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Describing Changes in Personal Networks over Time

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Social ties are continuously being created and lost as well as changing their nature over time. We emphasize that network descriptions are specific to their particular definitions of ties. Then, we suggest that studies of change can focus on: (1) individual ties, or whole personal networks; and (2) whether ties are gained or lost, or change their characteristics over time. For each of four possible study types, we describe an ideal type, provide a concrete empirical example, and briefly describe illustrative published work. Particular networks can rarely be regarded as random samples of meaningful populations, and generalization to populations of networks requires often challenging theoretical considerations of the nature of the relevant populations, as well as statistical considerations of random sampling error. Nevertheless, systematic description of changes within particular networks provides the bases for more general understanding of processes and outcomes of changes of social networks over time.

Keywords: social networks; network change; network analysis; social ties; personal relationships

The sets of relations that compose social networks are always changing, both in terms of the existence and the nature of the ties. Relationships that did not exist can come to exist once two people become acquainted. People add new relationships as they encounter new people and interact with some of these people more and in different ways. When an encounter between two individuals becomes a “relationship” or a “tie” between them is a matter of definition. Similarly, when a relationship that has existed ceases to exist depends on the definition of relationship existence.

This article describes some of the ways in which such changes can be examined using data from personal networks across time. We begin by outlining the processes involved in changes in personal networks. We follow this with a discussion of the ways in which changes in network ties over time can be studied using panel data on egocentric networks. Next, we illustrate such processes using data collected by Suitor (Suitor 1987a; Suitor and Keeton...
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1997) on women during the first 10 years after they returned to college in the early 1980s. Finally, we provide some additional examples of published articles that have described changes in personal networks in these ways.

The focus of our discussion is conceptual and descriptive. We suggest how to conceptualize change in networks over time and how to describe the nature and extent of those changes. Generalizations of findings about particular networks to other networks will inevitably depend on similarities in the nature and extent of relevant conditions between the networks studied and the others that may be of interest.

DEFINING AND MEASURING CHANGES IN NETWORK TIES

Change in personal networks has been of substantial interest to scholars studying a wide range of issues, including friendship (Gouldner and Strong 1987; Suitor 1987a; Kalmijn 2003), health (Schulz and Rau 1985; Aartsen et al. 2004), widowhood (Morgan, Neal, and Carder 1997), and the transition to parenthood (Belsky and Rovine 1984), to name just a few. Studies of this phenomenon have taken markedly different approaches, ranging from qualitative explorations in which individual cases are cited as examples of the ways in which life events and status transitions alter interpersonal ties (Young and Willmott 1957; Gouldner and Strong 1987; Oliker 1989) to quantitative inquiries in which sophisticated mathematical models are used to chart changes in network structure and function (Leik and Chalkey 1997). In the present article, we describe some simple, useful ways of describing changes in interpersonal networks over time.

We begin by discussing ways of both defining and measuring changes in interpersonal networks. In principle, once we define and determine the relationships that exist at a given time, we can then measure various characteristics of those relationships at that time. So, in terms of change, we consider: (1) changes in which ties are included in the network, and (2) changes in the nature of the relationships for those ties that remain in the network.

We say that, “in principle,” we determine the relationships that exist and then measure the characteristics of those relationships. But in practice, we inevitably use some characteristics of relationships as the operational definitions of which relationships are defined to exist. As derived from Moreno’s classic “sociometric test” (Moreno 1934), researchers typically ask respondents to list others who they “talk to about important matters,” “feel close to,” “encounter face to face at least once a week,” etc. It is easy to see that any such criterion is in terms of a particular characteristic of a relationship. The particular characteristic typically involves frequency of
interaction, feelings, cognitions, exchanges, usefulness, availability, or ascribed relations. See Marsden (1990) for further discussion of these types of measurement approaches.

