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Reorganization and Tie Decay Choices

Adam M. Kleinbaum[a]

[a] Tuck School of Business, Dartmouth College, Hanover, New Hampshire 03755

Contact: adam.m.kleinbaum@tuck.dartmouth.edu, http://orcid.org/0000-0003-3654-2154 (AMK)

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Abstract. Whereas most research on network evolution has focused on the role of interaction opportunities in the formation of new ties, this paper addresses tie decay choices. When the opportunity structure gets reorganized, social actors make choices about which ties to retain and which to allow to decay, informed by their past experience of the tie. I argue that, conditional on changes in opportunity, people (especially those with Machiavellian personalities) choose to retain ties to valuable contacts, they retain reciprocated ties (especially with highly empathic others), and they retain socially embedded ties (especially if they are low self-monitors). The empirical design, which exploits a randomized natural experiment, confirms these hypotheses and suggests that our understanding of tie decay choices—and, consequently, of network evolution—is enhanced by an integrated theoretical perspective that encompasses both social structure and social psychology.

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Introduction

Few observers of organizations now doubt that social networks matter. Research over the past several decades has consistently shown that advantageous networks are associated with superior attainment in both markets and organizations, including such outcomes as promotion, compensation, employment, and subjective performance evaluation (e.g., Burt 1992, Podolny and Baron 1997, Burt 2004, Mizruchi et al. 2011). Yet, for all the progress that has been made in understanding the consequences of networks, far less is known about the forces that drive network formation and evolution (Zaheer and Soda 2009).

Research on network evolution has focused on tie formation, which is known to occur through a process of opportunity and choice, with much of this research emphasizing the role of opportunity in creating new ties (e.g., Festinger et al. 1950, Sailer and McCulloh 2012). In this paper, I seek to extend our understanding of the evolution of networks by examining the decay of social ties, the equally fundamental, but less well understood, side of network evolution. I argue that because tie decay necessitates the preexistence of (and, correspondingly, knowledge about) a social relation, deliberate choice plays a more prominent role in tie decay than it does in tie formation. Because individual choice is influenced by both individual and contextual factors, understanding decay choices—that is, understanding which ties are likely to decay and which to persist, holding opportunity constant—requires an integrated theoretical perspective encompassing both social structure and social psychology.

To elucidate the role of such decay choices in network evolution, and to drive a theoretical wedge between shifting opportunities and tie decay choices, I exploit a randomized, natural experiment in which social settings (Feld 1981) are randomly assigned and reassigned: the reorganization of class sections in a Masters in Business Administration (MBA) program. Consistent with the theory, empirical results confirm that, conditional on changes to opportunity structures, people (especially those with Machiavellian personalities) choose to retain ties to valuable contacts, they retain reciprocated ties (especially with highly empathic others), and they retain socially embedded ties (especially low self-monitors). The empirical evidence assembled here supports the claim that our understanding of tie decay choices is enhanced by the theoretical integration of social psychology with structural theories of network change.

Tie Decay Choices in Network Evolution

Given the fundamental importance of networks to individual (e.g., Burt 1992, 2005), group (e.g., Reagans and Zuckerman 2001, Reagans et al. 2004), and organizational outcomes (e.g., Argote and Ingram 2000, Kleinbaum and Tushman 2007, Alcácer and Zhao 2012, Dahl and Sorenson 2012), much scholarly effort has recently been directed to understanding the antecedents of network structure and dynamics. Early work in this domain emphasized the stability of networks, with prior structures predicting future structures (e.g., Feld 1997). Other work has focused on intrapersonal factors, such as personality (e.g., Kilduff and Krackhardt 2008, Kleinbaum et al. 2015) or, even more fundamentally, neuroanatomy (e.g., Lewis et al. 2011, Powell et al. 2012) in explaining differences in network size and structure.

At root, any analysis of network evolution requires an understanding of two fundamental processes: the formation of new ties and the decay of old ones. Accumulated evidence has taught us a lot about the factors that govern tie formation. Research has shown that new ties get formed through the confluence of opportunity and choice (e.g., McPherson and Smith-Lovin 1987, Sorenson and Stuart 2008). Much of this research has focused on opportunities for interaction, which are created when social foci of various kinds bring individuals into contact (Feld 1981). Consistent with this perspective, Kossinets and Watts (2009) showed that among university students, taking the same course induced the formation of ties through a mechanism of increased opportunity. Similar effects have been shown in a corporate setting (e.g., Han 1996, Kleinbaum et al. 2013), even when accounting for other bases of interaction, such as geographic propinquity (Allen 1977) or task interdependence (Galbraith 1973). Conditional on the opportunity afforded by such contact, some people may choose to seize that opportunity by interacting and forming relationships. Social similarity in, for example, gender (Ibarra 1992), race (Ibarra 1995, Goodreau et al. 2009), attitude (Byrne et al. 1986), and personality (Feiler and Kleinbaum 2015) has been shown to increase the likelihood of tie formation, conditional on opportunity.

But social networks cannot grow without bound. To the extent that there are cognitive (Simon 1945, Dunbar 2008) and physiological (Lewis et al. 2011, Powell et al. 2012) constraints on network size, network change requires not only the formation of new ties, but also the decay of old ones. Yet far less research has explored the determinants of tie decay, this second fundamental process of network evolution. In one of the earliest studies to focus on tie decay, Burt (2000, p. 8) analyzed the decay of "frequent and substantial business" ties among investment bankers over four years and suggested that the same factors that promote tie formation also tend to impede tie decay. More recent research has examined the factors associated with the decay of friendship ties (Martin and Yeung 2006), mobile phone communication links (Raeder et al. 2011), and key professional contacts (Jonczyk et al. 2016), but the literature remains sparse. If we accept the premise that network evolution proceeds through the dual processes of tie formation and tie decay, then the relative dearth of research on tie decay represents a significant gap in our understanding of network evolution.

Taken together, the limited extant literature focuses on the role of changing opportunity structure in inducing tie decay, in much the same way that opportunity is emphasized in the tie formation literature. As one college student in McCabe's (2014, p. 209) ethnographic study described the decay of a friendship tie with the change in semesters: "Work kind of takes over. You can't call as often. And then you just kind of drift apart and into new groups of friends. . . . There was no, like, fight or something that occurred that made us not friends. I just don't see them." Similarly, Burt (2000, p. 2) describes the decay of ties as a consequence of opportunism in the earlier process of tie formation: "Many relationships originate from factors, exogenous to the two people involved, that define opportunities for relations to form . . . regardless of individual preferences. . . . [In such situations,] it is rude not to strike up a relationship. Thus, relationships generated by exogenous factors (not all are of course) will often connect people who discover that they do not enjoy one another or cannot work well together, so they disengage in favor of more compatible contacts." When tie formation is driven by opportunity, reorganization of that opportunity structure will tend to induce the decay of dyadic ties.

Although reorganization may, in general, induce tie decay, this tendency can be overcome by the active choices of individuals. Indeed, anyone who has ever had a friend knows that when the structural locus of interaction is reorganized away, people may actively choose to continue interacting with one another, at the cost of greater effort, to sustain the relationship. Thus, the interesting theoretical question concerns not the main effect of reorganization of opportunity structures on tie decay, but the heterogeneity in this effect: under what structural and psychological conditions will one choose to retain a tie when the underlying opportunity structure is reorganized? I argue that, conditional on shifting opportunity, people make choices about tie decay and persistence and that such choices differ systematically from tie formation choices.

The basis of this systematic difference lies in a fundamental asymmetry between tie formation and tie decay that has important implications for the choices actors make about network change. Prior to tie formation, two disconnected actors have limited information—and may even lack awareness altogether—about one another.[1] This relatively limited information means that although one can speculate about the social or professional benefits that a potential new tie might later convey, such speculation is necessarily imperfect. Blumstein and Kollock (1988, p. 483) put it succinctly: "Two strangers cannot be incompatible." Indeed, this relative lack of information may explain why the tie formation literature has emphasized opportunity over choice. When it comes to existing ties, on the other hand, people can better assess the benefits that another person brings them based on their own prior experience of interacting with that person. Consequently, they can make better-informed decisions about which of their contacts they might want to retain in their networks and which ties to permit to decay. Simply put, they can make better tie decay choices.

Building on this asymmetry, the aim of this paper is to elucidate the mechanisms of tie decay choices. To do this, I exploit a strategic research setting that takes opportunity out of the equation: reorganization. In the face of the changing interaction opportunities that occur in a reorganization, which ties do people choose to retain and which ties do they allow to decay? I argue that three factors contribute to tie decay choices: individual strategic action, dyadic tie reciprocity, and structural embeddedness. Furthermore, to the extent that these factors matter in general, the degree to which they matter to a given person should vary as a function of individual psychological factors. We most expect to see individual strategic action from high Machiavellians; dyadic reciprocity should exert the strongest effect in the presence of perceptions of high empathy; and the effect of structural embeddedness should vary as a function of self-monitoring personality. These moderators both extend the theory and confirm the hypothesized mechanisms.

Hypothesis Development

First, I consider the extent to which individual differences may motivate social actors to retain their ties with some contacts while allowing other ties to decay. The premise of this argument is, simply put, that some contacts have greater value than others. There are numerous sources of value that a contact can provide, ranging from friendship and social support (Ibarra 1992) to strategic information and material resources (Burt 1992). There are also numerous sources of variation in the value of a contact, which may vary as a function of the contact's location in the formal organizational structure, access to needed resources, position in the informal network, or personality (Mechanic 1962, Cook and Emerson 1978, Burt 2005). And although there is voluminous practitioner-oriented writing on the subject, the scholarly literature has generally been dubious about actors' ability to strategically form relationships with advantaged others. For example, Ryall and Sorenson (2007) offer analytic proofs and agent-based simulation models showing that, absent special conditions, one actor's attempt to network strategically is foiled by the equally strategic networking of other actors. Other work—both conceptual (e.g., Blau 1964, pp. 62–63) and empirical (e.g., Kleinbaum et al. 2015)—suggests that people who appear to be strategically motivated may be rebuffed in their attempts to connect with others, undermining their ability to build the ties that they covet.

But whereas the ability to form ties depends, in part, on the agency of others (Kleinbaum et al. 2015), actors have greater unilateral latitude to invest in maintaining some existing ties while allowing others to wither (Simmel 1902, pp. 122–124).[2] For this reason, I argue that, all else being equal, and whatever the value that a contact provides, actors' tie decay choices will favor more valuable contacts over less valuable contacts.

If such strategic agency does play a role in guiding tie decay choices, research in personality psychology suggests that such self-serving, calculated behavior will not be evenly distributed across the population; rather, it should vary with the personality trait of Machiavellianism. Taking inspiration from the writings of the Medici adviser in Renaissance Florence (Machiavelli 1910), psychologists have described the construct of Machiavellianism as a duplicitous achievement orientation marked by cynical beliefs and pragmatic morality (Christie and Geis 1970). Highly Machiavellian individuals are known to behave strategically to maximize their own advantage, with little regard to the consequences for others (Austin et al. 2007). Focusing specifically on social networks, Shipilov et al. (2014) have shown that highly Machiavellian people network more actively and more deliberately. I hypothesize that the general tendency to maintain ties to valuable contacts while allowing ties to less valuable contacts to decay will vary as a function of the focal person's Machiavellian personality.

