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# A Comparison of Social Network Mapping and Personal Network Visualization

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*This article presents an analysis of personal network visualization based on systematic evaluations of alter pairs compared to freestyle drawings respondents made of their personal network. In most cases, personal network visualization provided important details that are different from respondents' perceptions. Several case studies are discussed that highlight the additional data provided when using personal network visualization.*

**Keywords:** *personal networks; visualization; cognition*

**I**n this article, we focus on the visual representation of people a respondent knows—their *personal network*. Personal networks are a type of ego-centric network; they consist of the set of family, friends, and acquaintances surrounding a focal person. In social network analysis, personal networks are contrasted with whole (sociocentric) networks in which the focus is on the pattern of interactions within a focal group.

Visual representations of personal networks are not used much in social science research but are common in counseling psychology and social work. *Genograms* are techniques used by mental health therapists to capture the relationships, both past and present, surrounding a client (DeMaria, Weeks, and Hof 1999; McGoldrick, Gerson, and Shellenberger 1999). By representing men, women, and children as circles and triangles, as in a kinship diagram used by anthropologists, therapists attempt to understand the social environment that may have contributed to the conditions that led them to seek help. The visual representation helps both therapists and

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clients understand the social environment that may be contributing to or hindering mental health. Genograms tend to focus on close, mostly family relationships and typically represent the social environment chronologically, including relatives who are both living and dead.

The *hierarchical mapping technique* (Antonucci 1986; Ajrouch, Antonucci, and Janevic 2001) uses three concentric circles to represent the personal network of the respondent. In the middle of the circle is the word "YOU." Respondents are asked to put the first name of people they know closely in the innermost circle and those they know but are less close to in the outer circle. The resulting map gives the researcher some sense of the size of the network and the distribution of their network based on closeness.

Carrasco, Hogan, Wellman, and Miller (forthcoming) used a similar approach with four concentric circles. In their study, respondents free listed alters first, then placed them on the network map—those closest to the respondent in the inner circles and those less close in the outer circles. Respondents were asked to place those who knew each other nearby and finally to draw circles around groups of respondents. This method adds network structural features to the hierarchical mapping technique.

Perhaps the most straightforward technique for acquiring an image of a personal network is to ask respondents to draw them freestyle, with little instruction as to how they are represented. For example, respondents can be told to represent people with dots and groups of people with circles. Unlike genograms and hierarchical mapping, both of which start with some structural constraints, freestyle drawing captures the variability in the way respondents represent their network. Despite its simplicity, there are few examples of this approach in the literature. Coates (1985) used this technique in the study of the personal networks of black adolescents.

Another approach is to elicit names of network members from the respondent, then ask him or her to evaluate the relationship between each individual pair of alters. We call this *personal network visualization*. This method differs from the others because the respondent is being asked to evaluate a set of binary relationships that are then built into a representation of personal network structure, as opposed to the respondent being asked to try to summarize all relationships into a structure from memory. McCarty (1992, 2002) used this approach in a study of structure within personal networks. Mitchell (1994) used this approach for a small sample of homeless women in Manchester, England. More recently, Widmer and La Farga (2000) used visualizations of personal networks to study the variability in the structure of families.

In this article, we contrast the two techniques that are the most different. At one end of the spectrum are freestyle drawings that allow respondents to represent their network however they like. At the other end are personal

network visualizations based on the systematic evaluation of the relations between all pairs of network members. We illustrate these differences using case studies showing the types of conclusions an interviewer might make about the respondent's personal network using each technique. In the next section, we outline the principles of personal network data collection for those who are unfamiliar with the process.

