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The Relationship of Age to Personal Network Size, Relational Multiplexity, and Proximity to Alters in the Western United States

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Objectives. This study examines the association of age and other sociodemographic variables with properties of personal networks; using samples of individuals residing in the rural western United States and the City of Los Angeles, we evaluate the degree to which these associations vary with geographical context. For both samples, we test the hypothesis that age is negatively associated with network size (i.e., degree) and positively associated with network multiplexity (the extent of overlap) on 6 different relations: core discussion members, social activity participants, emergency contacts, neighborhood safety contacts, job informants, and kin. We also examine the relationship between age and spatial proximity to alters.

Method. Our data consist of a large-scale, spatially stratified egocentric network survey containing information about respondents and those to whom they are tied. We use Poisson regression to test our hypothesis regarding degree while adjusting for covariates, including education, gender, race, and self-reported sense of neighborhood belonging. We use multiple linear regression to test our hypotheses on multiplexity and distance to alters.

Results. For both rural and urban populations, we find a nonmonotone association between age and numbers of core discussants and emergency contacts, with rural populations also showing nonmonotone associations for social activity partners and kin. These nonmonotone relationships show a peak in expected degree at midlife, followed by an eventual decline. We find a decline in degree among the elderly for all relations in both populations. Age is positively associated with distance to nonhousehold alters for the rural population, although residential tenure is associated with shorter ego-alter distances in both rural and urban settings. Additionally, age is negatively associated with network multiplexity for both populations.

Discussion. Although personal network size ultimately declines with age, we find that increases for some relations extend well into late-midlife and most elders still maintain numerous contacts across diverse relations. The evidence we present suggests that older people tap into an wider variety of different network members for different types of relations than do younger people. This is true even for populations in rural settings, for whom immediate access to potential alters is more limited.

Key Words: Multiplexity—Social networks—Support relations.

THE negative association between personal network size and age is one of the most robust findings in social gerontology (Cornwell, 2011; House, 1987; Marcum, 2012; Suitor, Wellman, & Morgan, 1997). On average, older people have fewer ties than younger people (Lang & Baltes, 1997). Equally robust is the finding that older people have a greater proportion of kin, relative to other types of relations, in their personal networks (Antonucci & Akiyama, 1987; Wellman & Wortley, 1989). Additionally, a growing body of evidence suggests that older people are increasingly living alone—often in rural areas with fewer neighbors (Berry & Kirschner, 2013)—which raises the risk of becoming geographically isolated from their personal network members (alters) and disconnected from opportunities for forming new relationships (Cornwell & Waite, 2009) over time.

The process that underlies the decline in personal network size, greater geographic isolation than younger counterparts, and the entrenchment into kinship networks among older people may have additional implications for the breadth of their social lives. In particular, the question of whether older people rely on a smaller set of actors to fulfill a larger number of roles in their personal networks remains open. Likewise,

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questions remain regarding variation in personal network size for different kinds of ties over the life course and the dependence of such variation on ecological context (e.g., rural vs. urban populations). Here, we examine the association between age and number of ties in six different network relations: core discussion partners, social activity participants, emergency contacts, neighborhood safety contacts, job informants, and kin. Additionally, we examine the multiplexity of relations—that is, the extent to which ties in one relation overlap with ties in another set of relations—to test the hypothesis that declines in personal network size are likewise associated with increased multiplexity. Because the potential consequences of social isolation are greatest for those who are geographically isolated (due e.g., to fewer available resources, such as transportation, that could help promote social contact in the event of isolation), and because limits to the number of easily accessible alters is itself a potential risk factor for declines in personal network size, our primary focus is on the rural population of the western United States (an understudied group). As a point of comparison, we also consider residents of the largest urban center in the region, the city of Los Angeles, CA. By examining the network correlates of age at the urban and rural extremes, we are better able to assess the geographical robustness of our findings than previous studies.

For the last 20 years, the primary explanatory work on aging and social networks has been socioemotional selectivity theory (SST) (Carstensen, 1991). The theory posits that the contraction in social network size and entrenchment into kinship components often observed as people age is attributable to individual adjustment to impending mortality and a refocusing of goals to enrich and maintain existing relationships rather than invest in forming new ones. Recent independent studies by Marcum (2012) and Cornwell (2011), however, have found evidence that the age-associated declines in social network activity are largely due to social structural factors including the changing availability of potential alters. This often involves a reduction in household size as children move out and spouses become widows among a growing population of older people who wish to age-in-place (Tang & Lee, 2011).