Hypothesis 1. *In the face of reorganization, people choose to retain ties to more valuable contacts and allow ties to less valuable contacts to decay.*

Hypothesis 1A. *The effect of a contact's value on tie decay choices will be especially strong for people with highly Machiavellian personalities.*

A second factor that mitigates the tendency for reorganization to induce network decay is tie reciprocity, a state in which two individuals each view the other as a friend. The tendency to reciprocate others' social interactions is so strong and so pervasive, it has become taken for granted as a "norm" of social life (Gouldner 1960) and, as a consequence, a "fundamental principle of network formation" (Schaefer et al. 2010). Empirical evidence abounds on the pervasiveness of reciprocity in helping, favor exchange, and gift giving (e.g., Flynn 2003, Bartlett and DeSteno 2006, Cook and Rice 2006), and, to a lesser extent, in the more fundamental processes of initiation of conversation, self-disclosure, and other gestures of friendship that comprise the formation of social ties (e.g., Friedkin 1990, Sprecher et al. 2013). One mechanism that gives rise to the reciprocation of social ties in networks is the tendency of people to like others who like them (Newcomb 1956). More generally, research in psychology has shown that being liked creates positive affect and even neural reward activity (Davey et al. 2010) and that positive affect induces interpersonal attraction, both in general (Gouaux 1971) and specifically toward the other (Montoya and Insko 2008). A related mechanism lies in the observation that asymmetry in friendship can result in discomfiting imbalance (Heider 1958), a state often resolved either by alter's reciprocation of the tie or by ego's withdrawal from it (Hallinan 1979).

Of course, not all ties are reciprocated. Despite strong social norms and psychological tendencies that encourage reciprocation of social ties, there are other logics of network formation that tend to leave ties unreciprocated, such as status dynamics (e.g., Podolny 2005) or resource dependence (e.g., Pfeffer and Salancik 1978). And although natural variation occurs in the reciprocation of social ties, little research has focused on the consequences of reciprocity in social interaction. Blau (1964), in his work on social exchange, suggested that reciprocated ties are stronger and, therefore, more stable than unreciprocated ties because of the mutual exchange of emotional investments. Subsequent empirical work has shown that reciprocated ties are more likely to persist over time than unreciprocated ones (Hidalgo and Rodriguez-Sickert 2008), especially if one views tie reciprocity as an indication of tie strength (Friedkin 1990). Consequently, I expect that when the opportunity structure is reorganized, tie decay choices will favor reciprocated ties over those that are not reciprocated.

Under what circumstances will tie reciprocity reduce the focal actor's willingness to let the tie decay? The answer lies in ego's beliefs about alter's motivation to reciprocate the tie. Just as the focal individual may behave strategically, retaining some ties while allowing other ties to decay, so too may alter behave strategically. And if alter is perceived as having reciprocated ego's friendship for instrumental or strategic reasons, ego may prefer to allow that tie to decay, engaging instead with other contacts. Conversely, if alter is perceived as genuinely understanding the thoughts and feelings of others (Rogers 1980) and as having reciprocated ego's tie to forge a meaningful relationship (Oishi et al. 2008), ego may be more likely to choose to retain the tie. In this way, perceptions of alter's empathy may affect ego's willingness to retain the contact following a reorganization of opportunity structures. Indeed, prior research suggests that perceptions of a person's empathy play a critical role in determining whether others choose to reciprocate their social ties (Kleinbaum et al. 2015). Extending this result beyond tie formation, I argue that the effect of tie reciprocity on the decay of social relations will vary with perceptions of alter's empathy: when alter is viewed as highly empathic, tie reciprocity will reduce the likelihood of tie decay. Conversely, when alter is viewed as lacking in empathy, tie reciprocity will have little mitigating effect on tie decay choices.

Hypothesis 2. *In the face of reorganization, people choose to retain reciprocated ties and allow unreciprocated ties to decay.*

Hypothesis 2A. *The effect of tie reciprocity on tie decay choices will be especially strong in ties with others who are perceived as highly empathic.*

Finally, the tendency of network ties to decay or persist in the face of reorganization will also be a function of the broader social structure within which they are embedded (Granovetter 1985, Uzzi 1997). Early work by Simmel (1902) described the impact of third-party observers to a dyad on dyadic interaction. Coleman (1988) elaborated this perspective, arguing that closed networks—networks in which two people tend to share contacts in common—create normative pressure, in which a reputation mechanism induces people to behave "appropriately" in the eyes of observers. For this reason, Krackhardt (1998) argued, the presence of shared third parties tends to make a tie "super strong and sticky"—that is, resistant to decay. Other research suggests that shared contacts create not only normative pressures, but also ongoing opportunities for two people to interact (Kossinets and Watts 2009), providing a second mechanism by which embeddedness promotes ties persistence.

Although the intuition for the effect of social embeddedness on tie longevity is straightforward, evidence of the temporal "stickiness" of embedded ties has been scarce. Krackhardt (1998) reanalyzed a classic data set (Newcomb 1961) and found evidence consistent with the persistence of embedded ties. Similarly, Feld's (1997) reanalysis of Wallace's (1966) data on undergraduates at "Midwest College" and Martin and Yeung's (2006) longitudinal analysis of former members of urban communes showed that embedded ties were more likely to be cited again on a subsequent network survey than less embedded ties. Burt (2001) showed that social embeddedness slows the rate of decay of an individual's tie to an institution. More recent work in a professional services setting found that when individuals undergo job transitions, embeddedness impedes the decay of their ties to partners in the firm (Jonczyk et al. 2016). Applying the extant theory and evidence to the present setting, I argue that social embeddedness will mitigate the extent to which reorganization induces tie decay choices.

There is little theory or evidence to suggest how this stickiness will be distributed, however. Combining structural theories with social psychology, I argue that the effect of social embeddedness on tie decay should vary as a function of an individual's self-monitoring personality. The foundations for self-monitoring theory lie in Goffman's (1959) work on self-presentation. The theory argues that individuals exhibit natural variation in the degree to which they tend to present themselves favorably to different audiences or to dissimilar others (Snyder 1974, Gangestad and Snyder 2000, Toegel et al. 2007). High self-monitors are more concerned with understanding the social norms and reading the behavioral cues of others and adjusting their own behavior accordingly (Snyder 1974, Gangestad and Snyder 2000); low self-monitors, by contrast, tend to express self-consistent behavior regardless of the social context (Kilduff and Day 1994). Self-monitoring has long been associated with brokerage in social networks (e.g., Mehra et al. 2001, Kilduff and Krackhardt 2008), especially when high self-monitors are skilled at conveying a sense of empathy (Kleinbaum et al. 2015).

Structural embeddedness impedes the decay of social ties following reorganization through a reputation mechanism (Coleman 1988), in which the presence of mutual friends both encourages and facilitates ongoing interaction. If so, then for high self-monitors—who are strongly attuned to their social environments (Gangestad and Snyder 2000)—even a single mutual friend should be sufficient to make the reputation mechanism highly salient and, consequently, to induce choices that are consistent with social norms of collegiality. Just one mutual friend might be sufficient to create a strong situation (Mischel 1977), in which a high self-monitor closely attends to the presence of others and feels "maxed out" on reputational salience, with little incremental effect of additional mutual friends.[3] In contrast, because low self-monitors' behavior tends to be more self-directed and less socially responsive, variation in the number of mutual friends should matter more: many mutual friends would induce socially responsive behavior even on the low self-monitor, whereas fewer mutual friends comprise a weaker situation in which the low self-monitor does not attend to the presence of mutual friends, instead allowing her self-directed personality to drive her behavior (Schutte et al. 1985). Consequently, if the mechanism for the social embeddedness effect is reputation, variation in the extent of embeddedness should matter more for low self-monitors than for high self-monitors.

Hypothesis 3. *In the face of reorganization, people choose to retain more socially embedded ties and allow less socially embedded ties to decay.*

Hypothesis 3A. *In dense networks, the effect of social embeddedness on tie decay will be especially strong in people with a* low self-monitoring *personality.*

A theory of network evolution requires understanding both tie formation and tie decay. And because tie decay is, necessarily, informed by first-hand experience of the value that a tie conveys to one's network, tie decay choices are particularly important. Taken together, the above hypotheses comprise an integrated theory of social structural and social psychological antecedents of tie decay choices. Actors' attributes, assumptions, agency, and inferences about others are all argued to influence the role of structure on tie decay and, consequently, on network evolution.

Data and Methods

To empirically test this theory of network evolution, I examined the socializing ties among students in a full-time, residential MBA program at an elite, private university in the northeastern United States. Although studies of MBA students may lack the external validity to generalize readily to other kinds of organizations, this limitation was counterbalanced by a key feature of the research setting that is unavailable in virtually any other empirical context: a randomized, natural experiment in which highly salient social settings were randomly and simultaneously assigned and reassigned for all members of the cohort (see also Chakravarti et al. 2014, Hasan and Bagde 2015, Yakubovich and Burg 2016). As at many institutions, the business school examined here randomly assigned students to sections and study groups upon their arrival on campus in the fall. Formally, sections serve as the locus of all coursework; as prior research suggests (Feld 1981) and as the empirical results will indicate, they also serve as a focus of informal socializing. Nested within sections are study groups, in which students collaborate to learn course material and complete assignments and which were required to meet at least five days per week, often for several hours each day, during the observation period. Assignment to both sections and study groups followed a stratified random process designed to promote diversity within groups and relative parity of experience across groups. Random assignment solves the *selection problem* that has posed a challenge to causal identification of peer effects in prior work (Mouw 2006).

The key source of exogenous variation that I exploit in this study is the reassignment of sections and study groups that occurred in the winter term, beginning in January. Winter term sections and study groups were assigned by the administration of the MBA program through the same stratified, random process used in the fall term. An important feature of my identification strategy is the fact that random chance will leave some pairs of fall-term section mates "reorganized" (that is, in different sections for the winter term), whereas others will be randomly assigned to the same winter section. This temporal variation provides a solution to the *reflection problem* of causal inference (Manski 1993). While imperfect, this strategic research site compares favorably with more natural organizational settings, in which reorganizations occur for reasons that are decidedly not random—and which, therefore, are likely endogenous to the variables of interest—because the exogenous, longitudinal change in opportunity structure permits the cleanest identification of the causal effects of reorganization on informal networks that is possible.

Sample and Data Collection

The sample studied includes the complete cohort of 276 active[4] first-year MBA students (33% women; 59% white, non-Hispanic; 65% U.S. citizens). The analysis required the collection of three different data sets. First, I collected data from the registrar about each student's section and study group assignment for both fall and winter terms, along with other academic and demographic data. Students arrived on campus in late August for a week-long orientation program, at the end of which first-term section and study group assignments were made known. Fall-term classes began the following week and continued through mid-December. Winter-term section and study group assignments were revealed to students during the first week of December, roughly 10 days prior to the end of the fall term. After several weeks of break, during which students were away from campus, the winter term began in early January, with students taking all classes in their newly reassigned section. The registrar also provided demographic data about each student, including gender, race, citizenship, and residence status (on versus off campus).

Second, students filled out online surveys to measure their socializing networks at two points in time: once in mid-November, roughly 2.5 months after their arrival on campus (hereafter, "Time 1"), and again in early February, roughly four weeks after the start of the winter term and seven weeks after learning their winter-term section and study group assignments (hereafter, "Time 2"). The timing of these surveys was intended to follow the period of social disequilibrium that marks the start of each term. Students were informed about the survey in class and directed to the study website via email; they answered a question (adapted from Burt 1992, p. 123) that was designed to assess their position within the evolving first-year MBA social network. At Time 1, the network survey question read: "Consider the people with whom you like to spend your free time. Since you arrived at [university name], who are the classmates you have been with most often for informal social activities, such as going out to lunch, dinner, drinks, films, visiting one another's homes, and so on?" In the Time 2 network survey, the phrase "Since you arrived at [university name]..." was changed to "During the last month (that is, since the winter break)...." Because relationships were relatively new, especially during Time 1, I was concerned about the possibility of incomplete or biased recall (Brewer 2000), so the survey employed a roster-based name generator, with names organized into columns by section and listed alphabetically within sections. Respondents indicated the presence of a tie by clicking a check-box next to the name of each active contact. No upper bound was imposed on the number of friends a respondent could cite, but a minimum of one contact was required. The median student cited 22 contacts at Time 1 and 32 contacts at Time 2; both distributions had very long right tails (Time 1, min = 1, max = 173, SD = 27.6; Time 2, min = 2, max = 214, SD = 30.6). The secular increase in network size from Time 1 to Time 2 was expected during a period when networks were actively being formed and, as I will demonstrate empirically, because there is a stronger tendency (at least in the short term) to add ties than to drop ties in response to structural change. The response rate was 100% in both surveys; however, because of a technical error, one student inadvertently overwrote his response data to the Time 1 network survey and had to be excluded. Thus, the final sample included 275 students, comprising a response rate of 99.6%.