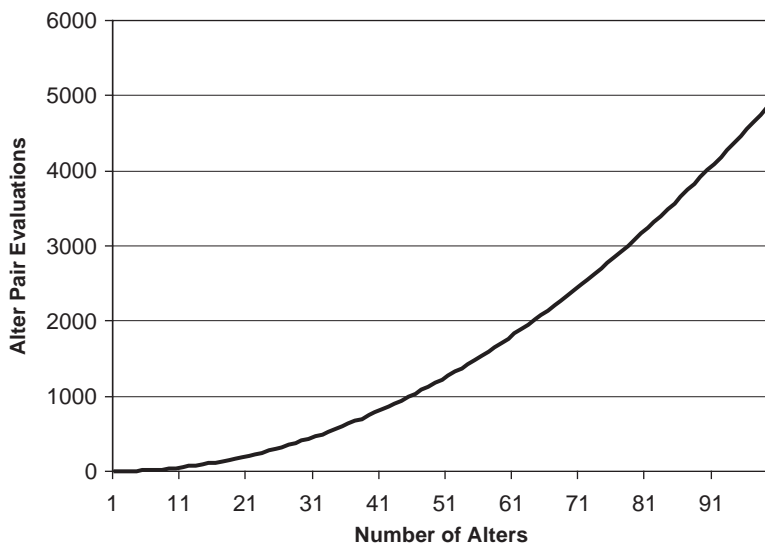
## COLLECTING PERSONAL NETWORK DATA SYSTEMATICALLY

The study of personal networks typically involves, at a minimum, acquiring a list of a person's network members (alters). 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, close friends, or coworkers) respondents may be asked to list up to sixty 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 mode of data collection. Some network studies have only a handful of respondents whereas 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, Schnegg, and Berzborn 1998; Hampton and Wellman 1999). 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 coworkers, 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 other variables. They may also be used as dependent variables or predicted by typical demographic variables or variables more specific to the topic of interest.

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 (see Figure 1). For a network of ten alters, a

FIGURE 1  
Respondent Burden when Collecting Structural Data



respondent must report on forty-five ties. For a network of fifty alters, they must report on 1,225 ties. There are conceptual and empirical issues surrounding the application of structural measures to personal network data (McCarty and Wutich 2005), specifically, whether to include or exclude ego for a given measure.

The collection and analysis of personal network structural data has been difficult in the past, given the absence of software devoted to that purpose. Recently, a program called EgoNet was developed that is designed specifically for the collection, analysis, and visualization of personal network data.

EgoNet consists of four modules—questions asked of the respondent about themselves, questions used to generate the names of network alters, questions asked of the respondent about those alters, and questions asked of the respondent about the existence of relations between alters. It is designed as a questionnaire authoring language that allows researchers to tailor the interview to their specific research interests. The program displays a visualization of the respondent's personal network. As an illustration, consider the example in Figures 2 and 3. Figure 2 represents an adjacency matrix for

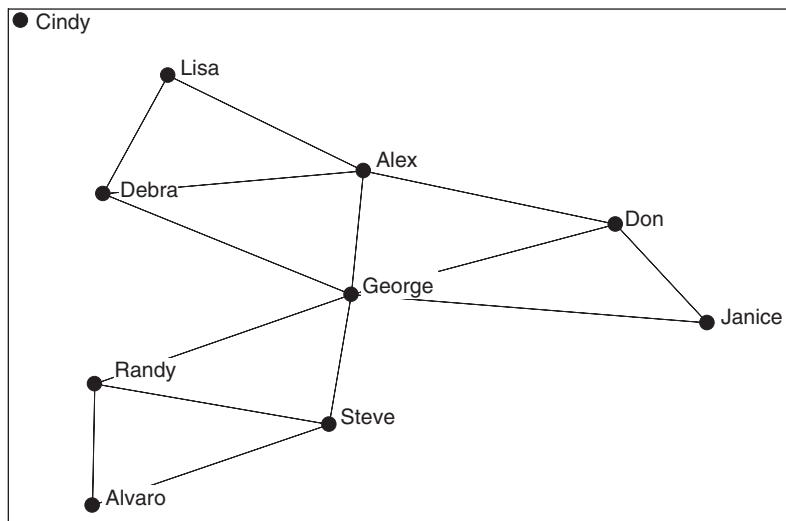
**FIGURE 2**  
Adjacency Matrix for Ten-Alter Personal Network