One of the consequences of older people's longer home tenures (Sabia, 2008) is their greater exposure to changes in their communities. One aspect of recent changes affecting people who choose to age-in-place is that they are more likely to live apart from their younger, more mobile family members (Mulder & Kalmijn, 2006; Tang & Lee, 2011). At the same time, older people are less likely to form new relationships despite geographic availability; Stevens, Martina, and Westerhof (2006) found that friendship formation was negatively associated with age even after older people were brought together in an intervention because they felt they needed more friends. While relationships and contact among kin are likely to persist (Lawton, Silverstein, & Bengtson, 1994; Treas & Gubernskaya, 2012), older people may be less likely to form new ties to others in their changing neighborhoods. This process implies that older persons risk having fewer local contacts to respond in case of emergencies or neighborhood safety issues. Indeed, for some older adults, these ties may be limited to a spouse or a single caregiver, especially among the oldest of old who expect to remain at home (as research by Tang & Lee, 2011 suggests). In the past, when other family members lived close by, they may have filled these multiplex roles. For this reason, examining the association between age and distance to one's social contacts may be important for understanding the extent of social isolation with age.

The above effects may be exacerbated in low-population density (i.e., rural) settings, due simply to the smaller number of potential alters available for interaction. Furthermore, rural areas in the United States typically have reduced availability of public infrastructure, particularly transportation. Individuals with impaired vision or mobility may still be able to travel within urban communities by means of public transit or otherwise find access to interaction partners within a short radius of their residence. By contrast, those living in rural settings may face the prospect of either traveling longer distances (on foot or by motor vehicle) to engage in face-to-face interaction, or else attempting to convince their alters to do so who, if same-aged, may also face mobility limitations. The geography and infrastructural limitations of rural settings create barriers to social interaction that should, all else being equal, fall more heavily on the elderly, arguably leading to a greater degree of social retrenchment and a greater reliance on multiplex ties. Unfortunately, there is only limited work on the wide variety of ties needed to address how age is related to multiplexity in personal networks.

We might speculate, however, that to the extent that other social structural factors vary across the life course, an individual's potential for interacting with others will evolve as he or she ages, due to both shifts in motivation for maintaining interaction partners and to changes in the availability of alters. These changes may give rise to age-related differences in multiplexity, as some interaction partners take on additional roles and others become more or less specialized over the life course. Although recent work has alleged a general increase in multiplexity due to a blurring between the life spheres of work, friendship, and family (Olson-Buchanan & Boswell, 2006; Pahl & Spencer, 2004) and a broadening of the types of ties that may have familial and/or intimate dimensions (Jamieson, Morgan, Crow, & Allan, 2006), we posit that age-related variation will persist.

Measurement of social networks from a gerontological perspective has traditionally focused on a limited number of relations, including tangible and emotional support providers, friends, and discussion partners. Additionally, little work has been done on the multiple types of relationships that are often incident on the same set of actors. Rook (2009) notes that the social networks of older people may

be characterized by multiplexity—yet quantitative assessment of the overlap in different aspects of the social lives of older people remains a considerable gap in the literature. Early gerontological work by Thompson and Streib (1961) depicted network overlap in the various types of relations between members of families with older adults—their primary observation was that the meaning extracted from their familial bonds may be shaped by the various types of interactions occurring within families. More recent studies have revealed that, increasingly, older people have more non-kin in their personal networks, though still less so than for younger persons. Among others, Ajrouch, Akiyama, and Antonucci (2007) and Suanet, van Tilburg, and Broese van Groenou (2013) have found that, in a cohort of older people, the number of non-kin present in personal networks increases as they age. Suanet and coworkers (2013) goes on to explain that part of this cohort effect may be the result of increases in reliance on others for support in the absence of geographically distant kin. Regardless, as the life course progresses and roles change for egos and alters alike, the extent to which the mix of kin and non-kin in older people's personal networks fulfill a range of multiplex roles is an open question. As multiplex relationships have been found to differ from uniplex relationships in both contact frequency (Verbrugge, 1979) and tie strength (Wellman & Wortley, 1990), and can be associated with differences in higher order structures such as subgroup overlap (McPherson, Smith-Lovin, & Cook, 2001), age-related changes in multiplexity could have broader implications for both relationship quality and social integration.