Finally, psychometric data were collected at three points in time. Following the November and February network surveys, subsequent pages collected the self-monitoring scale and the Machiavellian personality index, respectively. In a separate survey, administered in late October, peer assessments of empathy were collected. Across all data sources, personally identifying information was removed, leaving the various sources of data linked together only by anonymous identifiers.

Measures

Because my theorizing focuses on the effects of social settings and social psychology on the decay of friendship ties, the primary dependent construct is *Tie Decay*. Conceptually, *Tie Decay* occurs when a link between two people weakens and begins to disappear over time. I operationalize *Tie Decay* as occurring when person i reports having *no* tie to person j at Time 2, conditional on being in a risk set defined by two factors. First, i must have reported a tie to j at Time 1. And second, because the theory centers on reorganization, i and j must have belonged to the same first-term section; as such, the estimates reported will capture variance driven by reorganization, the removal of the social focus that had previously facilitated the social relation.

To establish the baseline effect of a shared social setting on the network, I also calculated a variable for *New Tie Formation*. *New Tie Formation* occurs when a tie is formed from the risk set of previously disconnected dyads. Operationally, new tie formation can be measured at both Time 1 and Time 2 in this data. At Time 1, we assume that no students knew one another prior to their arrival on campus, and therefore that all dyads were at risk of forming a new tie. Thus, at Time 1, *New Tie Formation* is simply a binary indicator that person i

reported having a friendship tie to person j. At Time 2, dyads who reported a tie at Time 1 were not at risk of forming a new tie, so were excluded from the risk set; *New Tie Formation* at Time 2 is thus a binary indicator that person i reported socializing with person j, conditional on the dyad being in the risk set for new tie formation.

Social Setting Variables. The key social setting covariates are binary indicators that two people were randomly assigned to the *Same Section* or *Same Study Group*, either in the fall or the winter term. *Reorganization* is a binary variable defined only for those dyads who were in the same section during the fall term and were therefore at risk of being separated; it takes a value of zero in dyads that were randomly reassigned to the same section during the winter term and a value of one in dyads that were randomized into different winter sections. In various analyses, these variables are used as covariates or to condition the sample of observations in a regression model.

Social Similarity Variables. I examined three demographic categories to assess social similarity. *Same Gender* is a binary indicator set to one for male–male and female–female dyads and to zero for mixed-gender dyads. *Same Nationality* is a binary indicator of whether or not the two members of the dyad share citizenship in the same nation, even if one or both dyad members has more than one citizenship. Both gender and citizenship are reported to the registrar at the time of enrollment. *Same Ethnicity* is a binary indicator of whether dyad members belong to the same racial/ethnic group. Students were asked to indicate their race/ethnicity in their enrollment materials to the registrar, so most race/ethnicity data is self-reported. But unlike citizenship or gender, ethnicity was not reported by a small number of students; for these students, the missing data were filled in based on the assessment of two independent coders.[5] The coders based their assessments on three documents: the student's resume, which included his or her name and, occasionally, revealed extracurricular activities, such as participation in ethnic affiliation groups; a photo; and an introductory video in which the student disclosed her preferred nickname and the correct pronunciation of her name. In such cases, the coders were able to identify the race or ethnicity of non-self-identifying students with 100% interrater reliability.

To examine whether the social similarity effect varies by majority/minority group status, each of these three variables was also split into two separate, mutually exclusive covariates. To examine gender, I created binary indicators of *Both Men* and *Both Women*, compared to a baseline category comprised of mixed-gender dyads. To examine ethnicity, I created the binary indicators *Both Caucasian* and *Minority Coethnic*, compared to a baseline category comprised of dyads in which the two members belong to different ethnic groups. To examine nationality, I created the binary indicators *Both U.S. Citizens* and *Foreign Conationals*, compared to a baseline category comprised of dyads with different citizenships.

Additionally, living on campus was expected to significantly shape social interactions, so a control variable for *Both Campus Residents* was calculated as a binary indicator that both dyad members live in campus housing, according to the registrar's records.

Social Structural Variables. Three social structural covariates were measured. The first is a dyad-level measure of the number of *Mutual Friends* shared by the two members of the dyad at Time 1. There are two required conditions for a person q to be counted as a mutual friend of i and j: first, either i cites q as a friend or q cites i as a friend; and second, either j cites q as a friend or q cites j as a friend.[6] To account for the likelihood that the marginal impact of each additional mutual friend is diminishing, the count of mutual friends was monotonically transformed into log(1+*Mutual Friends*). The second is a dyad-level measure of tie reciprocity. A tie between individuals i and j is defined as *Reciprocated* if both i reports a tie to j and j reports a tie to i.

At the individual level, I argue that people are less likely to allow their ties to valuable contacts to decay. In an organizational setting, one could measure the value of a contact based on formal status, such as hierarchical level or decision-making authority, or on informal status, based on the structure of their networks. In the present empirical setting, where there is no formal hierarchy, my proxy for the value of a contact is *Alter's Brokerage* in the Time 1 network.[7] *Brokerage* was measured as the inverse of the square root of Burt's (1992) structural constraint measure:

$$Brokerage_j = \left(\sum_{k=1}^{n}\left(P_{jk} + \sum_{q=1}^{n} P_{jq}P_{qk}\right)^2\right)^{-1/2},$$

where P_{jk} represents the proportion of person j's ties that comprise person k; the inner summation incorporates the indirect constraint imposed on each actor j by actor k through connections among actors q who interact with both j and k. I used the igraph package (Csardi and Nepusz 2006) in the R statistical computing environment (R Development Core Team 2013) to calculate constraint. Monotonically transforming the constraint measure by raising it to an exponent of $-1/2$ introduces no bias to estimation and eliminates skewness ($p > 0.47$, indicating no significant deviation from normal in the transformed variable; D'Agostino et al. 1990), thereby improving model fit. Additionally, the negative sign in the exponent results in a direct measure, rather than an inverse measure, of brokerage, which facilitates an intuitive interpretation of results.

Psychometric Variables. The social structural variables described above are argued to be moderated by ego's personality. Psychometric data come from previously validated and published self-report scales measuring the personality constructs of *Machiavellianism* and *Self-Monitoring* and a peer-report measure of *Perceived Empathy*. I assessed *Machiavellianism* using the MACH-IV instrument (Christie and Geis 1970), a 20-item self-report scale that requires that participants read a series of statements and indicate their agreement with each on a six-point scale ranging from "strongly disagree" to "strongly agree." Sample items include the following: "Never tell anyone the real reason you did something unless it is useful to do so," "It is wise to flatter important people," and "Honesty is the best policy in all cases" (reverse scored). The reliability of the Machiavellian scale was good in this sample (Cronbach's $\alpha = 0.74$). To facilitate interpretation without introducing any bias, each individual's Machiavellianism score was standardized by subtracting the global mean and dividing by the standard deviation. The resulting standardized variable had a mean of 0 and a standard deviation of 1 by construction (min = −2.84; max = 3.32).[8]

Self-Monitoring was measured using the 18-item self-report Self-Monitoring Scale (Snyder and Gangestad 1986), in which participants read a series of statements about themselves and labeled each as either true or false. Psychometric analysis (Lennox and Wolfe 1984) has shown this revised scale to be superior to the original 25-item Self-Monitoring Scale (Snyder 1974). Sample items include the following: "In different situations and with different people, I often act like very different persons," "I would not change my opinions (or the way I do things) in order to please someone or win their favor" (reverse scored), and "I would probably make a good actor." The present sample showed good reliability for the self-monitoring scale (Cronbach's $\alpha = 0.71$). Each individual's self-monitoring score was standardized by subtracting the global mean self-monitoring score from each observed score and then dividing by the standard deviation. The resulting standardized variable had a mean of 0 and a standard deviation of 1 by construction (min = −2.37; max = 2.20).

Perceived Empathy was measured using peer ratings of participants' behavior, as assessed in the Emotional and Social Competencies Inventory, University Edition (Wolff 2005), a multirater, 360° instrument (see also Kleinbaum et al. 2015). The items comprising the empathy scale asked well-informed peers (here, all members of one's fall-term study group) to assess the focal actor on five different dimensions of empathy, on a scale from 1 (never) to 5 (consistently): "Understands others by putting self into others' shoes," "Understands reasons for others' actions," "Understands others by listening attentively," "Understands others from different backgrounds," and "Understands others' perspectives when they are different from own perspective." Averaging across peer ratings for each item for each participant, internal consistency for the perceived empathy scale was excellent in our sample (Cronbach's $\alpha = 0.88$). Interrater reliability when averaging across items (average intraclass correlation coefficient = 0.52) compared favorably to other studies of observer ratings of personality (e.g., John and Robins 1993, Funder et al. 1995). As with the Machiavellianism and self-monitoring variables, I normalized each individual's perceived empathy score by subtracting the global mean perceived empathy score from each observed score and then dividing by the standard deviation. The resulting standardized variable had a mean of 0 and a standard deviation of 1 by construction (min = −3.30; max = 2.03).

Models

All models were estimated on dyad-level data with binary dependent variables using logistic regression.[9] Because my theoretical interest is in examining heterogeneity in the effect of reorganization on tie decay, primary estimates do not employ difference-in-differences models; rather, in most models, I condition on the prior existence of a tie and on exogenous reorganization, and then estimate the effect of various mitigating factors on tie decay.

There are two well-known issues in the estimation of dyad-level regression models that must be addressed for estimates to be consistent: common person effects and reciprocal autocorrelation (Kenny et al. 2006). Common person effects may occur if Y_{ij} is correlated with Y_{iq} (or, conversely, Y_{ji} is correlated with Y_{qi}) because of unobservable attributes of person i, who participates in both ties. Reciprocal autocorrelation may occur if Y_{ij} is correlated with Y_{ji} because of unobservable attributes of the dyad. Both of these problems render observations (and, therefore, their error terms) nonindependent, violating a key assumption of regression; as a result, conventional estimation approaches would underestimate standard errors and could mistakenly report estimates as statistically significant when, in fact, they are not (Kenny et al. 2006).

