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Network Instability in Times of Stability[1]

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Abstract

Personal networks undergo change in response to major life course events. Individual, relational, and network characteristics that influence network instability in the absence of a significant life transition/crisis are less understood. We focus on those ties that transition from active to dormant. Because the shift to dormancy is often interpreted as a reduction in support or social capital, it is considered problematic. This study is based on longitudinal survey data of middle-class adults who did not undergo life changes. Even in this context of relative stability, support networks experience rates of dormancy similar to those observed during periods of major upheaval. Tie dormancy is unrelated to individual characteristics, network size and density, or homophily along dimensions other than sex. Frequency and medium of communication are particularly notable as factors that were not related to tie dormancy. Ties were less likely to become dormant if they were geographically or emotionally close, immediate kin or neighbors, highly supportive, the same sex, or more embedded in the network. These findings provide context for how support networks operate when not buffeted by exogenous forces. They provide a baseline for understanding the impact on networks of transitions, trauma, new media, and difficult life circumstances.

Keywords: egocentric networks, network change, tie dormancy, persistence, social support

Instability in Times of Stability

Introduction

Instability in the composition of personal networks is one of the defining characteristics of a post-industrial, urban society (Hampton and Wellman, 2018; Bauman 2000). Sociologists have long remarked how, in response to major life course events, such as moving (Coleman 1988), starting school (Small 2017), or retiring (Ikkink and Tilburg 1999), network members are lost. Such tie dissolution is often viewed as problematic, an indication of social distress, reduced social support, or lost social capital. A considerable body of research has documented the loss of social ties among those who undergo major life transitions. However, far less is known about how much tie dormancy (at least the temporary loss of a social ties) is experienced within a person's networks in times of relative stability. Beyond experiencing a major event, it is not well understood what individual, relational, and network characteristics influence network instability. Understanding how networks change in times of stability is important, not only in itself, but to establish a baseline to understand the context of change in response to a crisis or major life event. Such an understanding is also important as a point of comparison for those scholars who argue that personal networks are becoming more or less turbulent in response to interventions and large-scale social change, such as those that may be related to mobility (Fischer 2011) or the use of new communication technologies (Hampton 2016). In the composition of people's personal support networks, stability may, in fact, not represent the norm in times between major life course transitions. Stability may represent a time that is surprisingly high in network churn.

This study examines network change from a multi-wave study of middle-class adults during times without major upheaval. Participants in our sample were not undergoing life changes,

which have the documented effect of shaking up networks. Their middle-class status protects them from many of the crises and tensions that precipitate the disintegration of ties in more disadvantaged populations (Cornwell 2015). Networks of supportive relations in this population should be as stable as possible. Our analyses test a series of competing predictors of tie dormancy over time. We explore the role of individual demographic characteristics of participants and their ties; network characteristics, such as size and density; relationship characteristics, including tie strength, duration, homophily, embeddedness, role (such as kin or neighbor), and proximity; exchange of support; and frequency of communication through different media. We find that even in a population in which one would expect maximum constancy, networks experience a rate of tie dormancy that is not very different from what other researchers have observed at moments of tribulation. Prior research suggests a range of factors that might protect ties from falling into dormancy, such as face-to-face contact, individual characteristics associated with access to higher social resources, and network structures that might reduce the cost of tie maintenance. However, we find a limited set of characteristics associated with lower likelihood of tie dormancy: embeddedness, relational closeness, physical proximity, sex homophily, and the provision of social support. Understanding how networks change in times of stability not only tells us how personal support networks operate when not buffeted by exogenous forces, but provides a baseline for understanding the impacts on networks of transitions, trauma, new media, and difficult life circumstances.

Understanding Dormant Ties

Although churn in networks can involve many processes, including dormant ties returning to active ones and the adoption of entirely new ties, we focus here on those ties that transition from being active to dormant. We define active ties as those whom participants

identify as providing support or who are otherwise especially close; dormant ties are those who provided support or were close at one point in time, but no longer are. The loss of a social tie is generally interpreted as a reduction of support and opportunity for deliberation or a loss of social capital, and is thus problematic (McPherson et al 2006).[4] However, just how problematic tie dormancy is depends, at least to some extent on how one interprets "dormancy," and what else is happening within a person's network. Dormant ties may be replaced by equivalent ties to other people, or even institutions (Hampton and Ling 2013). A tie that is present at one point in time, and absent in another, may eventually return to the network. Indeed, we would argue that dormancy is distinct from tie "loss," or the non-reversible "dissolution" of a tie. The widespread use of technologies that make it easier to articulate connectivity over time (e.g., Facebook), may even reduce the likelihood that ties will remain dormant (Hampton 2017). While the opportunity for reactivation could be very low, a tie that is not active is in a state of dormancy until the individual or the alter physically dies, which once and for all removes the potential that the tie will be resurrected. The precise cost of any individual tie going dormant is thus very much dependent on the context, the characteristics of the individual, the person they were connected to, the resources that person provided, and any tie replacement. This makes it difficult to forecast the true cost of higher rates of tie dormancy, and is beyond the scope of this paper. However, while the cost of dormancy is difficult to predict, dormancy is associated with disruption, either

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[4] The title finding of this article – that social isolation had increased over two decades – is now widely interpreted as having been a methodological artifact (McPherson et al. 2008; Paik and Sanchagrin 2012). However, the finding that core networks have becoming smaller and less diverse has been replicated (Brashears 2011; Hampton, Sessions, and Her 2011).

as an antecedent or an outcome. Dormancy has long been presumed to be an indicator of turbulence in a person's life.