	Don	Janice	Debra	Steve	Randy	Alex	Cindy	Alvaro	Lisa	George
Don	1	1	0	0	0	1	0	0	0	1
Janice	1	1	0	0	0	0	0	0	0	1
Debra	0	0	1	0	0	1	0	0	1	1
Steve	0	0	0	1	1	0	0	1	0	1
Randy	0	0	0	1	1	0	0	1	0	1
Alex	1	0	1	0	0	1	0	0	1	1
Cindy	0	0	0	0	0	0	0	0	0	0
Alvaro	0	0	0	1	1	0	0	1	0	0
Lisa	0	0	1	0	0	1	0	0	1	0
George	1	1	1	1	1	1	0	0	0	1

a ten-alter personal network. In most cases, we ask the respondent to describe the relations between their alters as symmetric, meaning both alters agree to the level of knowing. In cases where the question being asked is simply the presence or absence of a tie, respondents are quite consistent in their assessments. With a ten-alter symmetric network, the respondent must evaluate forty-five unique pairs of alters. This matrix can then be used to calculate several measures, and to visually represent the ties in the network, as depicted in Figure 3. The visualization in Figure 3 used a spring-embedding algorithm to place the nodes relative to each other (see Freeman 2000).

Several attributes of this visualization immediately suggest questions we might ask the respondent. First, we can see that George is a central figure in this network and that he connects two groups of people. Depending on the research topic, we may first want to know who George is and how he relates to the respondent. Next, we may want to know what the two groups are and why George is or is not connected to all of them. Disconnections within a group may be a sign of the potential formation of factions. Finally, although Cindy is part of the personal network, she is disconnected from

FIGURE 3  
Visualization of Ten-Alter Personal Network



everyone else. Is she a broker to another set of ties that may be potentially beneficial to the respondent? Or does she represent a social pressure that could impact the respondent negatively?

## METHOD

To test the utility of personal network visualizations against that of freestyle drawings of networks, we conducted nineteen interviews in Barcelona, Spain (seven men and twelve women, with a mean age of 33). Respondents were selected from different ethnic groups to maximize the differences discovered through the qualitative interview (ten from Spain, three from Ghana, two from Serbia, one from Senegal, one from Croatia, and two from Bosnia).

Respondents were first interviewed without the aid of the personal network visualization. A paper instrument was used to collect the names of exactly forty-five free-listed alters. The criteria for including an alter were: "You know them and they know you, by sight or by name. You have had

some contact with them in the past two years (i.e. phone, face-to-face, e-mail, mail) and you could contact them again if necessary.”

Respondents then provided data on each alter, including how they knew the alter, the language of communication, the intensity of the relation, frequency of contact, method of communication, occupation of the alter, and whether or not they consider them a foreigner. Respondents were then asked to draw a representation of their network using the following instructions:

We would like you to draw your *social circles*. The more people in each circle, the larger it will be. Circles that are farther apart mean that they are less socially connected. Circles can also overlap. You can also specify single individuals. When you are done drawing, you can put a label or name in each circle to tell us what it is.

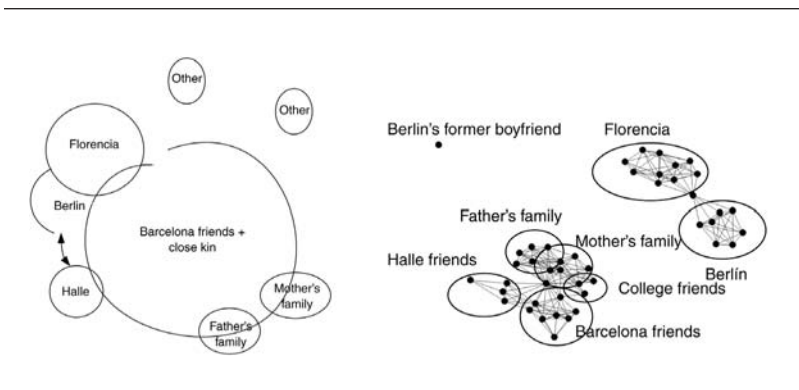
Following this task, respondents were interviewed about the way that their network impacts their ethnic identity. The interview was recorded. Each of the three interviewers then entered the alter names provided by their respective respondents into EgoNet. Interviewers only entered the names for the forty-five alters. The interviewers then arranged a second session with each respondent, no later than one week after the original interview, having them complete the 990 alter-tie evaluations. The tie evaluation question was whether the two alters would talk independently of the respondent. Following the fourth module, the program displayed a visualization of the personal network of the respondent based on the adjacency matrix from the tie evaluations. The interviewer, assisted by the personal network visualization, then asked the respondents the same questions they did during the first interview. The analysis consisted of the qualitative assessment of the benefit to the respondent and the interviewer of having the visualization as a cue. This method isolated the benefit specific to the visualization.