I address this problem using multiway clustering, developed theoretically by Cameron et al. (2011), independently validated (Lindgren 2010), and implemented for Stata in clus_nway.ado (Kleinbaum et al. 2013). The regression models presented are estimated with three-way clustering of observations around both ego and alter to correct for common person effects, and around the undirected ego–alter dyad, to correct for reciprocal autocorrelation. Cameron et al. (2011) describe this approach as functionally similar to other methods of accounting for dyadic dependence in network models, such as logistic regression

Table 1. Descriptive Statistics, Including Means, Standard Deviations, and a Correlation Matrix for Individual-Level and Dyad-Level Variables

Panel A: Individual-level variables

	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) *Campus Resident*	0.52	0.50	1									
(2) *Female*	0.33	0.47	0.06	1								
(3) *White, Non-Hispanic*	0.59	0.49	−0.11	0.07	1							
(4) *U.S. Citizen*	0.65	0.48	−0.01	0.17*	0.59*	1						
(5) *Machiavellianism*	0	1	0.00	−0.04	−0.02	0.02	1					
(6) *Perceived Empathy*	0	1	−0.08	0.05	0.08	0.04	−0.16*	1				
(7) *Self-Monitoring*	0	1	−0.03	−0.04	0.15*	0.10	0.19*	0.09	1			
(8) *In-Degree* (Time 1)	30.1	13.9	0.30*	0.10	0.20*	0.28*	−0.03	0.21*	0.18*	1		
(9) *In-Degree* (Time 2)	38.4	15.8	0.26*	0.13*	0.23*	0.31*	0.03	0.22*	0.23*	0.87*	1	
(10) *Brokerage* (Time 1)	4.59	0.83	0.30*	0.03	0.05	0.19*	−0.05	0.16*	0.16*	0.67*	0.66*	1
(11) *Brokerage* (Time 2)	5.06	0.83	0.14*	0.02	0.11	0.19*	0.05	0.21*	0.26*	0.55*	0.63*	0.68*

Panel B: Dyad-level variables

	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) *Tie* (Time 1)	0.110	0.313	1											
(2) *Tie* (Time 2)	0.140	0.347	0.475*	1										
(3) *Friends in Common* (Time 1)	9.75	9.65	0.459*	0.385*	1									
(4) *Ego's Brokerage* (Time 1)	4.59	0.83	0.109*	0.109*	0.501*	1								
(5) *Ego's In-Degree* (Time 1)	30.1	13.9	0.163*	0.144*	0.448*	0.673*	1							
(6) *Same Fall Section*	0.247	0.431	0.122*	0.104*	0.068*	0.000	0.000	1						
(7) *Same Fall Study Group*	0.017	0.131	0.195*	0.130*	0.027*	−0.001	−0.001	0.232*	1					
(8) *Same Winter Section*	0.247	0.431	−0.001	0.049*	0.000	0.000	0.001	−0.010*	−0.008*	1				
(9) *Same Winter Study Group*	0.017	0.131	−0.015*	0.106*	−0.012*	−0.001	−0.001	−0.022*	−0.018*	0.232*	1			
(10) *Same Gender*	0.556	0.497	0.056*	0.064*	0.007	−0.009*	−0.034*	−0.006	−0.024*	−0.006	−0.023*	1		
(11) *Same Nationality*	0.432	0.495	0.136*	0.144*	0.290*	0.116*	0.168*	−0.005	−0.014*	−0.005	−0.014*	−0.054*	1	
(12) *Same Ethnicity*	0.424	0.494	0.146*	0.162*	0.242*	0.026*	0.071*	−0.004	−0.012*	−0.004	−0.016*	−0.027*	0.415*	1
(13) *Both Campus Residents*	0.499	0.500	0.053*	0.053*	0.059*	0.010*	0.010*	−0.002	−0.018*	0.002	−0.016*	−0.001	0.001	0.008*

*$p < 0.05$.

with the quadratic assignment procedure (LR-QAP) or exponential random graph models (ERGMs). Prior research (e.g., Dahlander and McFarland 2013, Feiler and Kleinbaum 2015) has shown that the adjustments to standard errors provided with multiway clustering are similar to those in QAP, ERGMs, or even simulations based on a randomization test (Kennedy 1995). Because three-way clustering provides an adequate solution based on a well-understood extension of simple logistic regression procedures, I report estimates of these more readily comprehensible clustered logit models.

Results

Descriptive statistics and correlation matrices for both individual-level and dyad-level data appear in Table 1. Although all analyses are conducted at the dyad level, individual-level descriptive statistics are nevertheless reported to convey a clearer picture of the data. Notably, Table 1 indicates a secular trend toward larger, more brokerage-rich networks over time. The average net increase in in-degree[10] of 8.3 contacts (from 30.1 at Time 1 to 38.4 at Time 2) masks significantly more churn: unreported analysis indicates that for the average person, 20.1 new contacts were added from Time 1 to Time 2, while 11.7 ties decayed. But consistent with prior evidence of network churn (Sasovova et al. 2010), I find that even as reorganization induces a secular increase in both network size and brokerage across the board, relative brokerage positions remain relatively stable: brokerage scores at Time 1 and Time 2 are highly correlated ($r = 0.68$).

Table 2 presents the results of a manipulation check to confirm that, at the dyad level, assignment to second-term sections was independent of (any correlates of) the actors' Time 1 networks. The dependent variable in these dyad-level models is comembership in a second-term section, as a function of Time 1 network measures and demographic variables. Model (1) includes covariates related to Time 1 networks, all of which were statistically insignificant. Furthermore, the model had essentially no predictive power: it failed the Wald chi-square test of model fit and has a pseudo-R^2 of zero, down to four decimal places. Model (2) examines demographic variables in isolation. Model (3) combines network measures with demographic variables. Because random section assignments are stratified on the basis of demographic variables, it is not surprising that some of these come up as statistically significant, but small in magnitude. However, the pseudo-R^2 values of 0.03% indicate virtually no

Table 2. Regression Models of Whether Two People Are Assigned to the Same Second-Term Section, as a Function of Their Time 1 Networks and Demographic Variables

	(1)	(2)	(3)
Ego's In-Degree (Time 1)	0.000379		0.000129
	(0.001)		(0.001)
Ego's Brokerage (Time 1)	0.00873		−0.00315
	(0.011)		(0.013)
Alter's In-Degree (Time 1)	0.000379		0.000129
	(0.001)		(0.001)
Alter's Brokerage (Time 1)	0.00873		−0.00315
	(0.011)		(0.013)
log(1 + *Friends in Common*, Time 1)	−0.0233		0.00390
	(0.017)		(0.022)
Same Ethnicity		−0.00957	−0.0108
		(0.015)	(0.018)
Minority Coethnic		0.00122	0.00150
		(0.023)	(0.028)
Same Nationality		−0.0146	−0.0158
		(0.008)$^{+}$	(0.012)
Foreign conational		−0.320	−0.321
		(0.066)***	(0.070)***
Same Gender		−0.0222	−0.0221
		(0.004)***	(0.004)***
Both Women		−0.0187	−0.0196
		(0.009)*	(0.008)*
Both Campus Residents		0.00749	0.00726
		(0.027)	(0.027)
Same Fall Section		−0.0490	−0.0497
		(0.010)***	(0.010)***
Same Fall Study Group		−0.111	−0.111
		(0.087)	(0.087)
Constant	−1.168	−1.076	−1.061
	(0.087)***	(0.015)***	(0.100)***
Observations	75,350	75,350	75,350
Wald χ^2	1.96	26.61***	26.74*
Pseudo-R^2 (%)	0.00	0.03	0.03

Notes. The dependent variable is *Same Winter Section*. The insignificant effects of network structure suggest that our natural experiment is plausibly exogenous. Cluster-robust standard errors are in parentheses.

$^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

variance explained. Reassuringly, these results confirm that second-term section assignments were independent of any correlates of first-term networks and that demographics play only a small role. It thus seems reasonable to consider the reorganization of sections to be an exogenous structural shock to the network and a compelling natural experiment.

Baseline Results

Although the theoretical focus of this paper is on tie decay choices upon reorganization, I begin by briefly establishing the credibility of the data by showing evidence that social foci induce the formation of network ties and that the reorganization of social foci induces tie decay. In Table 3, I model the formation of new friendship ties as a result of being randomly assigned to the same section and study group. Models (4) and (5) estimate the effect during the first term, using all the data. Models (6) and (7) estimate the comparable effect in Time 2, based only on variance provided by dyads at risk of forming a new tie at Time 2; that is, those who were not in the same section and did not report a network tie during Time 1. Examining first the control variables in model (5), we found strong evidence of homophily and propinquity effects on tie formation, consistent with voluminous prior research. The strongest effects occurred in foreign conational dyads, whose odds of tie formation were 5.6 times the rate of otherwise similarly typical mixed-nationality dyads.[11] The conational effect was significantly weaker, but still quite large, between U.S. citizens: ceteris paribus, the odds that two typical U.S. citizens would become friends in Time 1 were 2.1 times higher than in mixed-nationality dyads. The coethnic effect was also quite strong, with those sharing a minority race/ethnicity over three times as likely to become friends and majority coethnic dyads 58% more likely to become friends as dyads with unmatched ethnicities. Gender homophily effects are also in evidence, with typical male–male dyads and female–female dyads 47% and 85% more likely to become friends, respectively, compared with male–female dyads. Propinquity effects are apparent as well: two otherwise typical campus residents were 42% more likely to become friends than dyads in which one or both members lived off campus. All of these effects are statistically significant, with $p < 0.01$, and all are substantively similar at Time 2 compared with Time 1.

Across both time periods, we find strong causal effects of a shared social focus on tie formation. Over and above the control variables, randomly assigned social foci (sections and study groups) play a significant role in creating opportunities for informal tie formation. Ceteris paribus, the odds of a typical dyad assigned to the same fall section becoming friends were 2.17 times higher than those of a similarly typical dyad assigned to different sections. When we layer on random assignment to the same study group, the magnitude of the effect is enormous, if not surprising: two people who were randomly assigned to the same section and study group[12] are 12.7 times more likely to be friends than an otherwise typical dyad who happened to end up in different sections. When we examine models (6) and (7), the results are muted slightly in magnitude because of the preexisting fall term network, but are directionally the same. In all, building upon earlier research (e.g., Festinger et al. 1950, Marmaros and Sacerdote 2006, Kossinets and Watts 2009), there is strong and compelling evidence that shared social foci induce the formation of network ties

To move beyond these intuitive and oft-reported findings, I now turn to the antecedents of tie decay.

Table 3. Baseline Models of Dyadic Tie Formation and Decay as a Function of Shared Social Foci, Reorganization, and Demographic Controls

	Time 1 tie formation		Time 2 tie formation		Tie decay (T1 to T2)
	(4)	(5)	(6)	(7)	(8)
Same Fall Section	0.872 (0.050)***	0.629 (0.052)***			
Same Fall Study Group		2.404 (0.119)***			
Same Winter Section			0.591 (0.045)***	0.275 (0.047)***	
Same Winter Study Group				2.274 (0.124)***	
Reorganization					0.218 (0.081)**
Both Caucasian	0.482 (0.138)***	0.503 (0.145)***	0.486 (0.127)***	0.520 (0.132)***	−0.340 (0.156)*
Minority Coethnic	1.212 (0.120)***	1.289 (0.124)***	1.083 (0.119)***	1.147 (0.123)***	−0.250 (0.149)+
Both U.S. Citizens	0.767 (0.127)***	0.820 (0.133)***	0.535 (0.124)***	0.568 (0.129)***	−0.313 (0.150)*
Foreign conational	2.062 (0.234)***	2.084 (0.234)***	1.658 (0.277)***	1.697 (0.279)***	−0.856 (0.328)**
Both Men	0.379 (0.078)***	0.422 (0.081)***	0.391 (0.074)***	0.437 (0.076)***	−0.108 (0.111)
Both Women	0.614 (0.095)***	0.679 (0.098)***	0.534 (0.109)***	0.608 (0.113)***	−0.254 (0.144)+
Both Campus Residents	0.350 (0.059)***	0.387 (0.061)***	0.227 (0.057)***	0.264 (0.058)***	−0.198 (0.076)**
Constant	−3.552 (0.119)***	−3.658 (0.128)***	−3.657 (0.131)***	−3.753 (0.139)***	−0.0543 (0.155)
Observations	75,350	75,350	51,720	51,720	3,285

Note. Cluster-robust standard errors are in parentheses.
$^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

In model (8), I estimate the effect of *Reorganization* on *Tie Decay* over the set of dyads who were assigned to the same fall-term section and who reported being friends at Time 1. The main effect of *Reorganization* is positive and significant, both statistically and practically: all else being equal, random assignment to different sections for the winter term raises the odds of tie decay by 15% ($p < 0.01$) compared to dyads who happened to be reassigned to the same section. Overall, there is strong evidence that sharing a social focus induces tie formation and that reorganizing social foci induces tie decay.

