How is Social Time Distributed Over the Age Pyramid? Demographic Baseline Models of Daily Social Interaction in Personal Networks

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Abstract

Age differences in the frequency of face-to-face social interactions have long been of interest to life-course sociologists. Most past research in this area has emphasized the role of health status, retirement, and psychological factors in shaping how age influences the amount of time people spend together. Fewer studies have examined propinquity based on demographic baselines. Following Mayhew (1973), I test competing baseline models of age-differences in social interaction in this paper. The results suggest that a substantial portion of social time can be explained simply by household structure, the age distribution, and gender. Data come from the pooled 2003–2007 American Time Use Survey and hypotheses are tested using Butts' (2008) generalization of proportional hazards analysis. Recommendations for further research and implications for social gerontology are discussed.

Keywords: Time Use, Social Interaction, Aging

Extended Abstract

Studying social interaction within personal networks has a long tradition in sociology. People acquire information, assistance, select mates and identify enemies through social interaction within their personal networks. Social interaction is a basis for exchange and support (Wellman and Wortley, 1990), is known to reduce stress Cohen and Wills (1985), and is protective against social isolation, loneliness, and health problems (Uchino et al., 1996). Personal networks are also conduits for — as well as protection against —

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disease, exploitation, and abuse (Berkman and Syme, 1979; Suitor et al., 1996; Wenger, 1997; Friedman and Aral, 2001). These issues are especially important to gerontological research, which has emphasized the supportive role of interactions for older adults and the ways in which social relations may be altered by life events (Kahn and Antonucci, 1980; Rook, 2009). On a given day, who is active in American's personal social networks, how are they active, and why do some people have certain patterns of interaction while others differ? That is, how does age, household structure, and gender (amon other demographic and life course factors like parenting status) affect how people get through a day in their lives? These questions are important for gerontological research: being able to typify age varying patterns in daily interactions enables prediction of who is likely to be available in times of need. More generally, personal network activity in daily life is an important sociological phenomenon. Studying social activity in daily life can shed light on the roles and processes of personal networks in task performance, leisure, personal care and other dimensions of how people spend their time. Past approaches relied on static reports of personal network activity in the aggregate, which are good for studying how individual characteristics relate to network properties (and the characteristics of their alters). However, there is still much to be learned about how individuals participate in their daily personal networks in an everyday context, which provides a foundation for global properties and dynamics of personal networks.

The three most robust findings about the relationship between age and social interaction from the developmental literature are: 1) as age increases, social network size decreases; 2) older people are less active in their personal networks than younger people in the sense that they have less contact with their alters; and 3) with the onset of old age, people tend to shed weak ties in favor of maintaing close relationships, particulary with kin. These changes in social profiles associated with aging are particularly interesting to social gerontologists, especially in light of life course theory that has emphasized linked-lives between and across generations (Elder Jr. and Caspi, 1990; Bengtson et al., 2006). While these findings are well-known and generally regarded as true, few studies have explored how the opportunity structure for spending time with others may be different for people of different ages. The present study advances this line of research by establishing the baselines of the opportunity structure for social interaction in personal network. The baseline effects explored here all stem from demographic factors, which I now turn to in the next section.

Age and the Social Structure

In *Inequality and Heterogeneity*, Blau (1977a) argued that the social structure molds interaction between people far more than any influence stemming from technology, culture, or psychology. The dominance of group size, institutions, the organization of work life, and heterogeneity of groups in shaping opportunities for social interaction all share common features of the social structure narrowly defined in Blau's words as "the distributions of a population among different social positions that reflect and affect people's relations with one another" (Blau, 1977b, pg. 28). Following, Ryder (1965) and Foner (1975), I argue that age is one of the common features of the social structure — i.e. in Blau's sense — that governs social interaction because of its influence as both a micro and macro variable. That is, age is simultaneously an individual process of maturation and senesence and a natural grouping based on shared experience and life trajectory (Glenn, 1976). The social structural constraints of age on social interaction stem from a variety of sources including: 1) cohort size (Ryder, 1965; Mayhew, 1973), 2) age-graded social institutions such as schools and the workforce (Blau and Duncan, 1967; Foner, 1975), 3) social norms and laws, especially those regulating sexual behavior (Waites, 2003), 4) cultural sources such as cohort differences in tastes for particular types of activities or knowledge domains (Putnam's discussion of Bridge clubs, for example (Putnam, 2000; 2007)), 5) bonding through shared-experience between people of the same age (Bengtson et al., 2006) and, perhaps least trivially, 6) physical and economic dependence between generations .