## RESULTS OF PERSONAL NETWORK VISUALIZATION INTERVIEWS

Most of the respondents were surprised by the personal network visualization. The process of evaluating the 990 alter pairs gave no indication of the structure of the graph. Indeed, the task of making so many evaluations makes it virtually impossible to fake. After the alter pair evaluations, which on average lasted about 20 minutes, respondents were interested in the product of their efforts. Most respondents were excited about the opportunity to describe the visualization and talk about their network.



FIGURE 4  
Drawing and Network Visualization of Elia, a 30-Year-Old  
Woman from Barcelona



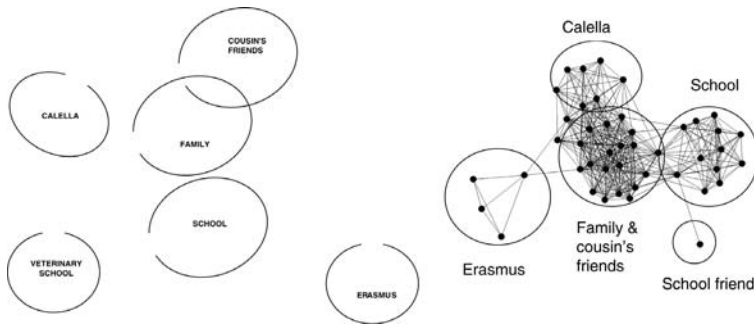
With two exceptions, respondents verified that the personal network visualization made sense to them, given what they knew about the social environment around them. They were all able to identify groups of people and people in structurally important roles. In some cases, respondents made errors in some of the 990 alter-pair evaluations and recognized those in the personal network visualization.

Those respondents who did not recognize groupings are suspected of not entering the alter-pair evaluations correctly. For example, one respondent coded nearly all the potential pairs as ties, resulting in a visualization with one large grouping of all forty-five alters. Although this is not impossible, the respondent's reaction indicated that it did not match her conception of her network.

Comparisons between the initial drawing and the personal network visualization are more revealing. In some cases, the visualization closely resembles their initial drawings. Figure 4 shows the network of Elia, a 30-year-old woman from Barcelona. Elia's drawing and her network visualization share many things in common. The drawing shows a large group of people at the center who are a mixture of family and friends. This is also depicted in the network visualization. In both, Elia separates maternal and paternal family and shows a strong connection with the central family and friend group.

In both graphs, Elia shows groups from a town in the Netherlands, the Halle, as well as groups in Florence and Berlin. However she shows a connection between the Halle group and the Florence and Berlin groups that

FIGURE 5  
Drawing and Network Visualization of Marta, a Catalan, 26 Years Old



does not exist in the visualization. She also shows a connection between the Florence group and her family that is not shown in the visualization. The connection between the Halle group and Berlin in the social circles graph is mainly due to one respondent who is from Berlin, but lives in Halle. When asked about that connection, the respondent said that the nature of the tie question (would the two alters talk independently of the respondent) negated that tie. In this case, the social circles represents links based on category association (being from Berlin), whereas the personal network visualization represents actual communication.