To examine heterogeneity in the tendency for structural separation to cause higher rates of tie decay, Table 4 estimates the effects of social structural and personality covariates on tie decay, conditional on reorganization. Model (1) includes only control variables and indicates that both *Same Ethnicity* and *Same Nationality* exhibit strong, independent negative effects on *Tie Decay* in the face of reorganization. An otherwise typical coethnic dyads who were separated by reorganization was 20% less likely than a dyad of dissimilar race/ethnicity to experience tie decay; similarly, tie decay was 19.5% less likely in conational dyads than in dyads of dissimilar citizenship. Unreported analyses show that these effects are similar in magnitude across racial/ethnic groups, but are not distributed evenly with respect to nationality. The conational effect in reducing tie decay in the face of reorganization is nearly twice as strong among non-U.S. conationals (34% reduction in tie decay) than it is between U.S. citizens (19% reduction in tie decay). Surprisingly, however, there is no significant mitigating effect of *Same Gender* on dyadic tie decay, either in the pooled analysis of model (9) ($p > 0.5$) or in an unreported, gender-disaggregated analysis ($p > 0.7$ for *Both Men*; $p > 0.39$ for *Both Women*).[13]

Hypothesis Tests

Hypothesis 1 argued that the effect of reorganization on tie decay will be reduced when alter has an advantageous network structure due to strategic

Table 4. Models of Dyadic Tie Decay as a Function of Social Structural and Personality Variables, Conditional on Reorganization

	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Alter's Brokerage		−0.137*		−0.152**							0.298***	0.302**
		(0.054)		(0.055)							(0.089)	(0.092)
Ego's Machiavellianism			−0.038	0.505+								0.687*
			(0.091)	(0.275)								(0.287)
Alter's Brokerage × *Ego's Machiavellianism*				−0.113*								−0.155**
				(0.056)								(0.059)
Tie Reciprocity					−0.887***		−0.867***				−0.873***	−0.820***
					(0.106)		(0.105)				(0.115)	(0.112)
Alter's Perceived Empathy						−0.084	−0.012					0.004
						(0.051)	(0.059)					(0.060)
Tie Reciprocity × *Alter's Perceived Empathy*							−0.160*					−0.172*
							(0.080)					(0.081)
log(1 + *Mutual Friends*)								−0.530***		−0.580***	−0.625***	−0.696***
								(0.117)		(0.111)	(0.163)	(0.163)
Ego's Self-Monitoring									−0.040	−0.956***		−0.880**
									(0.084)	(0.285)		(0.293)
log(1 + *Mutual Friends*) × *Ego's Self-Monitoring*										0.355***		0.331**
										(0.105)		(0.108)
Both Men	−0.026	−0.035	−0.025	−0.037	−0.038	−0.031	−0.050	−0.071	−0.025	−0.068	−0.071	−0.082
	(0.112)	(0.113)	(0.112)	(0.113)	(0.115)	(0.112)	(0.115)	(0.116)	(0.112)	(0.114)	(0.117)	(0.116)
Both Women	−0.142	−0.154	−0.144	−0.162	−0.036	−0.137	−0.031	−0.135	−0.144	−0.113	−0.003	0.005
	(0.154)	(0.154)	(0.153)	(0.154)	(0.156)	(0.154)	(0.157)	(0.154)	(0.154)	(0.153)	(0.156)	(0.156)
Foreign Conational	−0.727*	−0.744*	−0.729*	−0.727*	−0.435	−0.726*	−0.434	−0.651*	−0.733*	−0.623*	−0.320	−0.264
	(0.339)	(0.333)	(0.340)	(0.341)	(0.314)	(0.341)	(0.319)	(0.325)	(0.343)	(0.316)	(0.318)	(0.328)
Both U.S. Citizens	−0.301+	−0.270+	−0.302+	−0.274+	−0.268+	−0.307+	−0.282+	−0.132	−0.302+	−0.099	−0.137	−0.125
	(0.157)	(0.159)	(0.158)	(0.160)	(0.157)	(0.157)	(0.157)	(0.174)	(0.159)	(0.170)	(0.175)	(0.173)
Both Caucasian	−0.402*	−0.401*	−0.404*	−0.404*	−0.323+	−0.393*	−0.316+	−0.270	−0.398*	−0.272	−0.172	−0.168
	(0.163)	(0.162)	(0.164)	(0.164)	(0.166)	(0.163)	(0.166)	(0.174)	(0.164)	(0.170)	(0.185)	(0.185)
Minority Coethnic	−0.277+	−0.282+	−0.277+	−0.287+	−0.253	−0.288+	−0.265+	−0.156	−0.283+	−0.138	−0.102	−0.093
	(0.163)	(0.162)	(0.163)	(0.162)	(0.160)	(0.162)	(0.160)	(0.160)	(0.163)	(0.157)	(0.159)	(0.157)
Both Campus Residents	−0.163+	−0.162+	−0.161+	−0.158+	−0.147+	−0.162+	−0.147+	−0.126	−0.163+	−0.125	−0.107	−0.100
	(0.085)	(0.085)	(0.085)	(0.084)	(0.082)	(0.085)	(0.083)	(0.088)	(0.085)	(0.089)	(0.087)	(0.088)
Constant	0.112	0.757**	0.108	0.830**	0.461**	0.124	0.474**	1.457***	0.115	1.527***	0.642*	0.745*
	(0.152)	(0.289)	(0.152)	(0.296)	(0.171)	(0.151)	(0.171)	(0.300)	(0.152)	(0.297)	(0.309)	(0.336)
Observations	2,489	2,489	2,489	2,489	2,489	2,489	2,489	2,489	2,489	2,489	2,489	2,489

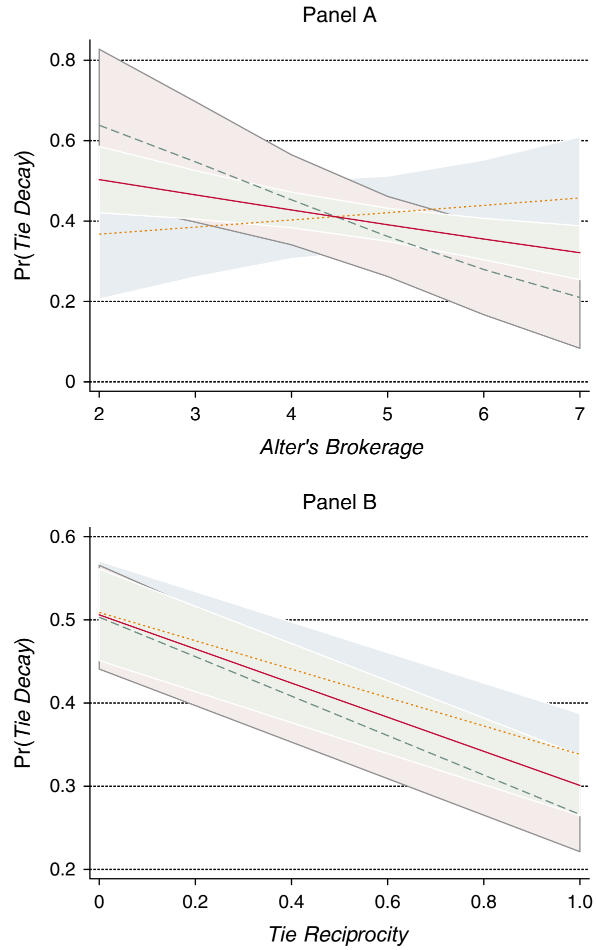
Note. Cluster-robust standard errors are in parentheses.
$^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

agency, especially when ego has a highly Machiavellian personality. Consistent with this hypothesis, model (10) shows that, ceteris paribus, ties to those high in brokerage are less likely to decay and that the effect size is moderate: compared to a tie with an average broker, a tie with a contact whose brokerage score is one standard deviation above the sample mean is 7% less likely to decay. Models (11) and (12) test Hypothesis 1A by examining how the effect varies as a function of *Ego's Machiavellianism* and, thereby, whether individual strategic behavior is the mechanism for Hypothesis 1. In model (11), I find no main effect of *Ego's Machiavellianism* on the baseline rate tie decay. For brevity, a model that includes both *Alter's Brokerage* and *Ego's Machiavellianism* was not reported, but results directly parallel their independent effects in models (10) and (11). Finally, model (12) includes their interaction and shows that, other things being equal, ties to brokers are significantly less likely to decay ($p < 0.01$) and that this effect is especially pronounced when the sender of the tie is highly Machiavellian ($p < 0.05$).

Because interaction effects in nonlinear models have been argued to be difficult to interpret (Allison 1999, Ai and Norton 2003; but see also Greene 2010), these results are depicted graphically in Figure 1, panel A, which plots the ceteris paribus probability of *Tie Decay* as a function of *Alter's Brokerage* separately for medium, high, and low Machiavellians (defined by Mach scores at the sample mean or one standard deviation above or below it, respectively). As the graph depicts, the magnitude of the effect is near zero (i.e., the curve is nearly flat) when *Ego's Machiavellianism* is one standard deviation below the sample mean, but is increasingly negative and significant, both statistically and practically, as *Ego's Machiavellianism* rises. In all, these results are consistent with Hypotheses 1 and 1A, that individual strategic behavior serves to reduce the decay of social ties in the face of reorganization, especially for highly Machiavellian people.

The rest of Table 4 shows the evidence for Hypotheses 2 and 3, which argued that the effect of *Reorganization* on *Tie Decay* will be reduced by tie reciprocity and by social embeddedness, with moderation by empathy and self-monitoring personality, respectively. Models (13) and (16) show very strong negative effects of tie reciprocity and social embeddedness, respectively, on tie decay. On average, a tie that was reciprocated at Time 1 is 41% less likely to decay as a result of reorganization than an unreciprocated tie. Similarly, dyads sharing mutual friends are significantly less likely to allow their social tie to dissolve when they are structurally separated. As an indication of the magnitude of the effect, when *ego* shares two friends in common with a given *alter*, the odds of tie decay decrease by 8%, compared to having just one friend in common.[14] A second mutual friend further reduces the odds of tie decay

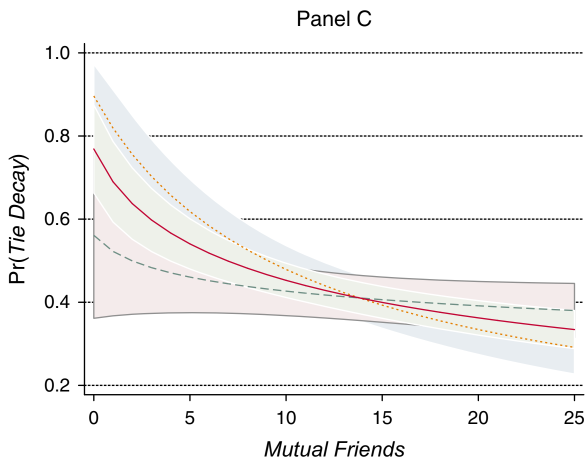
Figure 1. (Color online) Graphical Depiction of (A) the Effect of *Alter's Brokerage* on *Tie Decay*, (B) the Effect of *Tie Reciprocity* on *Tie Decay*, and (C) the Effect of *Mutual Friends* on *Tie Decay*



by 6%. The average dyad shares nearly 10 friends in common, the cumulative effect of which is to reduce the likelihood of tie decay by 32%, relative to an otherwise similar dyad that shares just one common friend. Interestingly, the main effect of *Same Nationality* is reduced by half and rendered statistically insignificant when *Mutual Friends* is entered into model (16), suggesting that clustering may be the driving mechanism of the conational effect.