Perhaps the most important aspect of any study of social networks across time, and even of social networks at a given time, is the recognition that the criterion for selection of ties determines the particular “partial network” that is being analyzed; the results of any analyses can vary greatly depending on the particular partial networks being analyzed (see Milardo 1988; van Groenou and van Tilburg 1997).

Whether networks are growing or shrinking over time depends on the specific nature of the partial networks that we consider. For example, as people age, their networks of face-to-face interactions may shrink even as their networks of acquaintances continue to grow. Criteria for inclusion need to be made as explicit as possible, and findings must be understood in this context.

Once we determine the set of relations that exist, we often want to describe the characteristics of those relationships and how they change over time. Although we may talk about characteristics of relationships as if they have a particular state at a given time, it is usually more accurate to consider that nearly all characteristics of relationships are themselves always changing. The characteristics that each individual reports are summaries of multiple thoughts, feelings, and interactions accumulated over some period of time. If Person A reports feeling “close to” Person B, then Person A is generally reporting how she or he has more or less consistently felt in thinking about and interacting with Person B over some recent period.

As time marches on, new interactions and feelings are accumulated, the older ones become less relevant, and the characteristics of the relationship change. Thus, it is reasonable to think of the usual characteristics of a relationship as moving averages of the thoughts, feelings, and interactions that the reporting individual has experienced over some indeterminate time period. The relevant period depends on the nature of the characteristic being measured. Characteristics based on short time periods (e.g., frequency of contact in the past week), can be very volatile. In contrast, characteristics based on longer periods (e.g., being a close friend), tend to be relatively stable. Nevertheless, over long enough periods, nearly all relationship characteristics are subject to change, and it is often useful to understand the nature of those changes over time.

We have suggested above that scholars are often interested in changes in (1) which ties exist and changes in (2) the characteristics of those ties. Further, researchers in this area are often interested in changes in (1) the existence and characteristics of each tie and the overall changes in (2) numbers and types of ties composing whole personal networks.
The various combinations of the levels of analysis and the different types of changes give us four different possibilities, as shown in Table 1.

### Which Ties Come and Go

One of the primary issues in studying networks over time is determining which ties persist over time. The dependent variable for such analyses is generally a dichotomy between continuing to a subsequent time or not. Independent variables are characteristics of the ego, the alter, and the situation, especially in combination with the initial characteristics of the relationship. We expect to be able to understand the persistence of relationships in terms of the interaction between the characteristics of the existing relationships in the context of changing circumstances of the individuals involved.

For example, when a woman gets married, we might want to know which of her ties continue through the following years and which ones fall away. We might expect her ties to other married women to be more likely to persist than her ties to unattached women. We might also expect that the association between the marital statuses of alters and persistence would be greater for housewives than for women who worked outside the home, because job interactions could continue to support ties even to alters who were dissimilar in marital status. In general, studies of this type look at the various factors that might affect the persistence (no, yes) of particular ties.

### How Characteristics of Ties Change

For relationships that persist, we are often interested in how the relationships change. The dependent variables for such analyses are generally the various characteristics of the relationships and/or changes in the characteristics of the relationships from the initial time period. As in the first case, the independent variables are characteristics of the individual (the ego) and the associate (the alter), and the situation especially in combination with the initial characteristics of the relationship. We expect to be able
to understand changes in the nature of relationships in terms of the interaction between the initial characteristics of the relationships in the context of changing circumstances of the individuals involved.

For example, when a woman gets married, we might be interested in how her particular ties change their form, function, feelings, etc. We might want to know whether her relationships with married friends and relatives increase their frequency and supportiveness more than her other relationships; this involves looking at the association between marital status of alters and changes in frequency and supportiveness of relationships. We could also examine whether increases in some alters’ parental responsibilities (e.g., having a child) might increase the extent to which the ego provided help to those alters or reduced the respondents’ frequencies of interactions with those alters.