It is well established that some ties go dormant during a major life transition. Studies examining network turnover (e.g., see the 1997 special issue of *Social Networks*, several of the included papers are cited here), during and after significant life events consistently find that a relatively large number of people who once provided support are absent from support networks at some later time. Examples include studies that focus on students who are transitioning to school and after graduation (Bidart and Levenu 2005; Roberts and Dunbar's 2011b; Suitor and Keeton 1997; Oswals and Clark 2003; Roberts and Dunbar 2011a; Small et al. 2015; Small 2017), transnational migrants (Lubber et al. 2010), people recently diagnosed with mental illness (Perry and Pescosolido 2012; Wright and Pescosolido 2001), the recently divorsed (Terhell et al. 2004; Albeck 2002), the recently retiered (Ikkink and Tilburg 1999), and the recently widowed (Morgan et al. 1997). This body of work has produced fairly reliable findings: in moments of major transition, one-third to one-half of all ties became dormant over a mostly short period of study of less than a few years.

Feld (1997) found that among first-year college students, 46% of ties became dormant through the year. Among Argentine migrants in Spain, 48% of ties dropped over a two-year time period. Among people newly diagnosed with mentail illness, 50% of ties turn over within three years (Perry and Pescosolido 2012). Morgan et al. (1997) used surveys with widows, measured with twenty-two snapshots over a one-year period, and found 55% stability between any pair of surveys. The data on incoming graduate students by Small et al. (2015) showed dormancy rates varyied by field of study, with approximately one-quarter to one-half of alters dormant six months later, and one-third to one-half dormant six months after that. Milardo's (1987) study of

how divorce influences network structure suggests that as many as 40% of ties made during a marriage are dropped after a divorce. Likewise, van Tilburg's (1992) study of retirement shows that men dissolve approximately one-third of their ties, primarily those to work colleagues. Of the various populations studied, retiring adults maintained the greatest number of their previous ties, but even they lost 21% of their network ties over a time period of between one and two years (Ikkink and Tilburg 1999). Other significant life transitions, such as the birth of a child, have also been associated with declines in network size (Cronenwett 1985).

Studies of network change on people who are undergoing major life course transitions suggest that the transition or crisis causes dormancy. But, in the absence of studies of people not undergoing a major transition, we do not know if some or perhaps the majority of the observed network change might have occurred even without the crises. Examples of studies of dormancy that do not focus on major transitions are considerably rarer. Longitudinal network studies that span a long duration but have few intervals of measurement pose a particularly unique problem of interpretation. Because movement between active and dormant is not unidirectional or irreversible, much of short-term flux in network composition may go unobserved.

Two studies that surveyed the same people over a decade found that between 73% and 75% of ties were absent ten years later. Suitor and Keaton (1997) followed a sample of forty-two women who returned to education in mid-life by surveying them at three points over ten years following the transition. Although the women had undergone an important transition ten year earlier, they were not necessarily in transition by the final survey. At the ten-year mark, only 24% of ties who provided school and work support, 34% of those who had provided general support, and 23% of those who had provided companionship remained active. Wellman et al. (1997) is a follow-up on his original East York study (Wellman 1979) based on thirty-three

interviews with participants from suburban Toronto. Only 27% of ties remained stable over time. Although these studies suggest a very high rate of tie dormancy over an extended period, they may not tell the full story. During the span of a decade, ties could go dormant and then be reactivated, possibly more than once. Absent major transitions, studies of network dormancy conducted over a shorter period would expand our understanding of network instability.

Which Ties Become Dormant?

Some ties are more likely to become dormant than others. Our review of the literature suggest that a number of factors are potentially at play. They include individual characteristics of the ego and of the alter, characteristics of the network, relationship characteristics, the provision of support, and the frequency and medium of communication. In general, prior research supports the expectation that the factors most likely to protect a network member from falling into dormancy are those that signal a tie's perceived value in terms of the resources they can or have provided, those that reduce the cost of maintaining a relationship (although the reverse has been suggested for some new communication technologies), and those that reinforce the cost to tie dissolution. However, there are conflicting accounts of the cost and benefits of some variables. Few studies have explored a range of individual, dyadic, and network factors; contributing to omitted-variable bias. In addition, some of the conclusions drawn about the role of different factors in protecting against dormancy may be artifacts of the methodology used to study personal networks – exchange-based name generators (for a review, see Marin and Hampton 2007). Thus, our work is exploratory, and the expectations we present here are preliminary.

Individual Characteristics

When conceptualizing individual characteristics in personal networks, it is important to recognize that these characteristics apply to both the individual (ego) and each of his/her network

members (alters). We focus here on four of the most frequently discussed personal characteristics: sex, education, marital status, and age.

Women hold a unique position in personal support networks, and they generally provide more social support than men (Wellman and Wortley 1989). As a result, they may be more valuable social ties and are thus less likely to become dormant. Similarly, married individuals provided access to the ties and resources in their household (Lai 2008). Rational actors presumably want to maintain the most supportive ties. However, exchange-based name generators explicitly enumerate ties that provide support (McCallister and Fischer 1978, van der Poel 1993) and may therefore have a sex bias toward female alters over other close relationships that do not provide direct support.

The argument for how education may affect dormancy is less straightforward. On the one hand, education may increase the risk of dormancy, because those with more years of formal education tend to have larger and more diverse personal networks (Moore 1990). As a result, those with more education may be less reliant on specific ties, thus reducing the cost associated with allowing any given tie to go dormant. On the other hand, because ties with more education tend to provide access to more resources (Lin, Cook, and Burt 2001), these ties may be perceived as more valuable.

Like those with higher education, older persons have large and diverse personal networks because they have more life experiences. They have had added time to build human, social, and cultural capital and may have the potential to provide access to more resources than their younger counterparts. If this is the case, then, as a member of a person's social network, age should be associated with a reduced risk of dormancy. The evidence is mixed. Some studies

suggest that ties decay as people age (Roberts and Dunbar 2011a), whereas other studies of older populations have found that personal networks remain stable with age (van Tilburg 1998).

Network Characteristics

Two network characteristics likely to be associated with tie dormancy are size and density. A network with an abundance of ties may make an individual alter more expendable, whereas a dense network may be protective.