Models (14) and (15) consider moderation of the *Reciprocity* effect by *Alter's Perceived Empathy*. In model (14), I find a negative and marginally significant main effect of *Alter's Perceived Empathy* on *Tie Decay*. An unreported model enters both *Tie Reciprocity* and *Alter's Perceived Empathy*, and the results echo their independent effects in models (13) and (14). Model (15) shows evidence of a negative and statistically significant interaction: the negative effect of *Tie Reciprocity* on *Tie Decay* is larger when alter is perceived as highly empathic than when alter is seen as lacking in empathy. The

Figure 1. (Continued)



Notes. Panel A shows a graphical depiction of the effect of *Alter's Brokerage* on *Tie Decay*, plotted separately for people with low, medium, and high levels of Machiavellianism, based on estimates from model (12) in Table 4. Machiavellianism is held constant at its mean (red solid line with 95% confidence interval (CI) in green), two standard deviations above the mean (green dashed line with 95% CI in pink), and two standard deviations below the mean (orange dotted line with 95% CI in blue), respectively. All other covariates are held constant at their mean values. Panel B shows a graphical depiction of the effect of *Tie Reciprocity* on *Tie Decay*, plotted separately for people with low, medium, and high levels of *Perceived Empathy*, based on estimates from model (15) in Table 4. *Perceived Empathy* is held constant at its mean (red solid line with 95% CI in green), two standard deviations above the mean (green dashed line with 95% CI in pink), and two standard deviations below the mean (orange dotted line with 95% CI in blue), respectively. All other covariates are held constant at their mean values. Panel C shows a graphical depiction of the effect of *Mutual Friends* on *Tie Decay*, plotted separately for people with low, medium, and high levels of *Self-Monitoring*, based on estimates from model (18) in Table 4. The x axis is converted from a log scale to a linear scale to facilitate interpretation. *Self-Monitoring* is held constant at its mean (red solid line with 95% CI in green), one standard deviation above the mean (green dashed line with 95% CI in pink), and one standard deviation below the mean (orange dotted line with 95% CI in blue), respectively. All other covariates are held constant at their mean values.

results of model (15) are shown graphically in Figure 1, panel B. The figure highlights the very strong effect of tie reciprocity and emphasizes that perceived empathy exerts a significant effect on the decay of reciprocated ties, but not on the decay of unreciprocated ties. In all, this analysis provides strong support for Hypotheses 2 and 2A.

Models (17) and (18) test Hypothesis 3A, that social awareness is the mechanism behind the role of embeddedness in mitigating tie decay, using interactions with self-monitoring personality. In model (17), the main effect of *Ego's Self-Monitoring* personality is entered into the models; it has no significant effect on tie decay.[15] An unreported model enters both *Mutual Friends* and *Ego's Self-Monitoring*, yielding substantively the same results as models (16) and (17), and model (18) adds their interaction. The results indicate that interacting *Mutual Friends* and *Ego's Self-Monitoring* does little to change the main effect of *Mutual Friends*: its magnitude remains approximately the same across models (16) and (18). However, adding the interaction term causes the main effect of *Ego's Self-Monitoring* to become negative and quite large ($p < 0.01$). The interaction term itself is positive and statistically significant ($p < 0.01$).[16]

This effect is shown graphically in panel C of Figure 1, which indicates that for reorganized dyads with one friends in common, the rate of tie decay is much higher for low self-monitors than for high self-monitors. For high self-monitors, the curve is gradually downward sloping, whereas for low self-monitors, it takes a much steeper downward trajectory. Adding one mutual friend causes the rate of tie decay to decline for both populations, but it also causes the gap to narrow. The decay rates for high and low self-monitors converge at 14 mutual friends, after which high self-monitors are more likely to experience tie decay upon reorganization. Thus, it seems that low self-monitors are more responsive to the effect of each additional friend in common on dyadic tie decay than high self-monitors are.

Finally, to examine whether the effects of these three hypotheses on *Tie Decay* are independent or overlapping, models (19) and (20) include all three sets of covariates. Model (19) includes the main effects of *Alter's Brokerage*, *Reciprocity*, and *Mutual Friends*. Model (20) add in *Ego's Machiavellianism*, *Alter's Perceived Empathy*, and *Ego's Self-Monitoring*, as well as the hypothesized interactions. In all cases, the results replicate those reported in separate models, indicating that the underlying mechanism for each hypothesis is independent of the others. In all, the results provide strong support for the theory.

To assess the robustness of these results to endogeneity in the formation of ties (which must necessarily precede tie decay), I replicated the fully specified model (20) using a two-stage Heckman estimator (Heckman 1979). In the first stage, dyadic similarity variables for demographics (gender, nationality, and race/ethnicity), location of residence, and randomly assigned fall class sections and study groups were used to predict the formation of network ties at Time 1. The covariates of interest (plus controls) then predicted tie decay for those dyads who were reorganized into different sections. The results of this supplementary analysis are quite consistent with those reported in model (20). In all cases, the hypothesized effects are in the same direction as model (20), and most coefficients are comparable in magnitude with a linear probability specification of model (20), though two of the interactions are only of marginal statistically significance.

Discussion and Conclusion

In this paper, I seek to extend research on network evolution by examining the structural and psychological antecedents of actors' tie decay choices in the face of the shifting opportunity structures. Whereas the burgeoning literature on network evolution focuses on the formation of network ties, I examine the antecedents of tie decay, a fundamental processes of network evolution that is nevertheless not well understood. Indeed, prior research on the effects of structural change on networks focuses on those ties that are retained, rather than those that decay, without examining what factors determine whether a given tie will decay or persist (e.g., Kleinbaum 2012). To examine tie decay—and to focus on actors' tie decay choices—I exploit a randomized, natural experiment in which class sections and study groups were randomly assigned and reassigned to a complete cohort of MBA students. This research builds on the growing interest in understanding the antecedents of network structure and the forces that drive network evolution (e.g., Sasovova et al. 2010, Ahuja et al. 2012) and addresses recent reiteration by McEvily et al. (2014) of a long-standing call for "study of the coevolution of foci and networks" (McPherson et al. 2001, p. 438).

This study underscores an important question about the epistemology of networks: what does it mean for a tie to "decay"? In this paper, I define tie decay very simply as a tie that was reported at Time 1 and not reported at Time 2. However, recent work (Levin et al. 2006, 2011) suggests that ties tend not to completely disappear; rather, they transition from an active state to a dormant state.[17] In the present empirical setting, there is no doubt that, consistent with this work, ties that have decayed could readily be reactivated; I thus make no distinction here between a tie that has "decayed" and one whose activity is "dormant." And although prior work in this vein has focused on the value of reconnection—when dormant ties are reactivated and put to productive use—there has been far less research examining, as I do here, the earlier transition from an active to a dormant state. Conceptually, these research streams are complementary, as a tie must first decay (or become dormant) before it can be reactivated.

Of course, like all research, the present work is not without limitation. The most notable limitation lies in the fact that we cannot know to what extent findings based on socializing ties of MBA students generalize to other kinds of organizations. Although the empirical setting entails students socializing within a closed community in the absence of any formal hierarchy and with relatively few prescribed task interdependencies, MBA sections and study groups are nevertheless not altogether dissimilar from work groups, departments, and other formal organizational arrangements in firms. Furthermore, most students have uprooted their lives and moved to a new place where they are collocated in close proximity with their classmates for many hours each day and with few outside social alternatives. All of these factors reinforce the internal validity of the data, while also making MBA students an idiosyncratic sample whose generalizability to other populations is unknown.

Yet, despite this limitation, these data are worth analyzing because the rare occurrence of a randomized, natural experiment (i.e., the random assignment and reassignment of students to sections) provides a strategic research context that enables cleaner causal identification than earlier cross-sectional or longitudinal studies in more naturalistic settings (cf. Jonczyk et al. 2016). Indeed, much prior research (e.g., Mouw 2006, Kleinbaum and Stuart 2014b) explicitly points to the problems of endogeneity and reverse causality in studies—even longitudinal ones—of network change and calls for research with more compelling identification strategies. The present research begins to answer that call, but even here, with random reorganization, the antecedents of tie decay are still imperfectly identified because of endogeneity in tie formation choices, which must necessarily precede decay. Such endogeneity could be addressed with, for example, a matching design or a selection model.

A second limitation lies in the measure of the value of a contact. While the present empirical setting offers many advantages, one limitation is that I have no measures of the value of a contact based on differential access to resources. Instead, I measure contact value in network terms. In a more naturalistic organizational setting, the brokerage measure of a contact value might be complemented by other measures, such as control over resources, level in the hierarchy, or expertise. Whatever the measure, however, I expect that the finding—that actors, and especially Machiavellian actors, choose to retain ties to valuable contacts—would hold.

Despite these limitations, I hope that this work will make several contributions to the literature. First, I make a theoretical contribution to research on network evolution by complementing the existing research on network tie formation (e.g., Dahlander and McFarland 2013, Kleinbaum and Stuart 2014a) with the complementary, equally important, but less well-understood phenomenon of tie decay. To the extent that people are limited in their network carrying capacity, adding new ties to one's network necessitates dropping others. And yet, the research on network evolution has focused on changing structures (e.g., Jonczyk et al. 2016) or on tie formation (e.g., Sailer and McCulloh 2012) with scant attention to tie decay. Despite early work (Burt 2000) surmising that tie decay is nothing more than the opposite of tie formation, I argue that the opportunity factors at play in tie formation do parallel those in tie decay, but that choice plays a different and more significant role in tie decay. Building on this claim, I develop and test an integrated theory of social structure and social psychology in tie decay choices. Furthermore, these results suggest that when acting in concert, the well-documented processes of tie formation and tie decay processes outlined here should systematically lead to network growth for advantageous contacts, those with highly embedded networks, and those with high levels of reciprocity. This could enable, for example, introverts—who are believed to build networks with high embeddedness and reciprocity—to accumulate large networks over time as well. Future research should investigate such possibilities directly.

This research also contributes to the literature on the personality antecedents of social networks. Early work in this domain argued that on average, chameleonic high self-monitors receive greater attainment than true-to-themselves low self-monitors (Kilduff and Day 1994) because of their greater ability to build advantageous network positions (Mehra et al. 2001, Oh and Kilduff 2008, Sasovova et al. 2010). More recent work suggests that this effect may be continent on the high self-monitor also being perceived as highly empathic (Kleinbaum et al. 2015). This work suggests that the self-monitoring effect may also depend on the social structure within which one is embedded. Furthermore, little prior work has examined the roles of the myriad other personality variables, such as Machiavellianism (cf. Shipilov et al. 2014) or perceived empathy, (cf. Kleinbaum et al. 2015) in network evolution (Burt 2012).

A related contribution of this paper is to posit boundary conditions on the generality of network research across levels of analysis.[18] It has long been argued—indeed, it has been one of the hallmarks of network science as an interdisciplinary field of research—that a network is a network is a network, regardless of the particular nature of the nodes and links (e.g., Wasserman and Faust 1994, Newman et al. 2006, Newman 2010). In one well-known example, Watts' (1999) work on the "small world phenomenon" illustrated a common structure across three very different networks: the collaboration network among Hollywood actors, the electric utility network of the United States, and neural network of the roundworm *Caenorhabditis elegans*. And while some highly general, graph theoretical truths have been discovered that span levels of analysis, in other ways, the social networks of people *are* different from the alliance networks of organizations, the physical networks of power stations, or the neural networks of worms. In this paper, I take seriously those differences and develop an integrated theory of tie decay choices that encompasses both structure (which is relatively agnostic of the nature of a node) and personality (which very much depends on nodes being human, with our attendant psychological processes), discrete bodies of scholarship that have tended to remain separated by disciplinary divides.