Analysis of such changes in characteristics of continuing ties should be considered in the context that certain types of changes in the characteristics of relationships have likely led to the loss of certain relationships that are, by definition, not included in the analyses of continuing ties. Thus, for example, if change of interests on the part of one or another of the individuals leads to a reduction in frequency of interaction, a sufficient change of interests could lead the relationship to cease entirely and so not be included in this analysis. To take account of these losses of ties as we are studying change in characteristics of continuing ties, we can include all initial relationships in the analysis of changing characteristics over time and assign a “zero” value of the time 2 (T2) characteristics to all relationships that have ceased to exist. In this way, we might find that the marital status of alters affects whether frequencies of interactions are reduced, and whether they are reduced to nothing when the relationships are discontinued.

Expansion and Contraction of Networks

Ties may come and go without substantial change in the overall size of a personal network. For example, an individual may have regular interaction with a certain number of work colleagues that remains constant even as some particular colleagues are replaced by others over time. At the same time, an individual can add entirely new sets of alters (e.g., from new activities—see Feld 1981) that are relatively independent of the sets of ties at the initial time period. For this analysis, we would likely consider the number of ties to be the primary dependent variable. We can then examine the factors that lead to growth and decline of overall networks over time. The independent variables, as above, would likely be changes in the characteristics of the egos, the characteristics of the sets of alters, and the nature of the situation. For example, individuals who become unemployed might be expected to reduce their alters...
as they not only lose contexts to interact with coworkers but also lose financial support to participate in other contexts with other alters.

Change in the Overall Characteristics of Networks

Many changes in networks over time can be anticipated. The largest changes may result from changes in participation in particular activities that result in corresponding changes in both the numbers and characteristics of continuing relationships derived from those contexts. For example, if one has a child, one is likely to participate in new contexts involving other parents with young children. For this type of purpose, we can consider numbers of ties with particular characteristics (e.g., from particular contexts or with alters with certain traits) as dependent variables. We can then determine whether changing involvements in contexts or changing identities result in increases and decreases of numbers of ties with particular characteristics. For example, as individuals become more educated, we might expect an increase in their numbers of alters who are highly educated and a decline in the numbers who are less educated, especially for those for whom higher education becomes an important part of their identity.

Even as we focus on the characteristics of personal networks that are simple summaries of the characteristics of the individual alters and their ties in presenting our basic conceptual typology, we should note that personal networks as whole entities also have other characteristics. For example, we can describe the proportion of relationships among pairs of alters in a network, the density, or the number of different dense clusters among the alters included in the network. Researchers might well be interested in how these other personal network characteristics change over time as egos and alters change their participation in foci of activity, their physical and social abilities, and their personal preferences and availability over time.

Measurement Error

Measurement error is a problem in all empirical studies, but it can be especially vexing in the study of social networks. In network studies, measurement error affects the determination of which ties exist, even before it affects the measurements of the characteristics of those ties. Thus, even with a precise conceptual definition of the existence of ties (e.g., a tie exists if two people have at least an average of one interaction a week during the previous month), we can have trouble making a valid determination of the defining property (e.g., the actual frequency of interaction) and hence whether particular ties “exist” at a given time. If those determinations are mistaken, all four of our types of analyses of changes over time are affected, and those effects
are in addition to any measurement errors in the characteristics of those ties (e.g., van Tilburg [1998] demonstrates some measurement errors that result from interviewer effects).

We mention these issues because researchers should consider the potential impacts of measurement error on the substantive conclusions they draw from the types of analyses that we are describing. Further discussion of the potentially complex impacts of measurement error is beyond the scope of this article, however.

**Panel Studies**

We typically collect personal network data on the first wave of a panel study just as in any single cross-sectional study. In subsequent waves, we can collect personal network data the same way independently of the first data, or use the first data to structure some of the questions at the second time. It seems most informative to approach it independently and collect all the appropriate data in that way, and then supplement these data with specific queries about alters who were mentioned at T1 but not raised at T2. Then the researcher is in a position to distinguish the data obtained with special prompting from the data obtained without it.