The resources required to sustain a large network have been found to reduce the time available to maintain individual ties (Hampton and Ling 2013), potentially contributing to decay due to neglect. In addition, a larger network may be a characteristic of redundancy. The resources provided by one individual might also be obtained through another, reducing the benefit uniquely available from individuals ties (Burt 1992) and the need to maintain many ties over time.

Personal networks are formed and maintained within the context of different social settings, or foci of activity (Feld 1981). Dense networks may share not only connections, but places. Density reduces the cost of contact by increasing the flow of information, because dense networks may be associated with shared activities, they reduce the effort to maintain contact relative to those with sparse networks (Feld 1997; Lubbers et al. 2010). Individual ties also tend to be more supportive in denser networks (Wellman and Frank 2001), and the individual receives greater benefit from each tie.

Relationship Characteristics

Relationship characteristics are likely to be among the most important factors associated with the consistent activity of a tie. Of these, tie strength, relationship duration, homophily, embeddedness, proximity, and kin status are likely to play a role in dormancy.

Tie strength is perhaps the most obvious relational characteristic assumed to predict stability. The familiarity and intimacy of strong ties makes them easier to maintain than weaker ones. Strong ties provide more support and are more motivated to help (Wellman and Wortley 1989; Marin 2012). Although tie strength and duration are not codependent, relationships that are in their early stage are more vulnerable to decay and dormancy (Wellman et al. 1997; Lubbers et al. 2010; Roberts and Dunbar 2011b, Burt 2000).

Relationships are more likely to exist – and thus perhaps persist – between individuals who are similar, based on factors, such as gender, age, education, and economic status (McPherson et al. 2001). Homophily may make relationships easier to maintain, because similar perspectives and experiences ease communication and mutual understanding. A protective effect of gender homophily has been found among pre-schoolers (Barbu 2003) and young people transitioning to adulthood (Degenne and Lebeaux 2005). However, in contrast to an argument that homophily is always protective, if, as previously argued, ties to women are less likely to become dormant, then cross-gender ties may be *less* likely to become dormant than homophilous ties between men (but not homophilous ties between women).

It will be easier for network members who are well integrated, that is, they know each other, to maintain ties, because they likely share a common foci (Feld 1997; Lubbers et al. 2010; Martin and Yeung 2006; Burt 2000). It is less disruptive to a network to remove someone on the periphery than someone who is popular.

Although the network literature sometimes downplays the importance of geographic proximity (Wellman 1979; Mok, Carasco, and Wellman 2010), individuals who are geographically proximate are more likely to maintain a relationship. This is because availability

is an important predictor of to whom people turn for interaction and support (Ikkink and Tilburg 1999; Marin 2013; Martin and Yeung 2006; Small 2017).

Kinship relations are less voluntary than other types of social ties (Marsden 1987, Wellman and Wortley 1989). As such, these ties are easier to maintain, can be costly to sever, and, due to a sense of obligation, tend to provide social support (Roberts and Dunbar 2011b; Suitor and Keeton 1997; van Tilburg 1998; Wellman and Wortley 1989; Degenne and Lebeaux 2005; Ikkink and van Tilburg 1999).

Social Support

To say that the provision of support is likely to affect the structure of personal support networks is a tautology. Personal networks are inherently based on the exchange of support (Fischer 1982). The most common method of collecting personal network data – name generators – enumerates network names based on the recall of particular kinds of supportive exchange (Marin and Hampton 2007). However, relationships vary, based on the level of support and the type of support provided. Both may affect a tie's likelihood of becoming dormant. Some types of support may require more investment than others. For example, network members who provide some types of support, such as instrumental aid, may be more transient than those who provide other types of support, such as emotional aid (Desmond 2012). And some individuals may provide more support or be more dependably supportive than others. One possible reason why ties dissolve following divorce (Milardo 1987) may be the purging of non-supportive ties.

Communication

Although the level of contact required to maintain relationships may vary, communication is a necessary component of tie formation and is presumably related to the chances that a tie will drop from a personal network. Indeed, there is an entire area of

sociological study dedicated to understanding how relationships vary based on frequency and channel of communication (Hampton 2017). It is of no surprise that ties that are infrequently in contact are more likely to become dormant (Barbu 2003; Morgan, Suitor, and Wellman 1997; Wellman et al. 1997; Feld 1997; Ikkink and Tilburg 1999; Lubbers et al. 2010). There is an ever-expanding buffet of media through which relationships can be formed and maintained, and scholars are increasingly concerned that some media may be less beneficial than others for maintaining social ties. Generally, there is a strong bias that assumes face-to-face contact is more protective of relationships than the alternatives (Turkle 2015), although other work has challenged this idea (Hampton, Sessions, and Her 2011). Some scholars have even begun to argue that some new media, commonly referred to as "social media," specifically encourage relational persistence (Hampton 2016), although a robust test of that theory is beyond the reach of this paper.

Methods

Through a series of annual surveys administered in 2002, 2003, and 2004 to the residents of four, middle-class, Boston-area neighborhoods, data for this paper were collected as part of a study of how Internet access influenced relationships. All household members above the age of 18 were invited to participate in a postal mail survey. In the first year, eligible participants received a total of 487 mailed surveys, and 69% of those who received surveys returned a completed questionnaire. In subsequent years, the research team made attempts to survey those participants from prior waves who had not relocated, and to recruit new participants from each neighborhood (new arrivals or residents who had previously been unable to participate). The precise adult population of each neighborhood was unknown. Widely varying estimates were based on Massachusetts's local annual census, a reverse telephone directory, and the US Census.

Over a period of three years, 481 participants completed a total of 961 surveys. We estimate a response rate of 26% over the three years of the study (for a full explanation, see Hampton 2007). Data for the analyses presented here are based on the 252 participants who completed at least two waves of the survey.