Consistent with Blau's proposals, Mayhew (1973) has shown that group size alone can be highly predictive of interaction in a system and can be modeled using baserates. These results suggest that demography matters in shaping opportunities for interaction over the life span. The field of demography is predominantly occupied with assessing population growth and decline, along with its antecedents and consequences (Weeks, 1994). Demographic theory can be generalized to analysis of social networks insofar that social network size is determined by the same processes governing population size; namely, people can be born into a network, they can die out of it, or they can migrate into or out of a network. Moreover, social demographic factors such as age, race, class, and household structure often explain cohesiveness between close groups of immediate alters in a network, as explained by McPherson et al. (2001).

Demographic expertise on the age-structure and the needs of an aging population is particularly useful here Altman and Shactman (2002). Age-

specific population size, mortality, fertility, and migration all contribute to the opportunity structure for forming social ties. As Ryder discusses in two flagship articles, these demographic factors shape, among other things, the relative population share of each cohort on the population pyramid, the number of co-living generations, and intercohort dependence (Ryder, 1964; 1965). That is, demographic properties determine group size. Moreover, settlement patterns — i.e. as related to demography — comprise the geosocial context in which people live, work and play. These demographic properties, in turn, constitute the structural baselines for who is likely to interact with who and under what conditions those interactions are likely to occur.

Intuitively, the age-structure constrains interaction based on the availability of cohort members and non-cohort members. A largess in the share of the population in one generation, such as the baby-boom in the United States, naturally increases the likelihood of interaction between cohort members. And for members of other cohorts, increases their likelihood of interaction with people of this cohort (age) since there are so many members. Similarly, if there are fewer members of a certain cohort (e.g., the cohort of men who died in WWII), then people of other cohorts have fewer opportunities to interact with them (e.g., less likely to know their grandfathers, or befriend older neighbors). Likewise, the fewer people there are in an age group, generation, or birth cohort, the ferwer the number of like-aged alters and the fewer opportunity pool for age assortative mixing. As a corollary, cohort largesses might lower the likelihood of out-group interaction just as cohort dearths might increase such interactions (Blau et al., 1982). The age-structure of a population is, of course, *a priori* determined by mortality and fertility patterns, which have their own implications for age differences in social network size and content.

Older people are more at risk to lose their peers due to increased mortality in the upper steps of the age-pyramid (Antonucci and Akiyama, 1987). This translates into fewer opportunities for older people to seek out and interact with their age peers (and, in turn, more opportunity for younger people to do so). Following Blau's theory of group size and group mixing rates, then, we would expect that relative intercohort mixing rates would be higher than intracohort mixing rates for the older the population. This latter point is worth considering further: older people can be expected to loose ties — and irrespective of psychogenic properties — simply based on the fact that the force of mortality is greater for older people (Johnson and Barer, 1997). Fingerman (2009) points out that this was considered by Carstensen and her colleagues (Carstensen, 1992; Carstensen et al., 1997) in the development of socioemotional selectivity theory and further suggests

that the force of mortality — all things equal — would result in uniform decline in close and peripheral alters. However, while it is true that older network members are more likely to die out, there is probably too much heterogeneity in networks to determine the functional form of mortality on network content as it differs between close and peripheral ties, as Fingerman supposes. However, a clearer perspective of how mortality affects the networks of older and younger people alike is gained by research on the social lives of widows (which, incidentally, also sheds light on the effects of gender and marital status more generally on personal networks).

One factor contributing to both the effects of mortality and marital status on personal network membership that life span psychologists and sociologists alike have investigated is widowhood. When a spouse dies, it has the potential to sever all the ties that the deceased had brokered in marriage. However, unlike divorce which has been shown to polarize brokered relationships between spouses (Kalmijn, 2003; Terhell et al., 2004; Kalmijn and Broese van Groenou, 2005), widowhood often has a solidarity building effect in the personal networks of the bereaved (Walker et al., 1977; Morgan, 1989). It has long been known that interaction with informal/peripheral network members increases as a source of social support after the death of a spouse (Bankoff, 1983; Kohen, 1983) (and Balkwell (1981), for a review). Based on evidence from focus-group discussions with recent widows, Morgan (1989) suggests that this change is possibly due to the greater flexibility in social obligations that informal relations offer versus the more rigid expectations of family members.

While much is known about the supportive roles of peripheral and close relationships in the social networks of widows and widowers, less is known about changes in overall social behavior. Utz et al. (2002) and her colleagues report evidence from the *Changing Lives of Older Couples* study that points to increases in informal social participation (as measured by number of interactions outside of a formal group context) by widows and widowers compared to married adults of similar age. Both groups of the older adults interviewed in this study, however, had comparable levels of formal social participation (as measured by attending meetings, religious services, and completing volunteer activities, etc). While the increase in informal interaction, they argue, is the result of widows/widowers receiving support, it may also be indicative of a substitution process replacing the supportive role of the deceased spouse. Indeed, in Zettel and Rook (2004)'s study of more than 300 short and long term late-life widows, they found evidence of such a substitution process but the increase in support did not appear to compensate for the loss of a spouse. Their results held

even after controlling for duration of widowhood, indicating that the loss of a spouse is fundamentally unique in the personal network and is likely to influence broader patterns of social interaction. Of course, widowhood is not equally experienced by men and women due to women's longer life expectancy. Gender too, then, shapes age differences in personal networks through differential mortality.