**An Example of Collecting and Analyzing Personal Network Data over Time**

We will discuss one detailed example of collecting network data over time, using Suitor’s data on married mothers who were followed across a 10-year period beginning when they entered college in the early 1980s (Suitor 1987a, 1987b; Suitor and Keeton 1997; Suitor, Pillemer, and Keeton 1995). We have used this data set because it allows us to explore all four of the combinations of levels of analysis and types of changes.

Suitor’s study collected data from fifty-two women at the beginning and end of their first year of enrollment in a large state university in the northeastern United States. All of the women were “nontraditional students,” the term generally used to refer to individuals who begin or resume their college studies after an educational interruption of several years. To be eligible for participation in the study, the women had to be 25 years of age or older, married, and the mother of minor children. They also must have been entering a university for the first time or after an absence of at least 5 years. The women who participated in the study represented 72% of the students who met the eligibility criteria and entered the university in the fall of 1982. In 1991, forty-two of the original respondents were reinterviewed, focusing on the same issues regarding interpersonal processes. Suitor collected network data on the
respondents when they returned to school at the university, T1, a year later, T2, and 10 years later, T3. For our purposes here, the data we will use to illustrate these processes were collected at T1 and T3, to allow sufficient time for substantial network changes to occur. A complete discussion of the recruitment procedures and sample characteristics can be found in previous articles based on these data (Suitor 1987a, 1987b, 1988; Suitor, Pillemer, and Keeton 1995).

As already discussed, one decision that must always be made when studying networks is how to define the particular network on which to focus. Suitor’s approach was designed to cast a wide net across the respondents’ personal networks. Following in the tradition of Wellman (1979; Wellman and Wortley 1990) and Fischer (1982), Suitor asked her respondents a set of more than twenty name-elicitation questions. These questions focused on both positive dimensions of interpersonal relations, such as emotional and instrumental support and socializing, and negative dimensions, such as criticism, inattention, and casting guilt. Respondents were encouraged to name as many others as they wished in response to each question; others named included immediate family, more distant kin, friends, neighbors, coworkers, fellow students, and educational and medical professionals. The questions were asked at several points throughout the interview, as follow-ups to questions about the women’s multiple roles as wives, mothers, students, adult children, and in some cases, workers. Near the end of the interview, the respondents were asked to provide demographic information and describe their level of positive affect and frequency of contact with each of the associates whom they had named across the interview.

The procedures Suitor followed resulted in a rich set of data; we use only a few variables to illustrate the nature of the analyses. For our purposes here, we have defined the network under consideration to be those associates whom the women described as friends, who were 21 years of age or older, and whom the respondents indicated served as sources of school/work support or general emotional support. Friends were classified as a source of emotional support for school at T1 if they were named in response to any of the following questions regarding the women’s return to school: (1) “Whom do you talk to when you find it difficult being a wife, a mother, and a student at the same time?”; (2) “Whom do you talk to when you feel guilty about having returned to school?”; and (3) “Whom do you talk to about your schoolwork?” (The last question was asked as one of a series of items about emotional support for various issues; thus, it is unlikely that the women interpreted this as regarding instrumental help for difficulty with schoolwork.) Network members were classified as a source of emotional support for work at T3 if they were named in response to any of the following questions...
regarding their employment: (1) “Whom do you talk to when you find it difficult to have a job and be a wife and mother?”; (2) “Whom do you talk to about your work?”; and (3) “Were any of your friends particularly supportive of your employment during the past year?” Although the specific support changes somewhat from T1 to T3, we view these as comparable because they are support for the women’s primary work activity at each point in time.

At both waves, friends were classified as a source of general emotional support if they were named in response to either of the following items: (1) “Whom do you talk to when you feel bothered by day-to-day things?”; and (2) “Whom do you talk to about personal problems?” By these definitions, some of the same friends could be included in the personal network providing school/work support and also in the personal network providing general emotional support.