The survey included six name generators designed to include multiple dimensions of social support. The use of multiple name generators is an established and well-validated method of enumerating support networks (Fischer 1982, van der Poel 1993, Wellman 1979, Wellman and Wortley 1990*)*. These generators were based on those developed for the East York Studies (Wellman 1979; Wellman and Wortley 1990), the Northern California Communities Study (Fischer 1982), the U.S. General Social Survey (GSS) (Burt 1984), and van der Poel (1993). Some generators were altered to reduce length, ease understanding, and eliminate the use of time frames (for a complete discussion, see Marin and Hampton 2007).

1. From time to time, most people discuss important matters with other people. Who are the people with whom you discuss matters important to you?
2. Who from outside your home has recently helped you with tasks around the home, such as painting, moving furniture, cooking, cleaning, or major or minor repairs?
3. Suppose you need to borrow some small thing like a tool or a cup of sugar, from who outside your household would you ask to borrow it?
4. If you need to borrow a large sum of money, say $1000, whom would you ask for help?
5. Who are the people you really enjoy socializing with?
6. Please list anyone who is especially close to you who you have not listed in one of the previous questions.

In response to each generator, participants provided the first name and last initial of up to six people. The first five generators represent a broad, multidimensional view of social support (Fischer 1982; Marin and Hampton 2007; Veiel and Baumann 1992; Wellman and Wortley, 1990). The sixth name generator was intended to elicit names of people who had not recently provided social support but who were still regarded as members of a close personal network. Participants were instructed that they could give the same names for more than one question, but they could list only six names per generator. This limit was designed to reduce participant burden, but would still allow participants to list most contacts who came to mind. Previous studies have found that very few participants list more than six contacts in response to the GSS and similar generators (Burt 1984; Fischer 1982; Marin 2004; Marsden 1987).[5]

Following the six name generators, participants were presented with a series of name interpreters that collected additional information about each network member (alter). This included questions about demographic characteristics, the participant's role relationship (e.g., mother, child, etc.), and communication frequency. Finally, participants completed an adjacency matrix that indicated which pairs of contacts knew each another.

Variables

Personal network data are inherently nested data; alter and relationship characteristics (tie characteristics) are nested in ego and network characteristics (Wellman and Frank 2001). Our variables include measures at the ego, alter, tie, and network level of analyses. Descriptive statistics for each variable are shown in Table 1.

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[5] In our survey, only two participants listed the maximum of six possible "others," suggesting that participants did not exclude alters due to limitations in the name-generator methodology.

[Table 1 about here]

Dormancy: The names of participants' alters were matched across surveys. The dependent variable is a dichotomous measure of tie dormancy, coded 1 if an alter was listed in the first survey, but not the second, and 0 if the alter was listed at both time periods. We note that while we refer to this processes as dormancy, empirically we cannot make the distinction between dormancy and tie dissolution due to the permanent loss or death of an alter.

Individual characteristics: Individual characteristics refer to those characteristics that are innate to the individual. Each participant (ego) provided demographic characteristics, including age, sex, education, and marital status, for him/herself *and* for each alter. For both ego and alters, marital status was coded as a dichotomy; it was coded 1 if they were currently married. Age and education were coded in years.

Network characteristics: Characteristics of the network are measures that describe the pattern of relationships across all network members. Network size is the total number of unique alters named in the first survey (maximum 36). Network density is calculated from the adjacency matrix completed in the first survey and is the number of reported connections between alters divided by the maximum number of possible connections (Wasserman and Faust 1994).

Relationship characteristics: Tie characteristics are measured at the dyadic level and includes tie strength, tie duration, embeddedness, physical distance, role, and homophily. Tie strength is based on the participant's rating of the "closeness" of his/her relationship with each alter. Ratings are between 1 and 3, with a higher value indicating a stronger tie (Marsden and Campbell 1984). The duration of the relationship is measured as the number of years the participant had known the alter. Embeddedness is based on the adjacency matrix and represents the alter's degree or popularity: the number of other alters known by that alter (Wasserman and

Faust 1994). Physical distance is based on an eleven-item scale, ranging from "in the same house" to living "more than 1000 miles" away. Role is based on the participant's classification of an alter as a child, parent, sibling, other relative, neighbor, co-worker, person known from a voluntary organization, friend or acquaintance. Participants could select more than one role for each alter, coded as a dichotomous variable. Because participants could classify alters into more than one category, these roles are not mutually exclusive, and we do not exclude one as a reference category. Homophily pertaining to marital status is a dichotomous variable, coded as a 1 if participant and alter were married or not married. Age and education homophily were operationalized as the absolute difference between the alter and participant in age and education respectively; higher values represent *less* homophily, and they are different scores. To test for the possibility that sex homophily and tie dormancy vary for male and female pairs, we created an interaction between participant and alter's sex. We created dummy variables indicating that both ego and alter are male, that the ego is male and the alter female, and that the ego is female and the alter male. Dyads in which both the participant and alter are female serve as the reference category.

Support provided: Five of the name generators used to elicit network members are exchange-based, which means that they elicit the names of alters who have provided a particular kind of social support: discussion, major aid, minor aid, financial aid, and companionship. Alters listed in response to the sixth generator are those who do *not* provide any of the elicited types of support. For each name generator, we created a dichotomous variable coded 1 if an alter's name was elicited in response to that name generator. Alters could be listed in response to more than one name generator; they are not mutually exclusive, and we do not exclude one category as a reference.

Frequency of communication: Participants reported the frequently at which they communicated by various media with each alter. They reported the number of interactions per month by face-to-face communication, by telephone (both landline and mobile), email, instant message, and postal mail.

Ideally, it would also be desirable to include in our analysis dynamic measures, that is, measures of change in variables pertaining to the demographic characteristics of the alters listed (e.g., indicators of a major life event, such as an alter experiencing a divorce), change in the relationship (e.g., a decline in closeness), or frequency of communication. However, since, at the time of the second survey, we did not ask participants to answer name interpreters about alters that were mentioned at time 1, but did not appear at time 2, such an analysis is beyond the scope of the available data. As such, all independent variables were measured at Time 1.

