Factors underlying the structure of older adult friendship networks[1]

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Abstract:

This paper examines the structure of older adult friendship networks and how the immediate social environment in which they are embedded shapes them. Data were a probability sample (N = 65) of the residents of Greensboro, North Carolina, aged 55 years or older, living in noninstitutional settings.

Four of six bivariate hypotheses regarding the relationships between measures of homogeneity, internal hierarchy, and solidarity derived from the friendship literature were confirmed, but none of the 10 hypotheses based on findings from the organizational literature was. We used factor analyses to examine the dimensions underlying these network characteristics and cluster analysis to identify patterns of relationships among these dimensions. The three factors underlying networks structure—egalitarianism, sociability, and religiosity—shaped the friendships of the respondents and reflected the culture and social structure of the context in which this study took place. Although all elderly in this study were generally subject to the same cultural and social structural forces, slightly different components affected the outsiders, low status insiders, and high status insiders and thus they had different patterns of friendship networks factors.

Article:
1. Introduction
During the last 2 decades, researchers have been focusing more attention on the study of friendship, but gaps remain in the literature. Although the trend has been away from using global assessments of friendship attitudes and behaviors and toward measuring characteristics of specific dyadic relationships (Blieszner and Adams, 1992), examinations of the contexts in which people form and maintain friendships have remained a relatively neglected area in the adult friendship literature (Adams, 1993). Contexts range from the societies and communities to the immediate social environments and social networks in which friendships exist (Adams and Blieszner, 1993). In this paper, we are concerned with the structure of older adult friendship networks and how the immediate social environment in which they are embedded shapes them.

By friendship network structure, we mean the form of the ties linking a person to his or her friends and his or her friends to each other (see Adams and Blieszner, 1994, for a more detailed discussion of friendship network structure and its elements). Characteristics of network structure include, but are not limited to: size, homogeneity, internal hierarchy, and solidarity. Although network characteristics can be conceptualized independently of the characteristics of the dyads comprising them, in practice the characteristics of the network are measured by summarizing the characteristics of the member dyads in some way. Friendship network size is the number of nonkin that a person considers to be friends. Homogeneity is the similarity of a person to his or her friends in terms of social positions external to relationships such as gender, race, religion, or age. Internal hierarchy is the power and status of a person compared with that of his or her friends within the context of their relationships (McWilliams and Blumstein, 1991). Although internal hierarchy and homogeneity might be empirically related to each other, they are conceptually distinct. Solidarity is the degree of closeness between people involved in relationships (Brown, 1965).

Although many studies of older adult friendship have included measures of one or two structural dimensions of networks, no previous study has included as wide an array of these characteristics as does the Andrus Study of Older Adult Friendship Patterns. The lack of studies including measures of multiple network characteristics is understandable, because collecting these data is time consuming and thus costly. In the Andrus Study, we sacrificed a larger sample for breadth (many measures) and for depth (open-ended questions, not analyzed in this paper).

The Andrus Study includes measures of size, several types of homogeneity, internal hierarchy (both power and status), and solidarity. Adult friendship researchers have never measured some of these network characteristics before. For example, the Andrus Study includes a measure of denominational homogeneity, because religious institutions are such important organizing forces in Greensboro, North Carolina, the community in which we conducted the research. Adult friendship researchers have also never measured the internal hierarchy of friendships, probably because they have considered friendships egalitarian by definition (see Thomas, 1987). Although adult friendship researchers have measured some of the included network characteristics before, they have not examined their relationships with other structural characteristics.

Findings from previous research made it possible to generate hypotheses regarding bivariate relationships between pairs of each of the following four variables: size, solidarity, homogeneity, and hierarchy. For three of the six pairs, we found previous research on older adult friendship about the relationship between the two variables. In the remaining three cases, it was necessary to search farther afield for research findings suggesting bivariate hypotheses. We examined literature on friendships at earlier stages of adulthood, literature on social networks in general, and finally, literature on informal networks in work organizations. We were able to derive hypotheses for the three remaining pairs only from the organizational literature.