It is useful to consider how, at many points in the life course, there are differences in social profiles between men and women more generally. Biology, society, and culture shape appropriate social behaviors for men and women which change as people age and experience changes in ability, roles, and obligations. As with age, past research has shown that gender plays an important role in who interacts with whom and under what contexts social interaction takes place. A great deal of sociological work has shown how age and gender interact to shape social networks at different life stages.

Childhood gender differences in social interaction stem from how adult men and women socialize differently with children (Thomson et al., 1992). Young children are likely to choose same-sex playmates and, because of their dependence, spend a lot of time with their kin (Maccoby, 1990). This pattern changes in young adulthood with more sex-mixing and a decline in interactions between kin (Cotterell, 1996; Steinberg, 2003). Young adulthood is often a life stage of increased independence from parental supervision and a time when sexual partners and life-long friends are formed. Still, this life stage also foments relationships between children and their parents. In Frits van Wel (1994)'s study of Dutch youth, most young adults saw their parents as peers and counted them as friends. However, assortative age-mixing prevails in young adulthood as most young adults are still structurally bound by the highly age-graded highschool and college educational institutions (Foner, 1975; Nurmi, 1993). Middle-age represents a substantial increase in the heterogeneity of relationship types and the gender differences entailed within networks.

Putney and Bengtson (2001) have suggested that gender patterning of midlife relationships is shaped by the divergent roles men and women find themselves in at that life stage. While contemporary men and women in the United States (and throughout the West) both have to balance social, work, and family life, they have to do so with different sets of contraints. Women are far more likely to have their careers interrupted by family obligations, including more interruptions than men experience from childbearing, parenting, and care-giving to parents (Maume, 2006). Thus, women may have less time to commit to a large personal network because of these risks, which may be compounded by their greater likelihood of holding a second-shift in their

work/family life balance (Hochschild and Machung, 1989). With respect to the interplay between work and family, however, Loscocco and Spitze (1990) found that there are almost no gender differences in social support structures stemming from work-related social networks. Thus, even though men tend to have more work-related contacts than women, those contacts are context bound and less likely to remain with men as they age out of the workforce. With fewer work related relationships than men, women are often more involved with the family and begin the process of becoming kinkeepers in their midlife development, especially for married women (Putney and Bengtson, 2001). Given this, we would expect that as men retire they should begin to converge with women in terms of their social profiles in old age. Indeed, as Lee (1980) and Powers and Bultena (1976) have shown, women tend to maintain their kinkeeper role into old age and men trend towards investing more time in kinship relations as they age and move out of the workforce but do not reach the same level of involvement as women.

As mentioned above, because of their longer life expectancy and lower participation in dangerous occupations, women are more likely than men to experience widowhood. In old age, women will have more same-gender, same-age peers than men. Naturally, this means that men will have more age and gender diversity in their networks in old age. Women, though, are also more likely than men of the same age to live alone. However, their larger numbers and kin-keeping roles is likely protective against isolation in old-age. In their longitudinal study of an elderly cohort, Shye et al. (1995) found that the negative effect of mortality on network size is greater for men than for women. Prior evidence from the *Supports of the Elderly Study* indicate that this is due to men's greater reliance on their spouse to provide social support and maintain the marital social network (Antonucci and Akiyama, 1987). Indeed, widowers suffer more distress than widows during episodes of spousal bereavement which may in part stem from concomitant social losses (Stroebe and Stroebe, 1983). At no other stage in the life course do these baselines occur and the underlying mechanism is mortality.

Of course, the demographic compliment of mortality, fertility, is also an important factor in shaping age differences in social interaction. Having and raising children, a phenomenon typically associated with young adulthood and middle-age, strongly shapes individuals social opportunities. The financial and time responsibilities that comes part-and-partial with having kids may redirect resources away from spending time with friends and colleagues. While this may be the case intitially after the arrival of a baby, early longitudinal work by Belsky and Rovine (1984) on social networks and the transition to parenthood demonstrates no long-term differences in the

frequency of contact with non-kin, comparing before and after childbirth. Of course, single parents are at a disadvantage for social contact (Gunnarson and Cochran, 1990) due to the absence of a partner and his or her own personal networks and social resources. Still, having children tends to increase contact within the family and across generations (in the family) (Silverstein and Bengtson, 1997; McPherson et al., 2001) and this has long-term consequences for social interaction across the life course. For example, Spitze and Logan (1990) found that the structure of household composition early in life affects social contact later in life. Their findings indicate that having daughters is associated with high frequency of telephone communication for older people and is key to receiving help, while having many children (of either gender) increases the number of face-to-face visits between parents and their adult-children.