Figure 5 shows the drawing and the network visualization of Marta, a 26 year old. Comparison of the drawing and the visualization show that the categories are very much the same. Marta is aware that she has a large family group that overlaps with her cousins' friends group. She also depicted a group of friends from school who are connected to her family. Marta is an Erasmus student, a European program that sends students from one European country to study in another. She maintains a group of friends from the Erasmus program who are depicted in both the drawing and the visualization. Similarly, she depicts a group of friends from a small town called Calella in both pictures.

There are, however, some distinct differences. The main difference is the ability to identify key people in the visualization. The drawing depicts only broad categories of people, and, in only one case, a connection between those categories. The visualization shows bridging between categories from

key alters. In this interview concerning ethnic identity, the role of bridging ties can be critical.

For example, the visualization shows four key ties between the school group and Marta's family. There is also a bridging tie between the Erasmus group and her family. This raises two types of questions. Why do these people serve a bridging role? Why do the others within the group not serve one? The utility of the visualization for the interview would be made stronger by overlaying characteristics of the alters, such as sex, ethnic group, and age. Figure 6 compares the drawing and visualization of Milanka, a Serbian migrant in Barcelona. In this case, the two representations of her network are not quite so similar. She depicts her family group at the center, with a mixture of neighbors, extended family, friends, and work connected directly to it. The only indirect connection she shows is acquaintances from work through friends from work.

The personal network visualization tells a different story. Although the right side of the visualization does bear some similarity to the drawing, showing family work and neighbors, we see that the work group is actually connected through the neighbors by one key tie. On the left, we also see that Milanka has a set of family ties in Serbia that are connected to the family group on the left by one key tie. In the upper left, we see a group of five alters from a former job who were not represented in the drawing at all. Finally, in the far upper left is a single alter (an isolate), her hairdresser, who is not tied to anyone.

The ability to identify isolates is another key advantage of the personal network visualization. Isolates represent interesting subject matter for discussion. In the case of migrants, an isolate may represent attempts to reach out to other groups. Discussion about their success or failure in doing so may be facilitated by discussion about the reason an alter is an isolate.

Figure 7 shows the network of Edin, a Bosnian migrant. The drawing depicts a well-organized network, with several groups nested within each other. We would conclude from this drawing that Edin's maternal family and his university friends were connected and at the center of his network.

The personal network visualization on the right shows no connection between his family on the lower right and his university friends. Edin verified that this was the case. He does have a set of friends who live in the same town in Spain as his family, but they are connected by only one person. Information about this friend and why he is so key is useful for understanding how Edin integrates into Spanish society. We also see from the personal network visualization that Edin has an adoptive family in Spain, something that is not depicted in the drawing. The long list of isolates in the upper right represent clients from his work. The fact that he chose six of his forty-five alter choices

FIGURE 6  
 Drawing and Network Visualization of Milanka, a 34-Year-Old Serbian Migrant