It is unknown empirically whether age-related decline in network size is also associated with a contraction in the *variety* of ties active in the personal networks of older people. One possibility is that older individuals rely on a smaller set of actors to engage in a wider range of relations leading to greater multiplexity in old age. Alternatively, older people may react to their decrease in available alters by compartmentalizing their relationships diffusely across their personal networks leading to less multiplexity. The former scenario would be consistent with SST, as increasing interactional potential could be construed as evidence of relational enrichment. On the other hand, less multiplexity in the latter scenario would be inconsistent with SST, as it would suggest that older people seek out a variety of different individuals to fulfill different roles in their social lives. From a life course perspective—which emphasizes the interconnectedness of individuals through linked-lives and shifting roles as people navigate life as discussed by Elder Jr. (1998)—these age-related shifts in network size and composition may reflect an underlying and corresponding shift in interpersonal roles and in how older people tap existing network members for resources. Here, we are able to shed light on one aspect of how linked-lives and shifting roles intersect and differ over the life course by examining age differences in network multiplexity.

Method

We begin by defining a few standard terms from social network analysis that will be used throughout the remainder of the paper. Our focus here is on *egocentric* or *personal* networks, defined by Wasserman and Faust (1994) as "a focal actor, termed *ego*, [and a] set of *alters* who have ties to ego" (p. 43). Correspondingly, we refer to the survey respondent as ego and those to whom he or she is tied as alters. Finally, the number of alters to whom ego is tied on a given relation is called his or her *degree*. Given this terminology, we now proceed to a discussion of our sample, measures, and analytic strategy.

Sample

Our data come from the American Social Fabric Study (ASFS), a spatially stratified, large-scale egocentric network survey that contains demographic and geographic information on both respondents (egos) and those to whom they are tied (alters) (Butts et al., 2014). The ASFS includes questions about network structure, community outcomes, and the geography of social ties, giving us a view of structural variation multiple spatial scales and on several social relations. The ASFS study population consists of adult, non-institutionalized residents of the western United States; subjects were recruited by personal mailings inviting them to complete a web-based survey instrument, with small financial up-front and completion incentives. The period of data collection spanned approximately 4/2012–1/2013. Here, we use three samples from the study: a population sample of the city of Los Angeles (LA), a spatially stratified sample of adults in the Southern California region (CRS), and a spatially stratified sample of adults in the western continental United States (Western). Respondents were solicited by block group or tract. For the LA sample, respondents were sampled proportional to population, and for the CRS and Western samples, respondents were sampled approximately uniformly across space (accomplished by sampling proportionate to land area). The overall response rate was approximately 19%, which is in line with other studies using similar survey instruments and recruitment schemes (Dey, 1997; Dillman & Messer, 2011; Sax, Gilmartin, & Bryant, 2003); comparison of sample demographics with Census data show good overall agreement, and we here employ statistical controls (see below) as an additional correction for response bias. Unlike some other recruitment methods (e.g., respondent driven sampling [Salganik & Heckathorn, 2004]), the approach used by the ASFS is not dependent on network structure, and we hence have no reason to expect selection bias based on number or type of personal ties. See Supplementary Material for a map showing the study area and ego locations. In order to compare the association between age and network structure across urban and rural settings, we use only respondents sampled from rural tracts for the CRS and Western samples (N = 2,884) and compare to the LA sample (N = 210)—tracts were classified

as "rural" if less than half of their land area was contained within a region identified by the U.S. Census as an urban or urbanized area. However, in most cases, the percentage of land area identified as urban by the census was either 100% or 0%, leaving little ambiguity as to our classification. We here refer to the former as the Rural sample, and the latter as the LA sample.

Measures

We have three dependent variables: distance to alters (in log km), network degree (i.e., number of alters for a given ego) on six different relations, and multiplexity. Each is described below. Our primary covariate of interest is age, which we include as a polynomial (age + age^2) in our regression analyses to account for nonmonotone effects between age and our dependent variables, as prior research on the life course perspective has found curvilinear associations between age and various social structural outcomes (Cornwell, Laumann, & Schumm, 2008; Kleemeier & Kleemeier, 1979; Litwin, 1996).

Degree.—We calculate degree on six different network relations that were collected via egocentric name generator instruments (Butts, Hipp, Nagle, Boessen, & Smith, 2014). The six relations are as follows: (a) *Core discussion* indicates alters with whom ego has discussed important matters in the last six months; (b) *Social activities* indicates alters with whom ego engages in elective social activities; (c) *Emergency contact* indicates alters whom ego would contact to pass on information in the event of an emergency; (d) *Neighborhood safety* indicates alters with whom ego would discuss issues of safety in his or her neighborhood; (e) *Job leads* indicates alters whom ego would contact to seek information about jobs; and (f) *Kin*. No upper limit was set on the number of alters who could be identified in each relation, and it was explicitly indicated that alters could be nominated for more than one relation. Kinship ties are aggregated from several different questions specifically inquiring about spouses or partners, parents, children, and siblings and were identified by ego as living persons with whom ego was in at least occasional contact; for parent, child, and sibling relationships, adoptive, step-, or similar relationships were explicitly included.