From a managerial standpoint, this work recognizes the central role of reorganization in the managerial toolkit for organizational change and examines how reorganization effects network changes. Building on this point, the findings here support earlier accounts that reorganization is a useful tool for reshaping organizational networks (Gulati and Puranam 2009, Kleinbaum and Stuart 2014b), but beyond a few cases, convincing empirical evidence has been scant. By providing evidence from a randomized natural experiment, this research buttresses the evidence of earlier, observational studies of tie formation and brings new evidence about tie decay.

It is striking that reorganization is a readily available managerial tool for influencing organizational behavior and performance. If the results of this study do generalize to reorganizations in other settings, this research may have important implications for the practice of organizational change. Reorganization is typical of many organizational change efforts and is a prominent arrow in the quiver of the management consulting industry. But our understanding of how such changes affect the informal social network of the organization—and especially of how they affect the decay of network ties—is limited. Conceptual research has argued that the rate of tie decay may have strategic implications for firms (Kleinbaum and Stuart 2014b), so better understanding the effect of reorganization on tie decay (and persistence) is imperative for the successful implementation of organizational change.

Of course, the real world of contemporary organizations is far more complex than the social environment of an elite MBA program, with its transient friendships and randomly assigned structures. The natural experiment studied here offers novel and compelling evidence of the effect of social settings on networks; at the same time, I make no claim that in the real world the reverse does not also occur. Although changes in organizational structure affect networks, so too can networks induce changes in formal organizational structure; therein lies the fundamental endogeneity challenge of research on social networks. I hope that this paper will offer one modest step toward a more complete, theoretically integrated understanding of the complex interplay between networks and social settings.

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Endnotes

[1] Although this asymmetry affects the decay and persistence of interfirm ties (Yue 2012), it should be even more salient in the context of interpersonal networks, where knowledge about individual nodes is less readily codified and less publicly available.

[2] Of course, this argument does not preclude the possibility that the other person may analogously choose to let her tie to the focal actor decay.

[3] To preview the empirical setting, it is important to note that virtually all dyads that are at risk of tie decay (over 99.9% of them) have at least one friend in common. Thus, consistent with this theoretical argument, the variation that drives this effect is not whether or not there are *any* mutual friends, but rather, whether there are more or fewer mutual friends. In a hypothetical setting that is socially sparser, where many dyads have *no* friends in common and more than a single friend in common is rare, we might expect that the more socially aware high self-monitors would attend more strongly to the presence of a mutual friend, yielding a theoretical prediction that the effect of a single mutual friend on tie decay would be especially strong in high self-monitors. For this reason, the modifier "In dense networks…" is included in Hypothesis 3A.

[4] One enrolled student was inactive because of a medical leave of absence, which effectively excluded her from the social cohort of the class; she was therefore excluded from the sampling frame.

[5] To preserve students' anonymity from the researcher and to ensure that assignment of ethnicity codes was independent of the research questions, all coding was done by research assistants. Even with this precaution, alternative analyses were conducted using only those students who elected to self-report their ethnicities. Across all these analyses, the same-ethnicity effect sizes were slightly smaller than in the core results because of the additional noise created by missing data, but the substantive findings were unchanged.

[6] For robustness, I also measured two more conservative counts (both i and j cite q as a friend, regardless of q's perspective, and, separately, both i and j cite q *and* q cites both i and j) and found substantively identical results.

[7] I chose brokerage because of its paramount importance in the networks literature, but one might surmise that brokerage may be less observable to the actors themselves than popularity or social status. For robustness, I replicated all models using a measure of popularity/social status based on eigenvector centrality (Bonacich 1987) in lieu of the brokerage measure. Although they are conceptually distinct, eigenvector centrality is empirically correlated at 0.90 with brokerage; unsurprisingly, therefore, the results with the eigenvector centrality measure of a contact's value are substantively identical to those with brokerage as the measure of a contact's value.

[8] Here and throughout this paper, results are substantively identical when regressions are estimated using unstandardized variables.

[9] Some methodological work (Allison 1999, Ai and Norton 2003) has highlighted the difficulties in interpreting interaction terms in nonlinear regression, such as the logit models estimated here (but see also Greene 2010). To confirm that the coefficients here are not misleading, all models were reestimated in a linear probability specification with multiple clustering. Results were substantively identical, lending credence to the robustness of the findings.

[10] Because this is a whole-network analysis (Marsden 1990), average out-degree scores exactly equal average in-degree scores by construction.

[11] Effect sizes in colinear models depend on the levels of all other covariates. To estimate the size of the "typical" foreign conational effect, I set the U.S. conational effect to zero (because, by definition, foreign and U.S. conational status are jointly determined) and set all other covariates in the model at their mean values.

[12] Recall that study groups are strictly nested within sections.

[13] Unreported analyses reveal that although gender does not play a significant role in structuring relations among reorganized dyads, it does play a role for dyads who, by random chance, ended up in the same section: gender seems to exert its effects only on structurally persisting dyads, inducing same-gender dyads to stay in contact at a higher rate than mixed-gender dyads as the social environment around them changes.

[14] Recall that in this empirical setting, there are virtually no dyads that have no friends in common.

[15] But we note evidence from earlier work (Sasovova et al. 2010, Kleinbaum et al. 2015) that has shown that in the absence of reorganization, high self-monitors both build and dissolve social ties at a faster rate than low self-monitors do.

[16] These results are robust to the addition of a covariate for extraversion (John and Srivastava 1999). Additionally, to ascertain the theoretical precision of this prediction, I also estimated models in which extraversion was substituted for self-monitoring. There is a main effect of extraversion (i.e., ceteris paribus, extraverts allow fewer ties to decay), but the interaction effect that I hypothesize for self-monitoring does not occur for extraversion. These additional, unreported analyses help to buttress support for the hypothesized mechanism.

[17] I do not focus here on ties that are actively, deliberately severed, for example, as a result of a conflict. For one study of deliberate tie severance, see Vaughan (1986). On the strategic choice to impose costs on contacts who are "disposable," thereby inducing them to sever contact with you, see Desmond (2012). For related work on conflict and negative ties, see Labianca (2014).

[18] I am indebted to Henrich Greve for underscoring this point.

References

Ahuja G, Soda G, Zaheer A (2012) The genesis and dynamics of organizational networks. *Organ. Sci.* 23(2):434–448.

Ai C, Norton EC (2003) Interaction terms in logit and probit models. *Econom. Lett.* 80(1):123–129.

Alcácer J, Zhao M (2012) Local R&D strategies and multilocation firms: The role of internal linkages. *Management Sci.* 58(4): 734–753.

Allen TJ (1977) *Managing the Flow of Technology: Technology Transfer and the Dissemination of Technological Information within the R&D Organization* (MIT Press, Cambridge, MA).

Allison PD (1999) Comparing logit and probit coefficients across groups. *Sociol. Methods Res.* 28(2):186–208.

Argote L, Ingram P (2000) Knowledge transfer: A basis for competitive advantage in firms. *Organ. Behav. Human Decision Processes* 82(1):150–169.

Austin EJ, Farrelly D, Black C, Moore H (2007) Emotional intelligence, Machiavellianism and emotional manipulation: Does EI have a dark side? *Personality and Individual Differences* 43(1): 179–189.

Bartlett MY, DeSteno D (2006) Gratitude and prosocial behavior: Helping when it costs you. *Psych. Sci.* 17(4):319–325.

Blau PM (1964) *Exchange and Power in Social Life* (Wiley, New York).

Blumstein P, Kollock P (1988) Personal relationships. *Annual Rev. Sociology* 14:467–490.

Bonacich P (1987) Power and centrality: A family of measures. *Amer. J. Sociology* 92(5):1170–1182.

Brewer DD (2000) Forgetting in the recall-based elicitation of personal and social networks. *Soc. Networks* 22(1):29–43.

Burt RS (1992) *Structural Holes: The Social Structure of Competition* (Harvard University Press, Cambridge, MA).

Burt RS (2000) Decay functions. *Soc. Networks* 22(1):1–28.

Burt RS (2001) Attachment, decay, and social network. *J. Organ. Behav.* 22(6):619–643.

Burt RS (2004) Structural holes and good ideas. *Amer. J. Sociol.* 110(2):349–399.

Burt RS (2005) *Brokerage and Closure: An Introduction to Social Capital* (Oxford University Press, New York).

Burt RS (2012) Network-related personality and the agency question: Multi-role evidence from a virtual world. *Amer. J. Sociol.* 118(3):543–591.

Byrne D, Clore GL, Smeaton G (1986) The attraction hypothesis: Do similar attitudes affect anything? *J. Personality Soc. Psych.* 51(6):1167–1170.

Cameron AC, Gelbach JB, Miller DL (2011) Robust inference with Multi-way clustering. *J. Bus. Econom. Statist.* 29(2):238–249.

Chakravarti A, Menon T, Winship C (2014) Contact and group structure: A natural experiment of interracial college roommate groups. *Organ. Sci.* 25(4):1216–1233.

Christie R, Geis FL (1970) *Studies in Machiavellianism* (Academic Press, New York).

Coleman JS (1988) Social capital in the creation of human capital. *Amer. J. Sociol.* 94:S95–S120.

Cook KS, Emerson RM (1978) Power, equity and commitment in exchange networks. *Amer. Sociol. Rev.* 43(5):721–739.

Cook KS, Rice E (2006) Social exchange theory. DeLamater J, ed. *Handbook of Social Psychology* (Springer, New York), 53–76.

Csardi G, Nepusz T (2006) The igraph software package for complex network research. *InterJournal* Complex Systems:1695.

D'Agostino RB, Belanger A, D'Agostino Jr RB (1990) A suggestion for using powerful and informative tests of normality. *Amer. Statistician* 44(4):316–321.

Dahl MS, Sorenson O (2012) Home sweet home: Entrepreneurs' location choices and the performance of their ventures. *Management Sci.* 58(6):1059–1071.

Dahlander L, McFarland DA (2013) Ties that last: Tie formation and persistence in research collaborations over time. *Admin. Sci. Quart.* 58(1):69–110.

Davey CG, Allen NB, Harrison BJ, Dwyer DB, Yücel M (2010) Being liked activates primary reward and midline self-related brain regions. *Human Brain Mapping* 31(4):660–668.

Desmond M (2012) Disposable ties and the urban poor. *Amer. J. Sociol.* 117(5):1295–1335.

Dunbar RIM (2008) Cognitive constraints on the structure and dynamics of social networks. *Group Dynam.: Theory, Res., Practice* 12(1):7–16.

Feiler D, Kleinbaum AM (2015) Popularity, similarity, and the network extraversion bias. *Psych. Sci.* 26(5):593–603.

Feld SL (1981) The focused organization of social ties. *Amer. J. Sociol.* 86(5):1015–1035.

Feld SL (1997) Structural embeddedness and stability of interpersonal relations. *Soc. Networks* 19(1):91–95.

Festinger L, Schachter S, Back K (1950) *Social Pressures in Informal Groups: A Study of Human Factors in Housing* (Stanford University Press, Stanford, CA).

Flynn FJ (2003) How much should i give and how often? The effects of generosity and frequency of favor exchange on social status and productivity. *Acad. Management J.* 46(5):539–553.

Friedkin NE (1990) A Guttman scale for the strength of an interpersonal tie. *Soc. Networks* 12(3):239–252.

Funder DC, Kolar DC, Blackman MC (1995) Agreement among judges of personality: Interpersonal relations, similarity, and acquaintanceship. *J. Personality Soc. Psych.* 69(4):656–672.

Galbraith JR (1973) *Designing Complex Organizations* (Addison-Wesley, Reading, MA).

Gangestad SW, Snyder M (2000) Self-monitoring: Appraisal and reappraisal. *Psych. Bull.* 126(4):530–555.

Goffman E (1959) *The Presentation of Self in Everyday Life* (Anchor Books, New York).