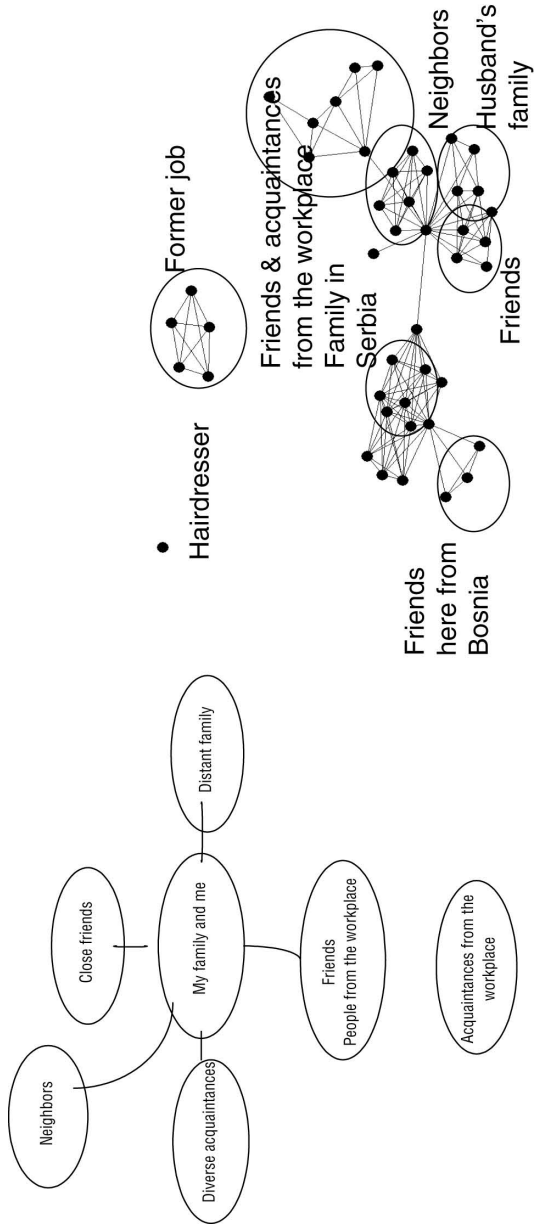
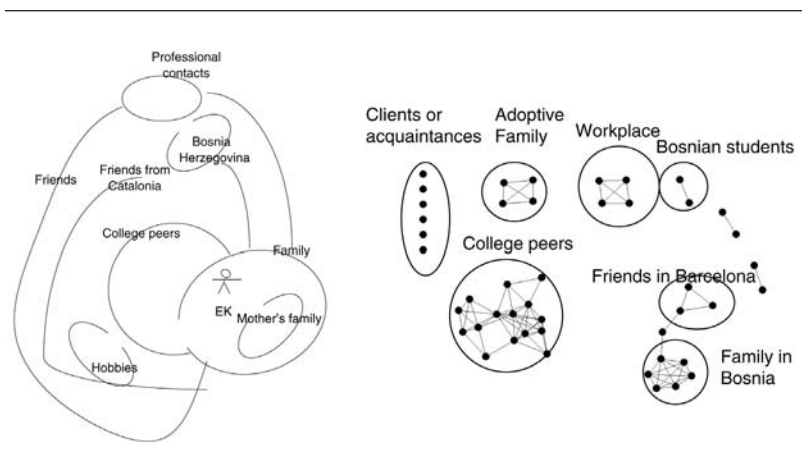


FIGURE 7

Drawing and Network Visualization of Edin, a 26-Year-Old Man from Croatia



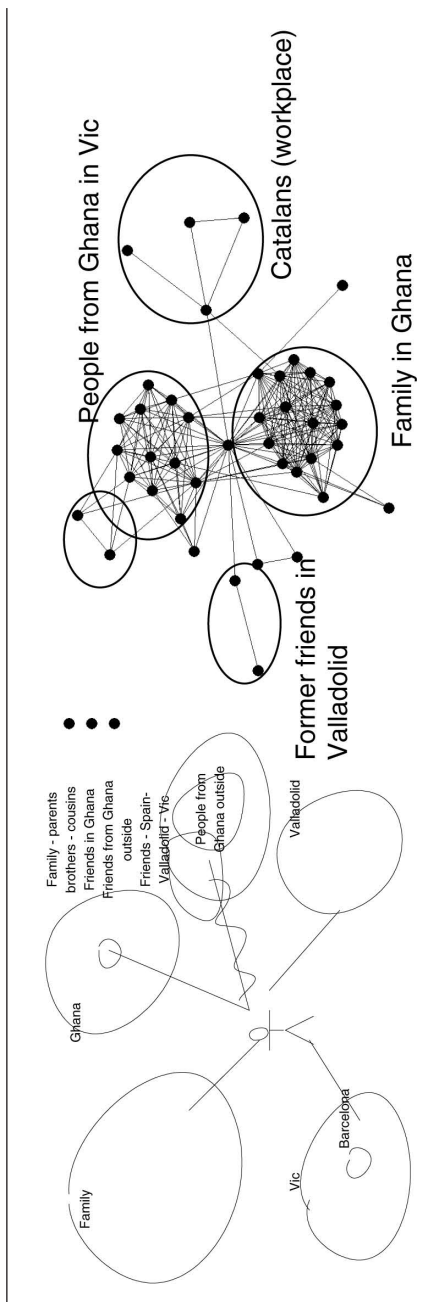
for clients who did not know each other could be significant. The interviewer should explore whether Edin considers these clients to be potential bridges to new alters.