Distance to alters.—We calculate the distance to each respondent's noncoresidential alters by computing the geodesic (i.e., great circle) distance from ego's residential location to that of the alter in question; this was performed using the WGS84 ellipsoid via the R sp package (Pebesma & Bivand, 2005). All distances are expressed in log km.

Multiplexity.—We measure tie multiplexity for each of the six network relations. That is, for an ego-alter tie on one relation, we count how many of the other five relations are also present for that ego-alter pair. This gives us a *multiplexity score* for each alter on each relation, from which we compute the average multiplexity score for each ego on each relation. For instance, a core discussion multiplexity score of 3 for ego would indicate that, on average, ego's core discussion ties overlap with 3 other relations.

Covariates.—The main predictor of interest is the age of ego. Additionally, we included the following demographic covariates of ego: gender, an indicator for self-identification as Black, an indicator for self-identified Hispanic ethnicity, education, residential tenure, household income, an indicator for whether or not ego has a spouse, an indicator for whether or not ego has children in the home, and employment status. Education was coded as a continuous variable, ranging from 0 to 3 (high school or less, some college, bachelor's degree, and graduate degree), on the basis of preliminary analysis suggesting approximately equal-interval effects for the variables considered here (analyses were also conducted with education as a categorical variable, with similar outcomes). Employment status was coded categorically: unemployed (reference), employed part- or full-time, and retired/other. We include these demographic covariates for two reasons. First, we expect a priori that the ability to sustain social ties could vary based on an individual's resource level (e.g., ability to travel, ability engage in activities that cost money, etc.) as well as demographic characteristics such as race and gender (McPherson, Smith-Lovin, & Brashears, 2006). Second, these covariates are needed to control for potential selection effects, some of which (e.g., through differential mortality) could potentially bias our estimates of the effect of age on personal network structure. Additionally, we include a measure of perceived neighborhood belonging (Bollen & Hoyle, 1990), indicating the extent to which ego reports feeling a sense of belonging to his or her neighborhood.

Analytic Strategy

The association between average distance to alters and age was estimated using multiple linear regression models. The association between age and average multiplexity was also estimated using linear regression models. To test our hypotheses regarding the association between age and degree, we used Poisson generalized linear models. Models were selected based on their AICc score (lower scores indicate better fit, corrected for sample size and number of predictors [Burnham & Anderson, 2004]). We compare results of the regression analyses between the Rural sample and the LA sample based on the respective best-fitting (AICc selected) models; where best-fitting models differed in inclusion of quadratic terms across samples, models fit using the excluded term produced qualitatively similar results.

Results

Descriptives

We note that the demographics of the samples are in line with the study region, and thus differ in some respects from

the United States as a whole (most obviously with respect to race and Hispanic ethnicity). Comparing the two samples, the average age is slightly higher for the rural sample than in the LA sample, with ranges of 18–102 years and 19–94 years, respectively. The two samples are relatively similar in terms of education level and income, whereas the rural sample has a higher proportion of respondents with spouses and kin. We also note that, on average, our respondents report between approximately two and seven ties for each elicited relation (the highest number of alters being for social activities, and the lowest being for job leads), with the rural respondents having more ties on average than the LA respondents on all relations. Across all relations, our respondents report an average of approximately 10 unique alters (some of whom are nominated for more than one relation). Finally, we note that the multiplexity of the relations is similar among rural and LA respondents, with an average multiplexity of around 3 for each relation. Please refer to the Supplementary Material for the table of means and *SD*s for the outcome measures and covariates in each of the samples.

Degree and Age

Tables 1 and 2 present the results of the Poisson regression models predicting degree on all six relations for the Rural and LA samples, respectively. To highlight the effect of our main covariate of interest, Figures 1 and 2 display the prediction for expected degree on each relation as a function of age, holding all other covariates constant at their means, for each sample. Overall, we note that—consistent with prior research—all relations ultimately show a decline in personal network size in old age in both the Rural and LA samples. Relations differ in both the form of the decline (monotone from early adulthood vs. peaked in midlife) and in the quantitative details thereof. Both the Rural and LA samples exhibit a nonmonotone decrease in degree of core discussion and emergency contact relations with age, though the magnitude and timing of these peaks vary between the samples. For the Rural sample, the degree of core discussion partners peaks at about age 50, with 4.5 alters compared to a peak around age 60 with only about 1.5 alters for the LA sample. Similarly, the emergency contacts and social activities peaks occur both earlier and at a higher magnitude in the Rural sample than in the LA sample. In contrast, degree on the neighborhood safety relation exhibits a monotone decrease for both samples. Differences in the form of the degree decline occur for the other two relations, with degree for kin exhibiting a nonmonotone decrease for the Rural sample and a monotone decrease for the LA sample, and with degree on job leads following a monotone decrease for the Rural sample and a nonmonotone decrease for the LA sample. Finally, we note that degree is lowest in old age for the job lead relation and highest for kin across both samples.