Analyses

To account for the nested nature of the data, we use random effects models in Stata that parse the error terms into ego-level and alter/tie-level components, thus accounting for the correlated errors of alters listed by the same participant (Perry, Pescosolido, and Borgatti 2018; Snijders and Bosker 1999). The addition of a random effects component for participants eliminates the need to aggregate alter-level characteristics to the ego-level (Wellman and Frank 2001).

We followed an iterative procedure to predict which ties were most likely to become dormant. We start with the null model, estimating a constant with no independent variables, but separate variance components estimated for within-ego and between-ego variation. A null random effects logit model predicts the odds of a tie becoming dormant at time two with no independent variables. The model shows that ρ, the proportion of variance in the dependent

variable explained by variation between participants is .151. A likelihood ratio test comparing this model to a model without random effects shows that the p value for the null hypothesis that $\rho=0$ is .000. That a statistically significant portion of the variance is attributable to between-ego variation, confirms the need to use multi-level models in estimating subsequent models, because alter-level observations clustered by participants will have correlated errors. Using single-level models would underestimate the standard errors associated with models run at the alter-level, possibly falsely showing effects to be significant (Snijders and Bosker 1999).

From the null model, we introduced variables in the following order: ego and alter demographic characteristics (Models 1 and 2), network characteristics (Model 3), homophily (Model 4), relationship characteristics (Model 5), role relationships (Models 6 and 7), social support (Models 8 and 9), and frequency of communication (Model 10). For each model, we report odds ratios and standard errors. We include log likelihood tests, which indicate whether each model explains significantly more variance than the null model. Where newly introduced sets of variables are not shown to be significant, we use likelihood ratio tests to compare the model with a model using the same cases but estimated without the new variables. This test compares the nested models to determine if the more inclusive model is a significantly better fit than the less inclusive model. It asks if the model with the new variables included explains significantly more variation than the model without those variables included. This method is similar to a Wald test but is more accurate where random effects models are used. For the sake of parsimony, at each iteration we remove variables that were not significant *and* did not improve fit over the prior model.

Findings

Overall, 46.8% of the 3,004 alters named in the first survey were dormant at the time of the second survey. Our first model adds to the null model ego characteristics for age, education, sex, and marital status. None of these variables is significantly associated with the likelihood of a tie becoming dormant at time 2. The likelihood ratio test comparing this model with the null model does not show these variables to be jointly significant. Characteristics of the individual ego do not predict the likelihood of any given tie going dormant.[6]

Model 2 adds the same demographic characteristics of age, education, sex, and marital status for alters. Older and more educated alters are less likely to become dormant ties. For each year an alter is older, the odds of dormancy are 0.9 percent lower. Each year of education reduces the odds of dormancy by 4.1 percent. While not statistically significant on their own, the coefficients for being female and being married both suggest substantively higher odds of dormancy. A likelihood ratio test confirms that these two variables explain significantly more variation than an otherwise identical model without them; the variables are jointly significant. Therefore, we include them in subsequent models. It is notable that at this stage of the analysis, individual characteristics of the alter, but not the ego are predictive of dormancy.

[Table 2 about here]

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[6] It is possible that some ties operationalized here as dormant were not listed in the subsequent survey, simply because they had been forgotten. However, this number is likely to account for a small number of ties (Wright and Pescosolido 2001) Furthermore, ties that are not elicited by name generators because they are forgotten tend to be precisely those ties that are not as strong as those elicited (Brewer 2000, Marin 2004). This suggests that even if alters are omitted because they have been forgotten, this could represent a slide along the continuum toward dormancy.

The third model adds two network measures: size and density. Neither variable is a significant predictor of tie dormancy, and the two variables are not jointly significant. Our expectation was that smaller and denser networks make it easier to preserve active ties. This is not supported in the data. The odds of an alter entering dormancy are not higher in larger or in sparser networks.

Model 4 adds measures of homophily. There is not a significant association between marital status, age, or education homophily and tie dormancy. Male egos tied to female alters have 63% higher odds of persisting to time two than homophilous female ties. Post-estimation tests show that male ego/female alter ties are also more likely (49% higher odds) to become dormant than male ego/male alter ties. No other combinations of participant/alter sex are significantly different from one another. Although we might expect that spousal ties, which are commonly cross-sex pairs, might be an exception to the rule for cross-sex tie dissolution, in models not shown, we examine sex homophily separately for non-spousal ties only. These models show that cross-sex ties of any type are far more likely to become dormant than same-sex ties.

In Model 5, shown in Table 3, we test additional relationship characteristics: closeness, tie duration, distance between ego's and alter's residence, and alter's network embeddedness. Closeness, residential distance, and embeddedness are all significant predictors of tie dormancy. The strongest of these is closeness; for each one level increase in participants' reported closeness to alters, the odds of tie dormancy are reduced by 68%. Alters who are more embedded in a participant's networks are also less likely to be dormant at time 2. For each additional alter known by the focal alter, the odds of dormancy are 4.8% lower. More distant alters are more likely to become dormant; odds of dormancy are 15.9% higher for each one-category increase in

the distance measure. The duration of the relationship is not associated with any change in the odds of tie dormancy.

Closer geographic proximity to the ego, stronger relational closeness, and being popular, or more embedded in the ego's network all reduce the odds that a tie will go dormant over time. However, prior research suggests that kinship ties, regardless of closeness, proximity, or embeddedness, are less likely than non-kin ties to go dormant (Hampton and Ling 2013). As such, we estimated Model 5 separately for kin and non-kin (not shown). In these models, relationship duration remains not significant, and, as suggested for kin, neither distance nor embeddedness is associated with dormancy. In general, ties that are geographically distant and less embedded may require more effort to maintain. However, models separating kin and non-kin show that kinship ties are persistent at a greater distance and with less embeddedness. This suggests that kin can be maintained with less effort (Roberts and Dunbar 2011a), or that they persist out of obligation (Hampton and Ling 2013).