Finally, we show the personal network visualization and the drawing from Regina, a 33-year-old woman from Ghana (Figure 8). Regina obtained a Masters in Spanish translation at the University of Valladolid in Valladolid, a city in the north of Spain. She's kept some friends from this stage in her life, but the transnational community of students whom she met in Valladolid are now in other countries. Some of them are represented as isolates in the upper left corner of the visualization. The two main groups of Regina's network are her family in Ghana and the people from Ghana who also live in Vic (a town in Barcelona). She met those people in Vic for the first time, with the exception of Sam, her husband. Sam is the dot connecting both worlds—the family and the transnational community. It is interesting to note the support role of the Evangelist church in Vic for migrants from Ghana.

## DISCUSSION

In seventeen of the nineteen cases, both the interviewer and the respondent recognized lines of questioning that were available to them using the personal

FIGURE 8  
 Drawing and Network Visualization of Regina, a 33-Year-Old Woman from Ghana



network visualization as a cue that were not available without it. Memories and information are not stored randomly, but arranged in hierarchical sets that are quickly accessible. The same is true for names of people. When participants free list names, they tend to cluster or mention successively persons from the same social context (e.g., family, work, school, church, etc.; Brewer and Yang 1994). This suggests that memories of people are, to some degree, organized by social structure.

When we ask respondents to describe their personal network (i.e., the social environment in which each respondent lives), we are asking them to describe the structure of their memory, using those labels that they have available to them. This is not a task that most people ever do, and is thus affected by their ability to report the structure of their memory accurately. Even if respondents can report the structure of their memories, there is reason to believe that this system of storing information differs significantly across respondents and that the labels used between people are radically different, and, in many cases, ad hoc. Assuming people can report accurately and store information in the same way, we see no reason to believe that they store names based on an accurate representation of social structure, although there are suspicions that social structure is the basis for the organization of people in memory (Brewer and Garrett 2001; Brewer et al. 2005). Thus, the drawings that respondents made in the first interview represent their attempt to apply those labels they have available to describe this structure.

The fourth module of the interview—the alter-tie evaluation—is, on the face of it, a much easier set of questions to answer. But it is more than that. The perception that two people are connected in some way does not require the respondent to abstract the nature of the relationship and fit it into a category that then must be labeled. Relations that cross conceptual categories, such as people we both work with and socialize with, can be evaluated by one criterion: whether they are socially connected, given the definition of a connection. The respondent can consider the multiplex relationships they have with their alters so that they accurately answer the question. The result is a picture of the structure that shows groupings, when they exist, and bridges between groups. It also shows people who are isolated and groups who are isolated and allows for the exploration of those relations.

Another reason that the personal network visualizations may differ from the categories generated by respondents is that respondent-generated categories tend to follow a certain dimension, such as types of behavior the respondent engages in with the alter (e.g., family, work, church), whereas social structures do not necessarily conform to one domain. In small-world studies in which the object is to try to get a message to randomly selected targets, it is not unusual for respondents to use alters that fit a behavioral domain

for local targets and a locational domain for those far away. This can be observed in the personal network visualizations in which clusters of respondents are identified by a mixture of behavioral and locational domains.

As can be seen from the analysis above, it is also quite common for the personal network visualizations to make distinctions between categories. For example, it is typical for respondents to talk about family relations. Yet, personal network visualizations often show clustering within families, based on kinship, location, or interaction. It is not uncommon to see groups within families who have no ties whatsoever. Such distinctions cannot be realized without the systematic evaluation of alter pair ties.

One potential disadvantage of the personal network visualization, at least the one used here, is that it does not accommodate overlap. From the drawings, we see that some respondents indicate comembership of people within more than one group. This is shown by overlapping circles. This version of the visualization software does not accommodate overlap. Alters are only shown in one position.