Other noteworthy factors associated with degree include male gender (which is a significant negative predictor in all cases save kin in LA, and never positive), education (significantly positive for all relations save kin in the Rural sample, and all save emergency contacts and neighborhood safety ties in LA), and embeddedness in one's local community (residential tenure and neighborhood belonging, both associated with higher degree in the majority of cases).

Multiplexity and Age

Figures 3 and 4 show the prediction for the expected multiplexity score as a function of age for the Rural and LA samples (respectively), holding all other covariates constant at their means (please refer to the Supplementary Material for the tables containing the results of the regression models). Like degree, multiplexity tends to decline throughout the life course, though the form of the decline varies slightly across population and relation. We see a monotone decrease in multiplexity for the core discussion, social activities, and neighborhood safety relations in the Rural sample and a monotone decrease for all relations in the LA sample. In contrast, rural kinship, job leads, and emergency contact ties decrease until around age 70–80 and then begin to increase again, as the age-curve indicates a slight "rebound" effect in late life (although this is small compared to the overall pattern of decline). Interestingly, few other predictors of multiplexity are consistently significant, with the exception of having a spouse or partner (which is generally associated with higher multiplexity) and, for the Rural sample, residential tenure (which is also associated with higher multiplexity).

Distance to Alters and Age

Table 3 presents the results of a regression model predicting average log distance to alters not living in ego's household for the Rural sample. As predicted by the "dispersal" hypothesis, as age increases, average distance to alters also increases. Other significant, positive predictors for average distance to alters are education, being male, Black race, and having a spouse. Negative predictors include residential tenure, Hispanic ethnicity, and increases in neighborhood belonging. For the LA sample, age was not a significant predictor of distance. In fact, the only significant predictor of average distance to alter was residential tenure which, like the rural sample, had a negative association with distance.

Limitations

Although we are able to infer a great deal regarding the relationship between age and personal network structure, we note some limitations of our study. First, while we have sufficient statistical power in the LA sample to identify the qualitative pattern behind the age effect, we are not able to conclusively rule out the possibility of more subtle (i.e., monotone but nonlinear) deviations from linearity. Follow-up studies on this and other urban populations are

Table 1. Regression Model Predicting Degree by Age and Other Ego Covariates for Rural Western Sample

	Core	Social	Emergency	Neighborhood	Jobs	Kin
Intercept	0.2919 (0.1552)	−0.1123 (0.1297)	0.5658*** (0.1395)	1.0452*** (0.1624)	1.1890*** (0.1918)	0.2185 (0.1304)
Age	0.0164*** (0.0038)	0.0114*** (0.0032)	0.0167*** (0.0035)	−0.0074*** (0.0010)	−0.0141*** (0.0011)	0.0242*** (0.0033)
Age^2	−0.0002*** (0.0000)	−0.0001*** (0.0000)	−0.0002*** (0.0000)			−0.0003*** (0.0000)
Education	0.1377*** (0.0099)	0.1139*** (0.0082)	0.0830*** (0.0090)	0.0988*** (0.0119)	0.0982*** (0.0143)	−0.0253** (0.0088)
Residential tenure	0.0038*** (0.0008)	0.0028*** (0.0007)	0.0042*** (0.0008)	0.0042*** (0.0010)	0.0090*** (0.0012)	0.0005 (0.0008)
Log (household income)	0.0387** (0.0132)	0.1083*** (0.0110)	0.0340** (0.0119)	−0.0524*** (0.0158)	−0.0117 (0.0189)	0.1141*** (0.0110)
Male	−0.3089*** (0.0184)	−0.3206*** (0.0153)	−0.2685*** (0.0166)	−0.1844*** (0.0221)	−0.3387*** (0.0264)	−0.0822*** (0.0162)
Black	−0.1975* (0.0807)	−0.3212*** (0.0711)	−0.1516* (0.0701)	−0.1662 (0.0927)	−0.1201 (0.1032)	−0.0203 (0.0647)
Hispanic	−0.1696*** (0.0348)	−0.0932*** (0.0283)	−0.0952** (0.0299)	−0.0503 (0.0385)	−0.2089*** (0.0470)	
Has spouse	0.0839*** (0.0240)	0.1143*** (0.0205)	0.1231*** (0.0221)	0.3123*** (0.0305)	0.0801* (0.0340)	
Has children	0.2585*** (0.0253)	0.3865*** (0.0220)	0.3646*** (0.0235)	0.4121*** (0.0319)	0.1562*** (0.0343)	
Employed	−0.0840** (0.0304)	−0.0180 (0.0261)	−0.0522 (0.0274)	−0.0355 (0.0364)	0.0428 (0.0418)	−0.0262 (0.0267)
Retired	−0.1379*** (0.0337)	−0.0147 (0.0287)	−0.0476 (0.0303)	−0.0370 (0.0401)	−0.1586*** (0.0479)	−0.0494 (0.0300)
Neighborhood belonging	0.0448*** (0.0034)	0.0471*** (0.0028)	0.0457*** (0.0031)	0.0752*** (0.0042)	0.0529*** (0.0049)	0.0171*** (0.0029)
Likelihood ratio chi-squared	1065.77	1898.895	1279.445	968.880	766.776	495.766
Model degrees of freedom	13	13	13	12	12	10
p value (LLR chi-square test vs null)	0	0	0	0	0	0
Log likelihood	−7728.4246	−10014.5254	−8738.4319	−6835.0569	−7186.6428	−6950.1913
Number of observations	2,580	2,580	2,580	2,580	2,580	2,587