Forty women who participated in both waves of the study reported friends meeting these criteria. We use these data to illustrate each of the four combinations of level of analysis and type of change outlined above.

Cell 1: Which Ties Come and Go?

We begin with Cell 1, which considers both the persistence of ties at the level of the individual ties, and the characteristics of ego or alter-ego dyads that help explain which ties are retained. Using Suitor’s data, we calculated the proportion of friends named as sources of support at T1 who were named again as sources of support 10 years later at T3. To recapitulate, in this case our dependent variable was whether ties had been maintained.

To start, we examined persistence. We considered two different types of ties, those that provided school/work support, and those that provided general support. We found a very similar level of persistence of both of these types of ties—20% of alters who provided school support at T1 were named as providing work support at T3, and 19% of alters who were named at T1 as providing general support were named again at T3 as sources of general support.

We then examined what characteristics of egos or alters help to explain which ties persist and which do not. Based on Suitor and Keeton’s (1997) analysis of these data and the theoretical framework informing that work, we expected that alters’ educational attainment would play an important role in explaining which ties were maintained. Specifically, we anticipated that educational attainment of alters would be relevant for persistence as in providing school/work support, but not for persistence in providing general support. As expected, we found that alters with higher educational attainment were more likely to persist as school/work supporters than those with
lower levels of education; of those friends who were mentioned as sources of career support at T1, 23% of the friends who had completed at least 2 years of college were named again at T3, compared to only 9% of those who had completed less than 2 years of college. Also, as expected, we found that alters with higher educational attainment were essentially no more likely to persist as general supporters than were alters with lower levels of education; of those friends who had been a source of general support at T1, 16% had completed 2 or more years of college compared to 14% of those who had completed fewer years of school.

We have illustrated a very simple way to examine how characteristics of alters might affect persistence. We could extend this approach to a multivariate analysis. For example, it is possible to conduct logistic regression analyses using the dichotomous persistence measure as the dependent variable, a continuous measure of alters’ educational attainment as the independent variable, and controls for other characteristics of alters, such as marital status, parental status, emotional closeness to ego, or length of acquaintance. In addition to determining which ties persist (cell 1), we can examine how and why the persisting ties change their characteristics over time (cell 2).

**Cell 2: How Characteristics of Ties Change**

The question posed in cell 2 is how persisting ties change their characteristics over time. Again, as in the analysis to examine the question of which ties persist, the level of analysis is the alter, or the ego-alter relationship. For example, we asked whether the frequency of contact declined by T3. At T1, they had just moved from being full-time housewives to students spending a relatively small number of hours on campus each week; by T3 they were employed full time in demanding professions. Thus, their time for interaction outside the workplace would be expected to shrink, and be reflected in the women’s contact with old friends. Further, as both Feld (1981) and Suitor (1987a) have argued, individuals’ active networks change in response to entering and leaving foci of activity in part because of differences in values and interests among people associated with various foci.

To explore this issue, we compared contact at T1 and T3 among associates who were named as sources of school/work support at both T1 and T3. As expected, there was a marked decline in contact. At T1, the respondents were in contact with 93% of these supporters at least weekly; by T3, they were in contact at least weekly with only 53% of them. Contrary to what we might have expected given the decrease in contact, closeness to persistent ties actually increased. At T1, 41% of these ties were described as very close, whereas at T3, 59% of those persistent ties continued to be described as very close.
Part of this pattern was repeated when we examined changes in contact and closeness among alters who were sources of general support at T1 and T3. Surprisingly, there was no change in frequency of contact; at T1, the respondents were in contact at least weekly with 67% of alters who provided general support, and at T3, they continued to be in contact with these supporters at least weekly. However, similar to the findings regarding closeness among persistent sources of school/work support, the proportion of ties to whom they were very close increased. At T1, 55% of the ties that were sources of general support were described as very close, however by T3, 72% of those ties were described as very close.