[Table 3 about here]

Model 6 tests the addition of variables indicating the alter's role relationship with the participant. Ties to spouses and siblings are significantly less likely than other relationship types to go dormant at time 2. Relationships to children and parents do not predict dormancy, but relatives other than immediate family members are more likely than other ties to go dormant. The odds of dormancy are 65.6% higher for these other relatives. Being friends, co-workers, acquaintances, or fellow club members with a participant is unrelated the likelihood that a tie will become dormant. However, ties to neighbors are the least likely to go dormant, with odds of dormancy 55.3% lower than for non-neighbor ties. This finding is consistent with ethnographic observations that support the importance of maintaining "neighborly" ties (Gans 1967).

In favor of parsimony, Model 7, shown in Table 4, simplifies by combining immediate family roles into a single variable, whereas other relatives and neighbors stand alone. Immediate family members have odds 46.5% lower than other ties of dormancy, other relatives have odds of dormancy that are 66.6% higher, and neighbors have odds that are 52.4% lower. Immediate family, spouses, and siblings, and some types of friends and neighbors are more protected from dormancy, whereas other relationships – non-immediate family – are more susceptible to dormancy.

Model 8 adds dichotomous variables for each type of support provided by the alter. Providing any form of support is associated with reduced odds of dormancy. The smallest association (29.2% lower odds of dormancy) was found for alters who socialize with the ego. The largest, 54.4% lower odds, if alters discuss important matters. There is no relationship between being listed as an "other close person" who does not provide specific support and the odds of dormancy. These findings suggest that each type of support provided by an alter generates protection against the risk of dormancy.

As a measure of the volume of support, in place of individual dichotomies for each type of support, Model 9 in Table 5 substitutes a variable that sums the total number of different types of support provided. For each additional type of support provided, the odds of a tie going dormant are 40.5% lower. Providing support and many different types of it are dramatic predictors of relational persistence.

[Table 4 about here]

[Table 5 about here]

Model 10 tests the addition of variables for frequency of contact by different media. Despite the recent explosion of research on the role of digital media and relationships (Hampton

2017), communication frequency, whether in-person or mediated, was not predictive of tie dormancy, and the set of communication variables are not jointly significant. In an ad hoc analysis (not shown), we analyzed the data separately for kin and non-kin to test the possibility that communication may be more important for retaining ties to non-kin (Roberts and Dunbar 2011a). Communication was not a significant predictor of dormancy for either set of alters. This provides some evidence against commonly held assumptions that in-person maintenance protects against the loss of close relationships, whether kin or non-kin (Turkle 2015).

The prior model tested the role of frequency of contact and offered no new, significant variables that predict dormancy. Therefore, as a final step, we tested a model, Model 11, for jointly significant variables by excluding variables not significant in Model 9. These variables include tie characteristics for age, education, and marital status. They were retained from the second model because one (age) was a significant predictor, and other two were jointly significant. The likelihood ratio test comparing Model 9, which includes these variables, to Model 11, finds that Model 9 is not a significantly better fit than Model 11. Now that relationship characteristics have been controlled for, tie characteristics are no longer jointly significant. Thus, Model 11 serves as our final model.

Discussion

We explored a range of factors that might predict the likelihood of ties shifting into dormancy, including those associated with the demographic characteristics of the ego or alter; characteristics of the relationship and the network, communication frequency and medium, and the type of support exchanged. Tie dormancy is related to but a small subset of variables among these factors, completely excluding individual characteristics of the ego and alter, network characteristics, homophily along dimensions other than sex, and communication frequency.

Alters are less likely to become dormant only if they are geographically and/or emotionally close to the ego, are immediate kin or neighbors, are highly supportive, are the same sex as the ego, or are more embedded in the ego's personal network. And for kinship relations, geographic distance and embeddedness matter less.

Dormancy is largely dependent on characteristics of the relationship and the prevalence of supportive exchange, rather than on individual characteristics of the ego or alter. The frequency and medium of communication are particularly notable as factors that were *not* related to tie dormancy for either kin or non-kin. This supports the conclusion that support networks can be maintained with surprisingly little routine maintenance (Wellman et al. 2006). This not only casts doubt on those who argue that the introduction of new media detrimentally influences the number and intensity of strong ties (Turkle 2015), but introduces additional conceptual issues for those who operationalize tie strength in closed communication systems, such as Facebook and mobile phone networks, as a function of communication frequency (Jones et al. 2013; Gilbert and Karahalios 2009).

We observed a relatively high level of tie dormancy over a relatively short time period. Forty-seven percent of ties active at time one were inactive at the time of the second survey. This rate is comparable to the churn observed in studies of major life course events, including Feld's (1997) study of first-year university students, where 46% of ties become dormant over one year, and Lubbers et al.'s (2010) study of Argentine immigrants to Spain, with 48% tie dormancy over two years. The rate of dormancy we observed is moderately higher than what Wellman et al. (1997) found over a ten-year span in the Toronto suburb of East York; 37 percent of alters in the study by Wellman and his colleagues were not listed in both study waves. Our sample participants experienced few major life course events and represented those who are generally at

a point of stability.[7] It is therefore surprising that we observed such high levels of network instability. The networks were as disrupted as those of participants who were studied while undergoing major life transitions or crises, and were less stable than the personal networks observed over a longer time period (Wellman et al. 1997). That rates of dormancy are comparable to those observed over longer periods, suggests that, over the long term, reactivation of dormant ties may be common. While variables such as the supportive nature of an alter and their geographically and emotionally closeness would seem to offer at least short-term protection from dormancy, it is not clear how protective these variables are over a longer period of time.