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 2. Regression Model Predicting Degree by Age and Other Ego Covariates for LA Sample

	Core	Social	Emergency	Neighborhood	Jobs	Kin
Intercept	−1.6458* (0.6850)	−1.9742** (0.6030)	−1.2041 (0.6695)	−1.7115* (0.7489)	−1.4184 (0.9625)	0.3320 (0.5298)
Age	0.0484** (0.0163)	0.0211 (0.0136)	0.0286 (0.0149)	−0.0044 (0.0039)	0.0360 (0.0242)	−0.0056* (0.0025)
Age^2	−0.0004** (0.0002)	−0.0003* (0.0001)	−0.0003* (0.0001)		−0.0004 (0.0003)	
Education	0.2130*** (0.0466)	0.1922*** (0.0422)	0.0676 (0.0436)		0.1793** (0.0661)	0.0977* (0.0415)
Residential tenure		0.0139*** (0.0035)		0.0144** (0.0044)		
Log (household income)	0.1353* (0.0586)	0.2214*** (0.0521)	0.1504** (0.0564)	0.1857** (0.0648)	0.1232 (0.0823)	0.0606 (0.0492)
Male	−0.3421*** (0.0819)	−0.4453*** (0.0712)	−0.2566*** (0.0757)	−0.3070** (0.1009)	−0.3548** (0.1154)	−0.0577 (0.0716)
Black	−0.3262* (0.1596)	−0.1847 (0.1388)	−0.1987 (0.1450)	−0.0144 (0.1777)	−0.4323 (0.2498)	0.1241 (0.1216)
Hispanic	0.0900 (0.1014)	0.3375*** (0.0853)	0.2625** (0.0918)	0.2365* (0.1173)	0.2270 (0.1374)	0.2379** (0.0882)
Has spouse	−0.1184 (0.0841)	0.1832* (0.0785)	0.2078* (0.0847)	0.4407*** (0.1179)	−0.1291 (0.1165)	0.4485*** (0.0843)
Has children		0.1935* (0.0851)	0.2537** (0.0909)	0.3112* (0.1219)		0.4689*** (0.0875)
Employed	−0.0279 (0.1187)		−0.0281 (0.1080)		−0.1243 (0.1486)	
Retired	−0.2674 (0.1579)		−0.2182 (0.1441)		−0.9259*** (0.2536)	
Neighborhood belonging	0.0323* (0.0157)	0.0443** (0.0136)	0.0206 (0.0143)	0.0348 (0.0188)	0.0405 (0.0221)	0.0105 (0.0133)
Likelihood ratio chi-squared	117.403	187.127	96.940	78.942	103.765	111.588
Model degrees of freedom	11	11	12	9	11	9
p value (LLR chi-square test vs null)	0	0	0	0	0	0
Log likelihood	−413.0419	−495.6737	−436.3054	−347.2703	−339.9320	−399.0423
Deviance	317.5235	448.3554	331.8994	283.8301	353.2240	223.1286
Number of observations	178	178	178	178	178	178

*$p < .05$. **$p < .01$. ***$p < .001$.