Previous research conducted by one of the authors suggests that network size is negatively related to solidarity. In a study of older women's friendship networks in a suburb of Chicago, Adams (1987) reported that over a 3-year period network expansion was associated with an emotional weakening of the network, while network contraction was associated with an emotional strengthening of relationships. Findings from studies of networks including friends

and other associates support this hypothesis (e.g. Wellman et al., 1991, Lang and Carstensen, 1994, Wellman and Gulia, 1997).

The Andrus Study includes measures of sex, age, and denominational homogeneity. Unpublished findings from the same study of elderly Chicago suburban women discussed above indicated that network size was negatively related to sex homogeneity and positively related to age homogeneity. Because age and sex homogeneity do not operate in the same way and no one has researched denominational homogeneity, it is not possible to generate a hypothesis regarding the direction of the relationship between network size and denominational homogeneity.

Research on older adults in Jefferson County, Kentucky showed that the average level of emotional closeness of friends (i.e. the level of solidarity of the relationships) was positively related to both their sex and age homogeneity (Usui, 1984). The Dykstra (1990) findings on the elderly Dutch confirm these relationships. Because similarity on either age or sex leads to solidarity, it follows that having religious denomination in common with friends would as well.

Although researchers have not studied the internal hierarchy of friendships, it was possible to read the organizational literature for clues regarding the relationship between power and status differentials and other characteristics of networks (e.g. Blau and Schoenherr, 1971, Child, 1979, McPherson and Smith-Lovin, 1987). This literature shows that the larger the size of the organization, the more developed the hierarchy within it. Because occupants of a hierarchical level in an organization tend to interact with one another and not with people at other levels, a more developed hierarchy leads to lower overall organizational solidarity (but higher within-level solidarity). Within levels a great deal of homogeneity exists, but when there are many levels (i.e. a well-developed hierarchy) organizational heterogeneity is greater. Extrapolating from organizations to networks thus suggests the following three hypotheses: network equality is negatively related to size, positively related to solidarity, and positively related to homogeneity.

In addition to testing these bivariate hypotheses, we used factor analyses to examine the factors underlying these network characteristics. One purpose of studying the structure of the friendship networks of older adults was to determine whether some measures are redundant and thus can be excluded from future studies. Another goal was to generate hypotheses about how the values and opportunity structures of the immediate social environments in which friendship networks are embedded shapes them. By examining factors underlying the structure of the networks, rather than only examining bivariate correlations, it is possible to identify the forces that influence them.

Scrutinizing the dimensions underlying networks only provides part of the picture though. Not all of the many environmental forces affect people equally and not all people respond to a given influence in the same manner. Thus, we identified patterns of relationships among the dimensions underlying network structure by using cluster analysis. This enabled us to examine the relationships between older adult characteristics and each type of pattern. The result is a set of hypotheses about what contextual forces helped shape and create the networks under examination.

2. Methods and data

2.1. Population and sample

The population for this study is the residents of Greensboro, North Carolina, aged 55 years or older, living in noninstitutional settings. The probability sample (N = 65), which was generated using a random-digit dialing technique, includes nine respondents who were unable for health reasons to complete the answers to the questions analyzed in this paper. Another of the remaining respondents had no close friends (i.e. no friendship network structure).

Of the remaining 55 respondents, about half (49.1%) were female. About two-fifths (38.2%) of them were between the ages of 55 and 64 years, two-fifths (38.2%) between the ages of 65 and 74 years, and the others were older than 75 years. About four-fifths (78.2%) of the sample were Caucasians and except for one respondent, the rest were African American. Most (80.0%) of them were born in Southern states, with over half (55.0%) of all respondents native North Carolinians.

The majority of the respondents were Protestant (85.5%), with about one-tenth (10.9%) being Catholic and a couple being Jewish. Over half of the 47 Protestants were either Methodists (27.7%) or Baptists (23.4%).