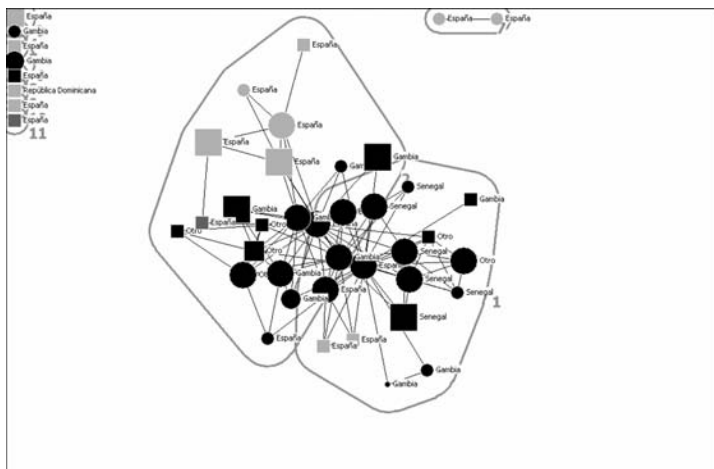
This method is not a panacea. When the subject matter does not concern a topic that is fundamentally interpersonal, the personal network visualization would help very little, if at all. For example, if the subject matter of an interview were specifically about knowledge or technique (such as the names of medicinal plants or how to construct a hut), it is doubtful that the tedium of collecting personal network structural data would be worthwhile.

On the other hand, if the research topic is fundamentally interpersonal (such as influences on migration choices or political opinion), then the personal network visualization provides a perspective on these topics that cannot be gained otherwise. For example, in the case of the interviews above concerning ethnic identity, the personal network visualizations show how some respondents compartmentalize alters of different ethnicities. This is most evident in Figure 8, where Regina maintains ties to a group of Catalans and several groups of Ghanaians. With the personal network visualization, the interviewer could question Regina specifically about people within those groups and how they interact, rather than hypothetical relations between abstract categories of relations.

A new version of EgoNet has been released that provides some additional capability that will no doubt be useful (available at [www.mdlogix.com](http://www.mdlogix.com)). Figure 9 shows the visualization, using this new software, of a second-generation Gambian woman living in a Catalan city. The circles with numbers by them are hierarchical clusters calculated by the program. As we can see, in the previous examples the circles do not fully match the naturally occurring groups that the informants defined from the visualization. However, they do provide a standard and objective way for interviewers to talk to respondents about the groupings



FIGURE 9  
EgoNet Visualization of the Personal Network of a 22-Year-Old  
Gambian Woman



in their personal network. The numbers make it easy to record these interviews and indicate to which group the respondent is referring. Having an objective way of identifying groupings increases the reliability of the qualitative interpretation of the visualization.

We can also see that the software has allowed us to represent attributes of alters. In this case, color is used to represent skin color (Black = Black, Light grey = White, Dark grey = Brown), size represents how close the respondent feels to each alter (larger nodes are closer), and shape represents whether or not the alter smokes (Circles = Nonsmokers, Squares = Smokers). The nodes are also labeled by the country in which the alter was born. Using these data gives a much more detailed view of the social context of the respondent. In this case, the interviewer can easily see how alter attributes are distributed through the personal network and if the respondent compartmentalizes alters based on that. For example, most of the isolates the respondent lists are smokers. The respondent lives with her Muslim family. When questioned about the number of isolates and the fact that they smoke, she revealed that she also smokes and stays with these friends on overnight trips where she can smoke

freely and go to parties. The ability to overlay alter attributes over structure is quite powerful.

Future modifications of the method should include ways to reduce the respondent burden, such as presenting alter-pair evaluations in a way that is easier for respondents to input, either visually or in groupings. More work must be done on perfecting name generators to elicit the names of alters in an unbiased way, or to elicit names so that the bias is known and manageable.

## NOTE

1. McCarty (2002) found that respondents recoding a set of alter-pairs were 97% accurate in recoding  $\pm 1$  point.

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