Data and Methods

The data come from the American Time Use Survey, pooled over survey years 2003 through 2007. The American Time Use Survey is a special product of the US Department of Labor Statistics and the US Census. A subsample of the Current Population Survey, the American Time Use Survey consists of a record of individuals' daily activities. The data can be characterized as spells of activities, which include activity-level covariates such as stop and start time, activity type, number of other people in the room, and the relationship of the other people in the room to the informant. This data is ideal for studing personal egocentric networks in a daily context.

Time-diary data on spells of activity are an important source of information with regard to the process that generates people's social profiles. One approach to make full use of this information can be generalized from Butts (2008)'s "relational event framework" for modelling social action. Under this framework, I can model the entire sequence of particular types of activity spells as an event history. The relational event framework improves over traditional approaches by simultaneously estimating of the likelihood of each activity spell and allowing for possible dependency between spell histories. Additionally, we can include individual actor and spell covariates in this model. It allows me to address the question, under what conditions do people engage in social activities?

The relational event framework is ideal for understanding social activity in short times scales, such as interactions taking place over the course of a day. As Heise and Durig (1997) observe, interactions can be thought of as events emitted by individuals and directed outward — towards other people

or even towards objects — with possible dependencies on previous events or exogenous factors. This approach is typically used in contexts where one wants to quantify the rate of types of social action, such as systems where actors sending and receiving communication between one another, for example. I generalize this approach to study the dynamics of how people navigate their days. The general parametric form of the model is represented in Equation 1:

$$\begin{aligned} \lambda_a A_t \theta = \lambda(c(a), A_t, X_a, \theta) \\ = exp^{\lambda_0 + \theta^T \mu(c(a), X_a, A_t)} \end{aligned} \tag{1}$$

which is expressed as the hazard of transitioning to activity spell 'a' given the activity spell's type ($c(a)$), the current history of activity spells (A_t), covariates (X_a), and a parameter vector (θ). The baserate at time 0 is represented as λ_0. Covariates can include the duration of the activity spell, the types and counts of people (if any) participating in the activity, and individual attributes of the time-diary informant. Importantly, events can depend on the past history and individual level covariates in this model. For example, spending a lot of time with family members may depend upon both starting the day in the household and the presence of kin in the house.

The relational event framework can be thought of, in a general sense, as a type of event history analysis (see Blossfeld and Rohwer, 2002, for a discussion of the proportional hazards approach to event history analysis). The events in my data are the transitions from one activity spell to another. An individual's set of spells may be thought of in this framework as that individual's *event history* for a single day. My research strategy includes modelling event histories jointly as individual and population processes whereby the hazard for following any particular event history depends upon the available pool of local events and the pool of event histories at large.

Baseline Models

I model the probability of an individual being at risk of face-to-face social interaction (i.e. *vis-a-vis* others being present in the room at the time of an activity) as a function of competing baseline models and stochastic effects of the event history itself. This means that all activities influence the survival function of the an individual's event history, but that only activities done with others present in the room are allowed to modify the likelihood of the event history. Model comparison is accomplished via likelihood statistics. While the parameters in the modelling framework discussed above are mul-

tiplicative on the overall event history hazard, for simplicity I'll adopt the more familiar additive form to describe the baseline models.

The first set of baseline models tested consist of parameters only for individual and household characteristics. These are allowed to influence the pooled baserate of an individual's event history and not particular events *per se*.

1. Age
2. Age + Household Population
3. Age + Household Population + Marital Status
4. Age + Household Population + Marital Status + Presence of Children
5. Age + Household Population + Marital Status + Presence of Children + Gender

Second, the terms in Models 1–5 are added via a set of sufficient statistics to separate models for inertia, saturation and a combination of inertia and saturation. Activity inertia refers to the propensity for people to get locked into activities with a fixed number of people. Stay-at-home mothers, for example, may have all their daily social time absorbed by their children. Saturation, on the other hand, is an effect for a spell (or spells) of activity done in the presence of others to be punctuated by spells of activity done alone. This effect intends to capture periods of relief from being saturated with lots of social activity that may occur in a day.

- Models 1–5 + Activity Inertia
- Models 1–5 + Saturation
- Models 1–5 + Activity Inertia + Saturation

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