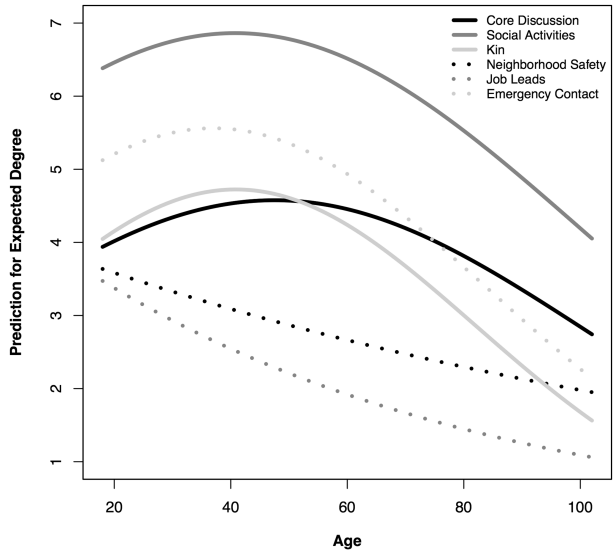

Figure 1. Prediction for expected degree for six network relations by age for rural sample, all other covariates held at their means.

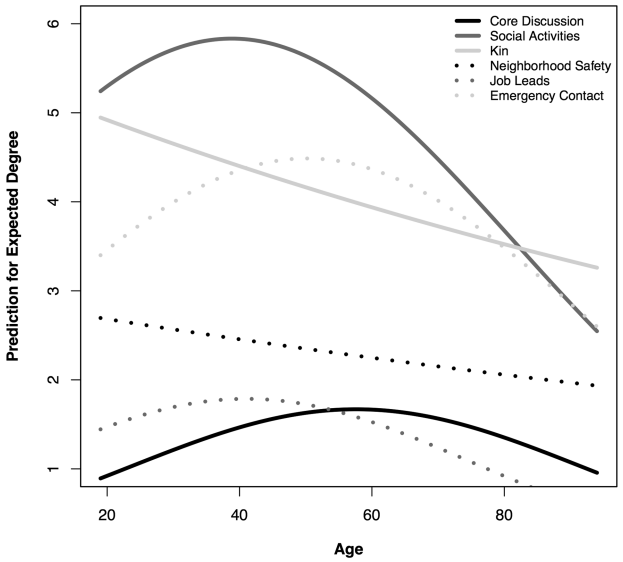

Figure 2. Prediction for expected degree for six network relations by age for LA sample, all other covariates held at their means.

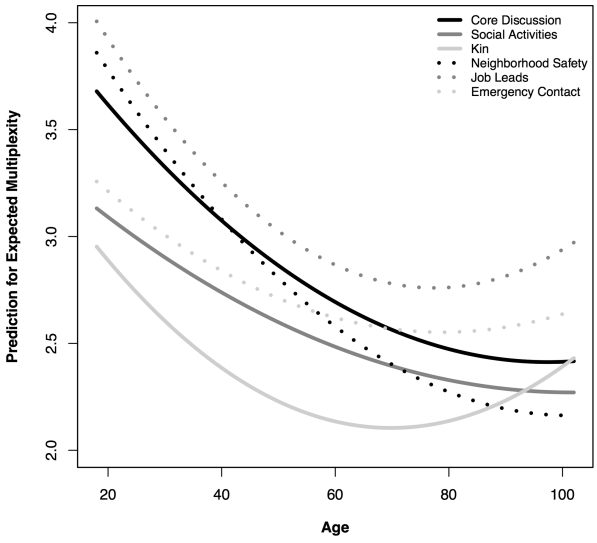

Figure 3. Prediction for expected multiplexity for six network relations by age for rural sample, all other covariates held at their means.

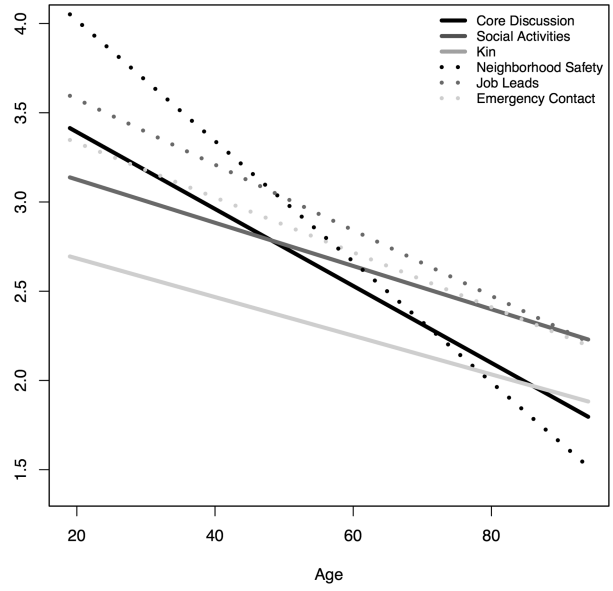

Figure 4. Prediction for expected multiplexity for six network relations by age for LA sample, all other covariates held at their means.