About two-thirds (65.5%) of the 55 respondents were married, a quarter (25.5%) widowed, and a tenth (9.1%) divorced. Only a quarter (23.6%) of them lived alone.

Most of the respondents identified themselves as members of the middle class (45.5%) or upper-middle class (36.4%). Their educational accomplishments support these subjective assessments; over two-thirds (67.3%) had completed some formal education after high school graduation. About three-tenths (30.9%) of them were still employed, at least part-time.

The study participants were relatively healthy, with a third (34.5%) reporting excellent health, another two-fifths (40.0%) claiming good health, and another fifth (20.0%) describing it as fair. Less than half (43.6%) reported any physical limitations on their activities.

2.2. Measurement of network characteristics

After respondents defined friendship, they listed the various places, groups, times of life, and activities from which their friendships came. Then the interviewer prompted them to list their friends from each of these contexts and to list other friends as well, adding contexts as they thought of them. Respondents had a mean of 28.5 (SD = 26.9) friends (not including their family members whom they listed as friends). The number of nonkin friends they listed ranged from three to 132. This mean and range of size of network are larger than is typically found in studies of networks of associates, and we asked them only to list their friends. For example, Fischer (1982) reported that his respondents had an average of 18.5 kin and nonkin associates. Wellman and Wortley (1989) reported a similar figure.

The interviewers asked the respondents a series of questions about each friend, including the degree of emotional closeness with each person. Respondents reported a mean of 10.8 (SD = 13.5) casual friends, 11.8 (SD = 14.5) close friends, and 6.0 (SD = 7.5) very close friends. The respondents answered additional questions about each of their close or very close friendships and the relationships of these friends with each other. The analyses of friendship network structure

included in this paper are analyses of networks of close and very close nonkin friends, not of their entire friendship network.

In addition to asking the respondents how close they felt to each of their friends, the interviewers asked them how close each of their close and very close friends felt to each other. These data were used to compute a measure of network solidarity using a weighted version of the standard density formula (Kapferer, 1969): $(200(b + 2c + 3d + 3q + 4e + 4\ r)/4)/m(m - 1)$, where b = the number of acquaintance links between friends, c = the number of casual links between friends, d = the number of close links between friends, e = the number of very close links between friends, q = the number of close friends reported by the respondent, r = the number of very close friends reported by the respondent, and m = q + r. The closer a friendship or link was, the larger a weight was assigned to it. Note that though only close and very close friends of the respondents were included in the computation of this measure of network solidarity, some of their friends had more casual relationships with each other and thus b and c are included in the equation. Network solidarity ranged from 5% to 100%. The mean solidarity was 28.2% (SD = 19.6%).

The measures of homogeneity are the proportion of all close and very close friends who shared a given characteristic with a respondent. Respondents reported on whether each friend was the same age, younger, or older than themselves; we used the proportion identified as the same age in these analyses. We also asked them about the sex and denomination of each of their close and very close friends. A respondent and friend were coded as homogeneous on denomination if both were not religious or if both were affiliated with one of the following religious groups: Roman Catholic, Jewish, Baptist, Christian Disciples, Congregational, Episcopalian, Lutheran, Methodist, Pentecostal, Presbyterian, Seventh Day Adventist, or the United Church of Christ. The mean homogeneity scores for age, sex, and denominational homogeneity were, 33.5% (SD - - 25.8%), 86.4% (SD = 14.3%), and 40.6% (SD = 30.1%), respectively.

In previous studies, investigators assumed that friendships were egalitarian, but our data suggest many of them are not. Of their close and very close friends, respondents described an average of 64.6% (SD = 32.4%) as equal in power (influence on decisions) and an average of 67.6% (SD = 29.8%) as equal in status (respect accorded).