Thus, supportive ties that remained active across time increased in closeness, regardless of whether those alters were sources of school/work or general support. However, changes in contact varied by the type of tie, with a substantial decrease in contact with school/work supporters across time. It is important to recognize that the changes observed in ties that persist over time are a combination of the change in the relationships and selection over time. Ties that became closer were more likely to persist as supportive ties than ties that became less close. With this recognition, it becomes less surprising that ties that persist are often stronger later, because they might not have otherwise survived.

Thus, from our analyses of ties in cells 1 and 2, we found considerable change in ties as many drop away, and considerable change in the characteristics of persistent ties in terms of closeness, and among some types of ties, frequency of contact. This does not, however, tell us about changes in the overall size and characteristics of networks because these processes depend on the inclusion of new ties as well as the loss of old ones. We explore the overall changes in network size and composition in the next sections.

**Cell 3: Expansion and Contraction of Personal Networks**

The question raised in cell 3 is to what extent personal networks expand or contract over time. As in the case of all of the questions we are posing, the answer is likely to differ markedly depending upon how the network is defined. Defining networks as composed of alters who are work/school supporters, we can examine whether the number of ties increased or decreased across the decade between T1 and T3. To address this issue, we now change the level of analysis from the individual tie to the network as an entity. In answering the question posed in cell 3, we are concerned with the overall change in network size, not the persistence of the particular ties named at T1.

Continuing with our example using Suitor’s data, we calculated the mean number of alters who were named as sources of work/school support.
and general support, at T1 and T3. These comparisons indicated that across all of the measures, the size of the women’s support network declined from T1 to T3. Across the decade, the average number of friends named as supporters regarding the women’s careers declined from 2.1 to 1.3. The decline in the average number of alters providing general support declined even more, from 2.9 to 1.2.

As in our earlier analyses, we can ask what factors were associated with the decline in network size; for example, we might expect that women who worked longer hours would have the greatest decline in numbers of ties that provided career or general support. In fact, this is the case. Among women who were employed less than 37 hours a week at T3, the number of school/work ties declined by only 0.2 (from 1.5 to 1.3), whereas for women who were employed 37 or more hours the number of ties declined by 1.5 (from 2.7 to 1.2). The same pattern held for changes in the number of ties who served as sources of general support. For women employed less than 37 hours at T3, the number of ties declined by 1.3 (from 2.6 to 1.3), whereas for women employed more hours, the number declined by 2.0 (from 3.2 to 1.2). Thus, not only is there an overall decrease in the number of supportive ties across time as women move from the home to school and the workplace, but the degree of change differs substantially depending on the women’s level of participation in the new focus of activity.

These analyses illustrate a simple approach to examine factors that affect networks expansion or contraction over time. One can use multivariate analyses with network size as a dependent variable to take account of other situational and demographic characteristics of the egos. Change in size of personal networks is more understandable when also considering the change in the composition of the personal networks over time, as we discuss in considering cell 4 in our typology of approaches.

Cell 4: Change in the Overall Characteristics of Networks

Finally, the question posed in cell 4 involves an examination of changes in the distribution of characteristics in the network as a whole. For example, over time does the network change in terms of the proportion of individuals who have particular characteristics, such as a particular gender or race, or in the proportion of network members who are parents or workers? As in the last analysis, the focus is on changes in the overall network, not on particular ties.

Considering that the women who participated in Suitor’s study had moved from being housewives to being full-time employees pursuing professions across the decade between T1 and T3, there are several network characteristics that we would expect to have changed between waves. For
example, we would expect that the educational level would have increased and that the average length of acquaintance would have declined as new associates from work entered the network.

Contrary to expectations, the analyses showed that the educational level of the network of school/work supporters remained essentially unchanged across the decade (T1, 14.7; T3, 14.5), as did the educational level of the network of general supporters (T1, 14.1; T3, 14.4). In contrast, consistent with our expectations, the average length of acquaintance decreased from T1 to T3 for the network of school/work and general supporters. Within the network of school/work supporters, at T1 the average length of acquaintance was 8.2 years, whereas at T3 it was 7.8 years. The change in general support was even greater. At T1, the average length of acquaintance of supporters was 9.4 years; by T3, the average length was 6.8. The more new members were introduced into the personal networks, the more the average length of acquaintance in the networks declined.