Our findings support the need to reconsider the body of research on network dormancy as a result of major life course events. Networks may be less susceptible to disruption due to a crisis or major life transition than has been generally accepted. Networks are in a state of perpetual

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[7] In contrast to the existing research on dormancy, which often focuses on samples undergoing a crisis or major life transition, our sample was chosen for its expected stability. When asked about the occurrence of recent, major life events, including the birth of a child, law suits, marriage, marital separation, divorce, new jobs, new household members, pregnancy, job loss and retirement, fewer than 2% of participants recently experienced any of these life changes with the exception of new jobs, which were experienced by 5.5% of participants. We verified these reports by analysing change in self-reported demographic variables over time (e.g., marital status). Our sample is likely unrealistically stable. Our sample frame excludes people who have experienced a residential move, which is likely to be concurrent with other major life events, such as job loss, retirement, and marriage. As such, we are probably understating the level of network dormancy experienced in relation to even relatively mundane life events.

flux. Although some ties may be consistently active over long periods, other ties likely move from active to inactive and back again in a relatively short time (Morgan et al. 1997).

To understand the dynamics of network change in any greater depth, the study of personal networks needs to address three critical deficits in the existing research. First, a clearer understanding of network change requires large, longitudinal network studies that follow a sample of the general population *not selected* based on the recent or anticipated experience of a major life transition or crisis. To successfully capture churn, the process of new tie formation, dormancy, and reactivation, one needs to interview the sample at frequent intervals.

Second, the study of network change requires a theory of dormancy and reactivation. Existing studies, including our own, operationalize ties as dormant if they are not named as active network members or occasionally if participants explicitly confirm that these ties have not provided support. This operationalization sheds only partial light on the nature of dormancy. How do participants conceive of dormant ties in their network, and are there levels of dormancy? When and how easily can dormant ties be reactivated and mobilized? Recent research suggests that ties that are dormant can nonetheless be important social capital reserves within social networks (Brashears and Quintane, forthcoming; Lin and Marin, 2018). Can we, should we, and how would we distinguish between ties that are dormant and those that are permanently dissolved? Greater attention to the frequency and predictors of tie reactivation would help shed light on the process by which people at different stages of the life-cycle experience variation in the structure of their networks. As revealing as it may be to study patterns of dormancy, patterns of reactivation, which are likely to vary based on variation in stable and eventful life periods, would add to our understanding of network change and how individuals respond to adversity

(Levin, Walter, and Murnighan 2010). A theory of dormancy would necessarily see dormant connections as a *type* of tie rather than the mere absence of a previously existing tie.

Third, the name generator approach needs to be expanded to capture data on dormant ties. Collecting network data through the use of name generators can be demanding (Marin and Hampton 2007). A series of generators followed by name interpreters not only takes considerable time, but is a monotonous task for participants. Name interpreters are generally only asked of listed, active ties. However, in longitudinal research, including our own analysis, name interpreters that focus only on active ties may miss dynamic data that predict dissolution. While many alter-level variables are relatively stable (e.g., gender, education, embeddedness), or change in a uniform linear fashion (e.g., age, tie duration), other characteristics, such a closeness or communication frequency, may be less stable. A relatively rare change in some other variables, such as job or marital status, may be indicative of an alter who has undergone a major life course event. Expanding the number of name interpreters to include non-active ties introduces a modest methodological hurdle that adds to the length and complexity of the name generator approach. It also invites new theoretical questions about the direction of tie dormancy, whether it is the result of change that originates with the alter or with the ego (i.e., life events experienced by either alter or ego), and time order; whether dissolution is the cause or consequence of relational change (e.g., change in closeness or communication frequency). To capture these data researchers need to ask name interpreters for alters listed in a survey at an earlier time period, but not listed in the current survey. This approach can be greatly facilitated through the use of computer assisted and internet based surveys that automate the process of comparing lists of alters over time.

Finally, studies of personal network change must develop methods and theories for understanding not only tie dormancy, reactivation, and dissolution, but tie creation. Such studies are much easier to conceive in the context of the closed systems that are the focus of whole network studies. Methods for studying network dynamics in whole networks assume a fixed set of nodes and examine the creation of new ties among these nodes (Robins et al. 2007). Studying tie creation in personal networks is hampered, because the set of potential network members can be characterized only as unknown or limitless. We need to resolve the methodological quagmire of how factors associated with tie creation can be studied when it is difficult to identify and study relationships that did not form. Potential solutions include artificially binding potential ties, focussing only on ties formed in particular settings (e.g. McPherson and Smith-Lovin 1987), studying extremely weak ties that might become stronger over time, and the use of qualitative methods to identify the opportunities for new ties that go unrealized.

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Tables

Table 1: Descriptive Statistics

	Mean	Std. Dev.
Dependent Variable		
Dormant at Time 2	.469	.499
Independent Variables - Ego-Level		
Individual Characteristics		
Age (years)	50.758	15.156
Female	.579	.491
Education (years)	16.461	2.074
Married	.771	.422
Network Characteristics		
Network size	13.487	6.140
Network density	.458	.294
Independent Variables - Alter-Level		
Individual Characteristics		
Age (years)	49.670	15.687
Female	.581	.493
Education (years)	15.872	2.328
Married	.662	.473
Relationship Characteristics		
Embeddedness	5.692	4.691
Closeness (1-3)	2.563	.631
Duration (years)	20.532	16.091
Distance	5.906	2.925
Homophily		
Sex homophily	.581	.494
Age difference (years)	11.142	11.820
Education difference (years)	5.400	3.758
Marital status homophily	.681	.466
Role Relationships		
Spouse	.065	.246
Parent	.052	.221
Child	.056	.217
Sibling	.075	.264
Other relative	.114	.319
Friend	.429	.495
Neighbor	.204	.403
Acquaintance	.020	.140
Coworker	.091	.288
Club member	.049	.217
Support Provided		
Discussion	.352	.478
Large favours	.097	.296

Small favours	.219	.414
Money lending	.162	.369
Socializing	.367	.482
Other close	.173	.378
Communication		
Face-to-face (per month)	8.167	10.635
Telephone (per month)	12.431	24.436
Postal (per month)	.132	.562
Email (per month)	25.404	79.671
Instant messages (per month)	.323	2.320

Table 2: Odds ratios from multilevel logit models predicting the likelihood of a tie being dormant at time 2.