3. Results
3.1. Bivariate correlations of network structure variables
After testing the linearity, homogeneity of variance, and normality assumptions,[2] we tested the bivariate hypotheses discussed in the introduction by examining Pearson's correlation coefficients for each pair of variables.[3] Of the 16 pairs of variables for which we were able to

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[2] Plotting residuals against predicted values for each pair of values revealed no distinct patterns, suggesting that the data meet the assumptions of linearity and homogeneity of variance. We also compared the observed distribution of residuals with that expected under assumptions of normality by plotting the two cumulative distributions for each pair of variables against each other. No large departure from a straight line occurred (i.e. the lines were identical for both), though some pairs of variables showed a slight tendency toward more large negative residuals and fewer residuals near zero than would be predicted. Nonetheless, the data satisfactorily met the normality assumption.

[3] One-tailed tests of significance *(P < 0.05)* were used. We performed two scts of analyses, one with pairwise elimination of cascs and the other with listwise. Only the listwise rcsults are rcported in Table 1, bccause thc

derive hypotheses from the literature, four pairs were significantly correlated in the predicted direction, including: size of network and solidarity, size of network and age homogeneity, size of network and sex homogeneity, and solidarity and denominational homogeneity (see Table 1).

3.2. Factors underlying network structure

Three independent factors underlying network structure emerged from a principal components analysis with a varimax rotation.[4] The first factor underlying network structure, as shown in Table 2, concerned egalitarianism. This dimension was a continuum from networks in which a large proportion of relationships were unequal in power and status to networks in which a large proportion of the relationships were equal in power and status. Egalitarianism was also evident in the high proportion of cross-sex friendships characteristic of the networks tending to include friendships equal in status and power.

The second dimension underlying network structure was sociability. This factor reflects a continuum from small age-heterogeneous networks of close friends to large age-homogeneous networks low in solidarity.

The third dimension underlying network structure was a religiosity factor. It identi-

Table 1
Listwise bivariate Pearson correlations ($N = 55$)

Variables	No. close friends	Solidarity	% Equal power	% Equal status	% Near same age	% Same sex	% Same denomination
No. close friends	×	−0.2635**	0.1348	0.2215	0.2831**	−0.3717**	−0.0313[a]
Solidarity	×	×	0.0883	0.0786	−0.1776	−0.635	0.3090**
% Equal power	×	×	×	×	−0.342	−0.3064	−0.0286
% Equal status	×	×	×	×	0.1153	−0.2127	−0.0065

[a]No a priori hypothesis was derived for the direction of this correlation.
**, One-tail tests are significant at the 0.05 level and indicated in bold.

Table 2
Rotated factor matrix ($N = 55$)

Variable	Egalitarianism	Sociability	Religiosity
% Equal power	0.76[a]	−0.19	−0.21
% Same sex	−0.71	−0.17	−0.19
% Equal status	0.64	0.12	0.06
% Same age	−0.08	0.82	−0.04
No. of close friends	0.42	0.69	−0.13
% Same denomination	0.02	0.10	0.82
% Solidarity	0.03	−0.33	0.76

[a]High loadings are indicated in bold.

findings were not different from the two sets of analyses. The results were the same when leaving in three apparent outliers as when omitting them, so we included them in all of the analyses reported in this paper.
[4] Bartlett's test of sphericity was significant $(P < 0.05)$, the eigen values were all larger than one, and the three-factor solution explained 63% of the variance. The values on the diagonal of the anti-image correlation matrix were all large, but none of the other correlations in the matrix were. Communality ranged from 0.42 to 0.69 after we eliminated some measures of homogeneity with small values from the analyses. The same three factors emerged from an oblique rotation, and these factors were not significantly correlated, demonstrating that the varimax rotation was not imposing independence where it did not exist.

Pies a continuum from networks characterized by low solidarity and denominational heterogeneity to those characterized by denominational homogeneity and high solidarity.

3.3. Patterns of network structure: cluster analysis

Because the three factors underlying network structure are independent, a given respondent could have a friendship network high on one factor and low on another. For example, an older adult's friendship network might be egalitarian, but low on sociability and religiosity. Theoretically, there can be myriad patterns of combinations of levels on the three underlying dimensions.