In sum, these analyses provide examples of the ways in which it is possible to simply address the question of changes in the distribution of characteristics in the network as a whole. As is the case for all the other examples we have provided, we could look for factors that were related to changes in mean educational level and mean length of acquaintance in these personal networks, and we could use multivariate analyses to examine multiple factors simultaneously and to take into consideration effects of various characteristics of the egos.

Additional Examples of Network Analysis over Time

Finally, we describe a selection of other relatively recent studies that illustrate these various approaches to changes in personal networks. We focus on studies that provide some of the clearest examples of each of the ideal types in our typology, but a quick perusal of the literature indicates that many studies address more than one of the issues. Consequently, even in studies that examine one or another type, we will mention some of the other issues considered, and we will also provide an example of one study that touches on all of these issues at once.

The issue of persistence of ties over time (our cell 1) is crucial for understanding changes in networks over time. Burt (2000) studies how ties tend to “decay” and eventually be lost over time, and shows that in personal networks of bankers, stronger ties are more resistant to such decay over time. Wellman and colleagues (1997) showed that in personal networks of residents of East York, ties that initially provided more social support, involved more frequent telephone contact, and were with kin were those
most likely to survive for 10 years to the follow-up interviews. Shulman (1975); Morgan, Neal, and Carder (1997); and van der Pas, van Tilburg, and Knipscheer (in press) have also shown that kin ties are persistent, especially at certain life stages.

A focus on changes in the character of particular ties as they persist over time (our cell 2) is especially important for understanding long-term relationships. For example, Scott (1996) examined the changes in the frequency of contact and supportiveness of siblings as women moved further into old age and found that changes in proximity were important determinants of changes in contact and supportiveness, but there was not much other change. Feld (1997) showed that structural embeddedness within a set of interrelated alters was a good predictor of future strength of relationships among college students. Consistent with that finding, he also found that highly embedded ties were more likely to persist over time.

Apart from the fate of particular ties, the tradeoff between ties gained and lost determined the overall changes in the sizes of personal networks (cell 3), which can have consequences for the individuals. Kalmijn (2003) found evidence for the dyadic withdrawal hypothesis; the networks of recently married and cohabiting couples tend to shrink. Examining a different part of the life cycle, among older people, Aartsen and colleagues (2004) found that greater age was associated with increased network size, and Morgan, Neal, and Carder (1997) even found an increase in overall network size across a 1-year period following recent spousal loss, as more ties were made than were lost. Change in size of personal networks is not the only aspect of personal networks that might affect individuals; they can be affected by the composition of the networks and the nature of the relationships, especially in terms of the supportiveness of the personal network as a whole (cell 4). In our mention of Aartsen and colleagues (2004) above, we indicated that they examined changes in overall network composition as people age; among other things, they found that physical decline was associated with the replacement of friends and neighbors by family members in large personal networks. Magdol (2000) focused on change in the physical dispersion of personal networks and found, as expected, that physical mobility was associated with increased dispersion of personal networks over time.

Even as many studies focus on one or a couple of these issues, some studies try to do it all, looking at which particular types of ties are gained and lost over time, how persisting ties change, and how these factors determine overall changes in sizes and overall characteristics of whole personal networks. Morgan, Neal, and Carder’s (1997) study of changes in the networks
of widows shows that these changes may be generally described by using the imagery or “core-periphery,” where ties in the core generally remain strong in networks over time, whereas ties in the periphery may drop in and out, even as the overall composition of networks may remain largely the same.

Our brief description of these examples is only intended to illustrate how our typology helps distinguish among studies that focus on different aspects of changes in personal networks over time.

