioner, likely making the household turn more inward. We measured these variables. Given that the richer families are the ones that first fill in the area under the house, this may lead to divisions between the rich and those who are not so rich.

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