needed to either discover or rule out such effects. A second limitation is that while we are able to identify the association of age to personal network structure, our study does not allow us to unpack the myriad associational and/or causal factors behind this effect. Most notably, health and mobility are both theorized to be key drivers of tie formation and dissolution and cannot be examined with the covariates available to us. Studies incorporating information on ego's health status would greatly aid in interpreting the associations uncovered via the present work. Relatedly, data on other relations, such as instrumental support or caregiving, in conjunction with those examined here would increase our understanding of these phenomena in late life.

Discussion

Our findings support the notion that personal network size ultimately tends to contract with age on six different relations, and that this pattern holds for persons in very different ecological settings. For certain relations and geographical settings (e.g., core discussion, social activities, emergency contact, and kinship in the Rural sample), this decline is preceded by a substantial *increase* in

Table 3. Regression Model Predicting Average Log Distance to Alters Not in Ego's Household by Age and Other Ego Covariates for Rural Sample

	Model 1
Intercept	4.51*** (0.44)
Age	0.01*** (0.00)
Education	0.19*** (0.03)
Residential tenure	0.05 (0.04)
Log (household income)	–0.02*** (0.00)
Male	0.03 (0.06)
Black	–0.40*** (0.11)
Hispanic	0.56* (0.24)
Has spouse	0.25** (0.08)
Has children	0.28*** (0.08)
Employed	–0.04*** (0.01)
Retired	–0.10 (0.10)
Neighborhood belonging	–0.03 (0.11)
R^2	0.09
Adj. R^2	0.08
Number of observations	2,359

Note. *$p < .05$. **$p < .01$. ***$p < .001$.

mean degree that extends into (and sometimes through) midlife; it is thus important to emphasize that the association between age and personal network size (net of other factors) is complex and dependent upon both geographical context and relational type. Further research is necessary to determine the factors that govern the nonmonotonicity of personal network size within specific populations. We caution that, despite the decline of average personal network size in old age, elders are still expected to have nonnegligible numbers of alters (with some sustaining fairly large combined personal networks). Contraction in personal network size need not mean social isolation.

This study is the first, to our knowledge, to examine the overlap of a broad spectrum of relations and to show that network multiplexity varies with age. While declining personal network size would seem to imply increased multiplexity—via a reliance on a smaller number of alters for the same range of social relationships—our results do not generally support this hypothesis. In general, relationships in both the rural and urban populations become *less* multiplex with time, reflecting an increasing pattern of specialization. For the Rural sample, this is slightly modified in late life by a tendency to rebound toward higher levels of multiplexity on kinship, job leads (a type of tie very unlikely to be resorted to for this group), and emergency contacts; we do not detect a similar pattern in the LA sample (although, given how late in life this tendency manifests, we may simply lack the power to do so). To the extent that multiplexity taps into a process of enrichment of relationships by relying on a few individuals for more types of interaction, these findings appear to be at variance with the predictions of SST. One possible explanation for this discrepancy is quantitative and contextual: selectivity theory may apply primarily in late life, and possibly for those with health impairments or other factors that motivate a reconsideration of personal relationships. Given that we see some evidence of a multiplexity rebound for egos in rural areas (where opportunities to find new alters are limited) and on relations like kinship (the central focus of the theory), our findings are not wholly incompatible with socioemotional selectivity. They do, however, suggest that the quantitative and relational scope of the theory should be examined more closely, and that alternatives such as "functional" selection (where network members are selectively retained because they provide access to important resources that would otherwise be unavailable) be considered (Lang, Rieckmann, & Baltes, 2002; Schulz & Heckhausen, 1999). More generally, our findings suggest value in future studies that seek to understand whether the smaller, more specialized networks of older people provide equivalent support and functions as the larger, more overlapping networks of younger people.

Finally, we have shown that regardless of rural or urban location, the length of residential tenure decreases the average distance to one's alters. This suggests that aging-in-place may not be as poor an option in terms of social opportunities as previously believed. Even as older people's social networks contract—and even as aging in a rural community is socially isolating—there is a protective effect on access to interaction partners of residing for longer periods in one's neighborhood and being more integrated into one's community. Although old age takes its toll on personal networks, embeddedness in a supportive community may help individuals maintain a diverse array of social ties as we have shown here.

Supplementary Material

Supplementary material can be found at: http://psychsocgerontology.oxfordjournals.org/

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