**Description of Change in Particular Networks and Generalization**

Our purpose has been to provide meaningful descriptions of changes within particular networks. Generalization to larger populations requires consideration of the nature of the relevant populations, the representativeness of particular sample frames, and issues of random sampling error.

In studies with an individual (and personal network) as the unit of analysis, random samples (and their approximations) provide reasonably representative samples of larger well-defined populations of persons. Such data are widely analyzed using ordinary inferential statistics. However, the reported ties of a random sample of persons do not constitute a random sample of the population of ties, because the ties are not selected independently of one another as random sampling requires. Statistical inference from such samples to the population of ties requires consideration of the interdependence in the selection of the sample of ties. Specialized statistical methods have been devised to deal with sampling errors in these situations, but as long as there is not a small proportion of the individuals whose ties account for a substantial proportion of the population of ties, a reasonably large random sample of persons should generally provide a reasonably representative sample of ties.

Finally, and perhaps most importantly, many studies of personal networks are within the context of particular populations of persons and ties that can be fully measured. In that case, the issue of representativeness of samples for generalization to that particular population is irrelevant, because the sample is the population. However, such studies are often designed to generalize beyond that particular specialized population of persons and ties. For that reason, the entire study is best regarded as a case study whose results are generalizable to the extent that the particular case is representative of the broader set of phenomena of interest, which is usually not reducible to a simple statistical issue. Nevertheless, meaningful descriptions of changes within particular networks provide the building blocks for general understandings of processes and outcomes of changes of social networks over time.
DISCUSSION AND CONCLUSION

In summary, we suggest that descriptions of changes in personal networks over time depend on: (1) the definition of a tie and the definition of the boundaries of the network; (2) whether we are interested in the existence of or the characteristics of the ties and the networks; and (3) whether we are interested in particular ties or the composition of the network as a whole. Furthermore, we can be interested in just describing the nature of the changes over time or in the characteristics of the individuals, situations, relationships, and alters that affect the nature and extent of these changes. For any given definition of ties and network boundaries, we have laid out a fourfold table of changes that one might describe, depending on focus on existence or characteristics of ties, and individual ties or whole networks.

All four of our ideal types of inquiries into changes in personal networks over time require panel data on ties and contextual factors to examine changes in networks and their causes. We summarize central issues for each of the four types below:

Type 1 simply involves the persistence of ties across time. Researchers measure the existence of ties at time 1 and then again at a later time, and attempt to understand the factors that distinguish between ties that persist and those that do not.

Type 2 studies follow those ties from time 1 that do persist and focus on changes in the characteristics of those ties from their initial time. Researchers attempt to understand the factors that are related to changes in the characteristics of these ties over time.

Type 3 studies focus on the sizes of personal networks at different points in time. These studies include consideration of issues that determine persistence at the tie level in type 1, but also consider sources and circumstances that contribute new ties. Thus, changes in the population of ties over time require demographic considerations of both births and deaths across time.

Type 4 studies focus on changes in the overall characteristics of personal networks across time that can result from issues considered in all the other types of studies and more. At any time, the composition of a network is a function of the additions, changes, and losses of ties in all previous periods. Change from one time to another involves additions, changes, and losses throughout the intervening times. In addition, network properties such as density, number of primary sources, and range, change over time with various aspects of the ego’s situation, including the ego’s motivations and participation in different foci of activity that change with both the individual’s situation (e.g., health, life stage, and work status) and surrounding circumstances.
(e.g., neighborhood change, natural and political events, and life events of others in the environment).

We have used Suitor’s longitudinal study of women returning to school (Suitor 1987a; Suitor and Keeton 1997) to show how one might provide descriptions and explanations fitting into each of the cells in the fourfold table. Finally, we have briefly described several other studies whose analyses fit into the four cells of this table. Our purpose has been to suggest a systematic way to describe the nature of a particular study of changes in networks over time and to facilitate the organizations of such a study.

REFERENCES


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