To identify groups of respondents with similar patterns underlying their network structures, the three sets of factor scores were used as the basis for an agglomerative hierarchical cluster analysis (Norusis, 1994).[5] The three-cluster solution was the most

Table 3
Pearson's correlations of respondent characteristics and dimensions of network structure with cluster membership ($N = 55$)

Respondent characteristic[a]	Cluster membership		
	Outsiders	Low-status insiders	High-status insiders
Demographics			
Male	−0.26*	0.22	0.05
Born in NC	−0.10	0.23*	0.11
Protestant	−0.28**	0.14	0.14
Socio-economic			
Subjective class	0.02	−0.28**	0.24*
Education	−0.14	−0.21	0.32**
Health			
Subjective health	−0.12	−0.17	0.26*
Has no limitations	−0.22	−0.05	0.25*
Family			
Married	0.16	−0.24*	0.07
Lives alone	0.28**	−0.24*	−0.05
Has grandchildren	0.21	0.03	−0.23*
Network structure			
Egalitarianism	0.28**	−0.38***	0.09
Sociability	−0.73***	−0.01	0.70***
Religiosity	−0.30**	0.63***	−0.29**

[a]Respondent characteristics were included in the table if they were significantly related at the 0.10 level to membership in at least one cluster.
*, Two-tailed test, significant at the 0.10 level; **, two-tailed test, significant at the 0.05 level; ***, two-tailed test, significant at the 0.01 level.

satisfactory, because cases were distributed in groups of relatively equal size. Table 3 shows the Pearson's correlations between membership in each of the three binary clusters and both a variety of respondent characteristics and dimensions of network structure. Examination of these

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[5] The average linkage within groups method was used for combining cases into clusters. The average distance among all cases in a resulting cluster was thus as small as possible. We used the city-block measure of distance between cases rather than the more commonly used measure, the squared Euclidean distance. "For any two cases, [the city-block measure] is the sum of the absolute differences of the values for all variables" (Norusis, 1994, p. 97). Because the differences are not squared, as with the more commonly used measure, large differences are not weighted as heavily.

correlations reveals that the three clusters represent different status groups whose members we can describe as outsiders (30.9%), low-status insiders (27.3%), and high-status insiders (41. 8%), respectively.

We included respondent characteristics in Table 3 only if they were significantly related to membership in one or more clusters. Notably absent are race and age. Members of the high-status cluster tended to be a bit younger than those in other clusters and members of the low-status cluster were more likely to be African American than those in the other clusters, but these tendencies were far from significant.

The outsiders tended to have networks characterized by a high degree of equality and low levels of sociability and religiosity. These respondents tended to be outsiders in three ways: they were the least likely to be native North Carolinians, the least likely to be Protestant, and the most likely to live alone. Seven-tenths (70.6%) of the outsiders were male compared with 33.3% of the low-status cluster and 47.8% of the high-status cluster. In an age-group in which women are in the majority, being male can be a characteristic of marginality.

The low-status insiders tended to have networks low in egalitarianism and shaped heavily by religious belief. They were more likely than those in other clusters to report working or lower-middle class membership (40.0% compared with 11.8% for the outsiders and 8.7% for those of high status). Although the correlation is not significant, they tended to have the least amount of formal education. They were the least likely to be currently married and also the least likely to live alone.

The high-status insiders tended to have highly sociable network patterns among people near their age and, like the outsiders, religious beliefs tended not to underlie their network structure. They were high status in both their subjective social class and their level of education. Their high socioeconomic status probably fostered their good subjective health and lack of physical limitations. They were the least likely of the respondents to have grandchildren, probably partly due to their slightly younger age and partly due to patterns of delayed child birth among upper status people.