Odds Ratio Conf. Interval	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Ego/Network-Level Variables				
Constant	1.124 (.371)	2.603 (1.320)	2.950* (.137)	1.741 (.703)
Age (years)	1.004 (.004)	1.006 (.004)		
Education (years)	.987 (.018)	.981 (.021)		
Female	.846 (.115)	.827 (.126)		
Married	.796 (.131)	.795 (.169)		
Network size			.991 (.013)	
Density			1.03 (.325)	
Alter-Level Variables				
Age (years)		.991** (.003)	.990** (.003)	.992** (.003)
Female		1.040 (.094)	1.021 (.093)	
Education (years)		.959* (.020)	.951* (.020)	.965 (.023)
Married		1.045 (.107)	1.091 (.114)	1.050 (.123)
Male ego, male alter				1.095 (.188)
Male ego, female alter				1.637** (.292)
Female ego, male alter				1.213 (.143)
Age difference (years)				1.005 (.004)
Same marital status				.971 (.118)
Education difference (years)				1.008 (.019)
Log Likelihood	-2004.461	-1711.582	-1629.011	-1663.313
x^2 p<	.000	.000	.000	.000
N (Egos)	227	216	200	211
N (Alters)	3004	2598	2463	2532

Note: † p<.1, * p<.05, ** p>.01, *** p<.001

Table 3: Odds ratios from multilevel logit models predicting the likelihood of a tie being dormant at time 2.

Odds Ratio Conf. Interval	**Model 5**	**Model 6**
Ego/Network-Level Variables		
Constant	20.945*** (9.955)	43.063*** (23.110)
Alter-Level Variables		
Age (years)	.995 (.004)	.994 (.004)
Education (years)	.961 (.003)	.970 (.023)
Married	1.010 † (.113)	1.007 (.115)
Male ego, male alter	.911 (.175)	.917 (.181)
Male ego, female alter	1.792** (.358)	2.04** (.428)
Female ego, male alter	1.384* (.178)	1.44** (.193)
Closeness	.320*** (.032)	.283*** (.031)
Duration	.993 (.032)	
Distance	1.159*** (.023)	1.078** (.025)
Embeddedness	.952** (.014)	.956** (.015)
Spouse		.404** (.129)
Parent		.628 (.196)
Child		.546 † (.170)
Sibling		.520* (.138)
Other Relative		1.656* (.402)
Friend		1.008 (.186)
Neighbor		.447*** (.094)
Coworker		.824 (.170)
Acquaintance		.877

		(.396)
Club Member		1.103 (.286)
Log Likelihood	-1514.732	-1492.830
x^2 p<	.000	.000
N (Egos)	2514	2527
N (Alters)	215	215

Note: † p<.1, * p<.05, ** p>.01, *** p<.001

Table 4: Odds ratios from multilevel logit models predicting the likelihood of a tie being dormant at time 2.

Odds Ratio Conf. Interval	**Model 7**	**Model 8**
Ego/Network-Level Variables		
Constant	40.670*** (20.691)	41.757 (22.183)
Alter-Level Variables		
Age (years)	.995 (.003)	.996 (.003)
Education (years)	.966 (.022)	.979 (.023)
Married	1.000 (.114)	1.060 (.023)
Male ego, male alter	.902 (.178)	.910 (.185)
Male ego, female alter	1.995** (.414)	1.873** (.400)
Female ego, male alter	1.200*** (.414)	1.317* (.181)
Closeness	.282*** (.030)	.339*** (.038)
Distance	1.091*** (.023)	1.058* (.023)
Embeddedness	.957** (.015)	.961* (.015)
Immediate family	.535*** (.073)	.568*** (.086)
Other relative	1.666** (.276)	1.500* (.262)
Neighbor	.476*** (.476)	.451*** (.089)
Discuss		.466*** (.059)
Large favours		.594* (.120)
Small favours		.667* (.115)
Money lending		.636** (.099)
Socialializing		.708** (.089)
Other close		1.000 (.174)
Log Likelihood	-1493.595	-1446.519

x^2 p<	.000	.000
N (Egos)	2527	2514
N (Alters)	215	214

Note: † p<.1, * p<.05, ** p>.01, *** p<.001

Table 5: Odds ratios from multilevel logit models predicting the likelihood of a tie being dormant time 2.

Odds Ratio Conf. Interval	**Model 9**	**Model 10**	**Model 11**
Ego/Network-Level Variables			
Constant	46.734*** (23.930)	47.880*** (24.700)	24.485*** (7.713)
Alter-Level Variables			
Age (years)	.996 (.003)	.995 (.003)	
Education (years)	.975 (.023)	.977 (.023)	
Married	1.089 (.127)	1.091 (.128)	
Male ego, male alter	.932 (.189)	.914 (.185)	1.009 (.192)
Male ego, female alter	1.918** (.406)	1.878** (.399)	1.955** (.388)
Female ego, male alter	1.361* (.184)	1.327* (.181)	1.388* (.179)
Closeness	.328*** (.036)	.331*** (.036)	.328*** (.033)
Distance	1.062* (.023)	1.054* (.025)	1.092*** (.020)
Embeddedness	.962* (.015)	.966* (.015)	.964** (.014)
Immediate family	.520*** (.073)	.567*** (.084)	.520*** (.070)
Other relative	1.463* (.246)	1.487* (.252)	1.485* (.238)
Neighbor	.483*** (.081)	.451*** (.078)	.505*** (.079)
Number of different support	.595*** (.038)	.612*** (.039)	.603*** (.036)
Face-to-face (per month)		1.000 (.002)	
Phone (per month)		.987 (.008)	
Email (per month)		.987 (.009)	
Postal (per month)		.923 (.094)	
Instant messages (per month)		1.012 (.021)	
Log Likelihood	-1449.985	-1430.903	1573.619

x^2 p<	.000	.000	.000
N (Egos)	2514	2484	2711
N (Alters)	214	210	221

Note: † p<.1, * p<.05, ** p>.01, *** p<.001