4. Discussion and conclusions
Two-thirds of the six bivariate hypotheses based on previous research on older adult friendship were confirmed, but none of the ten hypotheses based on findings from the organizational literature was. In retrospect, the failure of the findings from the literature on relationships within work organizations to predict findings on friendship networks is not surprising, because work organizations and friendship networks are both conceptually and substantively different from each other. The degree of choice involved in selecting friends is higher than that involved in becoming co-workers. In perhaps most cases, people have little or no control over who is employed by the same organization as they are. Another difference between friendship networks and work organizations is how clear membership criteria are. It is less clear now than in the past whether someone is employed by an organization, because teleworkers, contractors, and virtual organizations are becoming more common. Nonetheless, it is still less ambiguous whether someone is employed by an organization than whether someone qualifies as a friend. The failure of the organization literature to predict the relationships between pairs of friendship network

characteristics supports the notion that researchers should treat friendship as a distinct form of social relationship rather than categorizing friendships in a residual category with other nonfamilial associates (Adams, 1989).

Two of the hypotheses generated from previous research on older adult friendship networks were not supported. Unlike us, both Dykstra (1990) and Usui (1984) found that sex and age homogeneity were each positively correlated with network solidarity. The explanation for the discrepancy in our results and theirs lies in the way in which solidarity was measured in each study. Dykstra compared the homogeneity of her respondents' best friends to the homogeneity of their other close friends. Usui computed the average level of emotional closeness between each respondent and her or his friends. In contrast, our measure of solidarity included information on the strength of these ties as well as on the strength of the ties between each pair of other friends in the network. (Note that neither Dykstra nor Usui actually called the measure they included in their studies "network solidarity." We imposed this label on their measures of emotional closeness, because their measures were those conceptually closest to our notion of solidarity.) Our measure introduces the possibility that pairs of friends who are dissimilar could nevertheless be romantic partners or relatives with each other. These heterogenous pairs of friends would probably be emotionally closer to each other than their unrelated or romantically uninvolved counterparts. Measures of average emotional closeness between respondents and their friends do not include such relationships. For this reason, the correlation between homogeneity and solidarity is different using our network solidarity measure than it would have been using one of the previously published measures.

The three factors underlying network structure (egalitarianism, sociability, and religiosity) shaped the friendships of the respondents and reflected the culture and social structure of the context in which this study took place. In a younger-aged population or in one in a different region, different factors would have emerged. For example, the religiosity factor would probably be less likely to emerge either in a younger southern population or in an elderly northern population than it was in this one. Studying the factors underlying friendship networks reveals as much about the context in which they are formed and maintained as about the internal structure of the networks. Friendship is an ideal relationship to examine in studies of contextual effects, because the rules governing it are not as widely held or enforced as those pertaining to family and work relationships. Friendship is thus more reflective of its cultural context than other more institutionalized relationships are.

Because external forces so powerfully affect friendship network structure, a factor analysis of findings from a culturally specific context such as this one is limited in its usefulness as a data-reduction technique. The only variables than can be eliminated from future research instruments are those that seem to measure such similar concepts that one of them appears redundant with the other. The measures of status and power inequality arguably are such a pair.

Not all elderly people occupy similar positions in their structural and cultural environment and thus their networks are not all affected by the same external forces. Although all of the elderly in this study lived in Greensboro, North Carolina, and were generally subject to the same cultural and social structural forces, slightly different components affected each cluster and thus three different patterns of friendship network factors emerged. Those who were the least integrated

into their immediate social environment, the outsiders, had networks the least likely to be shaped by local cultural norms. The two insider groups, both the low-status and the high-status ones, were well-integrated into their social environment, but due to differential resources and values, they were integrated in different ways. The lower-status group relied heavily on the church as a source of friends and the higher-status group relied more on a wider network of people near their ages. These findings underscore the need for a large-scale study of a diverse population to gain a better understanding of how contextual forces affect people in different social structural positions and in various subcultural contexts in different ways. Understanding that friendship patterns are firmly embedded in contexts that exert influence over their form makes it clear that they are not merely the result of personal choice.

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