Goodreau SM, Kitts JA, Morris M (2009) Birds of a feather, or friend of a friend? Using exponential random graph models to investigate adolescent social networks. *Demography* 46(1):103–125.

Gouaux C (1971) Induced affective states and interpersonal attraction. *J. Personality Soc. Psych.* 20(1):37–43.

Gouldner AW (1960) The norm of reciprocity: A preliminary statement. *Amer. Sociol. Rev.* 25(2):161–178.

Granovetter MS (1985) Economic action and social structure: The problem of embeddedness. *Amer. J. Sociol.* 91(3):481–510.

Greene W (2010) Testing hypotheses about interaction terms in nonlinear models. *Econom. Lett.* 107(2):291–296.

Gulati R, Puranam P (2009) Renewal through reorganization: The value of inconsistencies between formal and informal organization. *Organ. Sci.* 20(2):422–440.

Hallinan MT (1979) The process of friendship formation. *Soc. Networks* 1(2):193–210.

Han SK (1996) Structuring relations in on-the-job networks. *Soc. Networks* 18(1):47–67.

Hasan S, Bagde S (2015) Peers and network growth: Evidence from a natural experiment. *Management Sci.* 61(10):2536–2547.

Heckman JJ (1979) Sample selection bias as a specification error. *Econometrica* 47(1):153–162.

Heider F (1958) *The Psychology of Interpersonal Relations* (Wiley, New York).

Hidalgo CA, Rodriguez-Sickert C (2008) The dynamics of a mobile phone network. *Physica A: Statist. Mech. Its Appl.* 387(12): 3017–3024.

Ibarra H (1992) Homophily and differential returns: Sex differences in network structure and access in an advertising firm. *Admin. Sci. Quart.* 37(3):422–447.

Ibarra H (1995) Race, opportunity, and diversity of social circles in managerial networks. *Acad. Management J.* 38(3):673–703.

John OP, Robins RW (1993) Determinants of interjudge agreement on personality traits: The big five domains, observability, evaluativeness, and the unique perspective of the self. *J. Personality* 61(4):521–551.

John OP, Srivastava S (1999) *The Big Five Trait Taxonomy: History, Measurement, and Theoretical Perspectives* (Guilford Press, New York).

Jonczyk C, Lee Y, Galunic C, Bensaou BM (2016) Relational changes during role transitions: The interplay of efficiency and cohesion. *Acad. Management J.* 59(3):956–982.

Kennedy PE (1995) Randomization tests in econometrics. *J. Bus. Econom. Statist.* 13(1):85–94.

Kenny DA, Kashy DA, Cook WL (2006) *Dyadic Data Analysis* (Guilford Press, New York).

Kilduff M, Day DV (1994) Do chameleons get ahead? The effects of self-monitoring on managerial careers. *Acad. Management J.* 37(4):1047–1060.

Kilduff M, Krackhardt D (2008) *Interpersonal Networks in Organizations: Cognition, Personality, Dynamics, and Culture* (Cambridge University Press, Cambridge, UK).

Kleinbaum AM (2012) Organizational misfits and the origins of brokerage in intrafirm networks. *Admin. Sci. Quart.* 57(3):407–452.

Kleinbaum AM, Stuart TE (2014a) Inside the black box of the corporate staff: Social networks and the implementation of corporate strategy. *Strategic Management J.* 35(1):24–47.

Kleinbaum AM, Stuart TE (2014b) Network responsiveness: The social structural microfoundations of dynamic capabilities. *Acad. Management Perspect.* 28(4):353–367.

Kleinbaum AM, Tushman ML (2007) Building bridges: The social structure of interdependent innovation. *Strategic Entrepreneurship J.* 1(1):103–122.

Kleinbaum AM, Jordan AH, Audia P (2015) An altercentric perspective on the origins of brokerage in social networks: How perceived empathy moderates the self-monitoring effect. *Organ. Sci.* 26(4):1226–1242.

Kleinbaum AM, Stuart TE, Tushman ML (2013) Discretion within constraint: Homophily and structure in a formal organization. *Organ. Sci.* 24(5):1316–1336.

Kossinets G, Watts DJ (2009) Origins of homophily in an evolving social network. *Amer. J. Sociol.* 115(2):405–450.

Krackhardt D (1998) *Simmelian Ties: Super Strong and Sticky* (Sage, Thousand Oaks, CA).

Labianca GJ (2014) *Negative Ties in Organizational Networks* (Emerald Group Publishing Limited, Bingley, UK).
Lennox RD, Wolfe RN (1984) Revision of the self-monitoring scale. *J. Personality Soc. Psych.* 46(6):1349–1364.
Levin DZ, Walter J, Murnighan JK (2011) Dormant ties: The value of reconnecting. *Organ. Sci.* 22(4):923–939.
Levin DZ, Whitener EM, Cross R (2006) Perceived trustworthiness of knowledge sources: The moderating impact of relationship length. *J. Appl. Psych.* 91(5):1163–1171.
Lewis PA, Rezaie R, Brown R, Roberts N, Dunbar RIM (2011) Ventromedial prefrontal volume predicts understanding of others and social network size. *NeuroImage* 57(4):1624–1629.
Lindgren K-O (2010) Dyadic regression in the presence of heteroscedasticity—An assessment of alternative approaches. *Soc. Networks* 32(4):279–289.
Machiavelli N (1910) *The Prince*. PF Collier.
Manski CF (1993) Identification of endogenous social effects: The reflection problem. *Rev. Econom. Stud.* 60(3):531–542.
Marmaros D, Sacerdote B (2006) How do friendships form? *Quart. J. Econom.* 121(1):79–119.
Marsden PV (1990) Network data and measurement. *Annual Rev. Sociol.* 16(1):435–463.
Martin JL, Yeung K-T (2006) Persistence of close personal ties over a 12-year period. *Soc. Networks* 28(4):331–362.
McCabe J (2014) Friends with academic benefits: How networks matter during and after college. Working paper, Dartmouth College, Hanover, NH.
McEvily B, Soda G, Tortoriello M (2014) More formally: Rediscovering the missing link between formal organization and informal social structure. *Acad. Management Ann.* 8(1):299–345.
McPherson JM, Smith-Lovin L (1987) Homophily in voluntary organizations: Status distance and the composition of face-to-face groups. *Amer. Sociol. Rev.* 52(3):370–379.
McPherson JM, Smith-Lovin L, Cook JM (2001) Birds of a feather: Homophily in social networks. *Annual Rev. Sociol.* 27(1):415–444.
Mechanic D (1962) Sources of power of lower participants in complex organizations. *Admin. Sci. Quart.* 7(3):349–364.
Mehra A, Kilduff M, Brass DJ (2001) The social networks of high and low self-monitors: Implications for workplace performance. *Admin. Sci. Quart.* 46(1):121–146.
Mischel W (1977) *The Interaction of Person and Situation* (Lawrence Erlbaum Associates, Mahwah, NJ).
Mizruchi MS, Stearns LB, Fleischer A (2011) Getting a bonus: Social networks, performance, and reward among commercial bankers. *Organ. Sci.* 22(1):42–59.
Montoya RM, Insko CA (2008) Toward a more complete understanding of the reciprocity of liking effect. *Eur. J. Soc. Psych.* 38(3): 477–498.
Mouw T (2006) Estimating the causal effect of social capital: A review of recent research. *Annual Rev. Sociol.* 32:79–102.
Newcomb TM (1956) The prediction of interpersonal attraction. *Amer. Psychologist* 11(11):575–586.
Newcomb TM (1961) *The Acquaintance Process* (Holt, New York).
Newman MEJ (2010) *Networks: An Introduction* (Oxford University Press, Oxford, UK).
Newman MEJ, Barabasi AL, Watts DJ (2006) *The Structure and Dynamics of Networks* (Princeton University Press, Princeton, NJ).
Oh H, Kilduff M (2008) The ripple effect of personality on social structure: Self-monitoring origins of network brokerage. *J. Appl. Psych.* 95(5):1155–1164.
Oishi S, Koo M, Akimoto S (2008) Culture, interpersonal perceptions, and happiness in social interactions. *Personality Soc. Psych. Bull.* 34(3):307–320.
Pfeffer J, Salancik GR (1978) *The External Control of Organizations: A Resource Dependence Perspective* (Stanford Business Classics, Stanford, CA).
Podolny JM (2005) *Status Signals: A Sociological Study of Market Competition* (Princeton University Press, Princeton, NJ).
Podolny JM, Baron JN (1997) Resources and relationships: Social networks and mobility in the workplace. *Amer. Sociol. Rev.* 62(5):673–693.
Powell J, Lewis PA, Roberts N, García-Fiñana M, Dunbar RIM (2012) Orbital prefrontal cortex volume predicts social network size: An imaging study of individual differences in humans. *Proc. Roy. Soc. B: Biological Sci.* 279(1736):2157–2162.
R Development Core Team (2013) *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna.
Raeder T, Lizardo O, Hachen D, Chawla NV (2011) Predictors of short-term decay of cell phone contacts in a large scale communication network. *Soc. Networks* 33(4):245–257.
Reagans R, Zuckerman EW (2001) Networks, diversity, and productivity: The social capital of corporate R&D teams. *Organ. Sci.* 12(4):502–517.
Reagans R, Zuckerman E, McEvily B (2004) How to make the team: Social networks vs. demography as criteria for designing effective teams. *Admin. Sci. Quart.* 49(1):101–133.
Rogers CR (1980) *A Way of Being* (Houghton Mifflin, Boston).
Ryall MD, Sorenson O (2007) Brokers and competitive advantage. *Management Sci.* 53(4):566–583.
Sailer K, McCulloh I (2012) Social networks and spatial configuration—How office layouts drive social interaction. *Soc. Networks* 34(1):47–58.
Sasovova Z, Mehra A, Borgatti SP, Schippers MC (2010) Network churn: The effects of self-monitoring personality on brokerage dynamics. *Admin. Sci. Quart.* 55(4):639–670.
Schaefer DR, Light JM, Fabes RA, Hanish LD, Martin CL (2010) Fundamental principles of network formation among preschool children. *Soc. Networks* 32(1):61–71.
Schutte NS, Kenrick DT, Sadalla EK (1985) The search for predictable settings: Situational prototypes, constraint, and behavioral variation. *J. Personality Soc. Psych.* 49(1):121–128.
Shipilov A, Labianca G, Kalnysh V, Kalnysh Y (2014) Network-building behavioral tendencies, range, and promotion speed. *Soc. Networks* 39(October):71–83.
Simmel G (1902) *The Sociology of Georg Simmel* (Free Press, Glencoe, IL).
Simon HA (1945) *Administrative Behavior: A Study of Decision-Making Processes in Administrative Organization* (Free Press, Boston).
Snyder M (1974) Self-monitoring of expressive behavior. *J. Personality Soc. Psych.* 30(4):526–537.
Snyder M, Gangestad S (1986) On the nature of self-monitoring: Matters of assessment, matters of validity. *J. Personality Soc. Psych.* 51(1):125–139.
Sorenson O, Stuart TE (2008) Bringing the context back in: Settings and the search for syndicate partners in venture capital investment networks. *Admin. Sci. Quart.* 53(2):266–294.
Sprecher S, Treger S, Wondra JD, Hilaire N, Wallpe K (2013) Taking turns: Reciprocal self-disclosure promotes liking in initial interactions. *J. Experiment. Soc. Psych.* 49(5):860–866.
Toegel G, Anand N, Kilduff M (2007) Emotion helpers: The role of high positive affectivity and high self-monitoring managers. *Personnel Psych.* 60(2):337–365.
Uzzi B (1997) Social structure and competition in interfirm networks: The paradox of embeddedness. *Admin. Sci. Quart.* 42(1):35–67.
Vaughan D (1986) *Uncoupling: Turning Points in Intimate Relationship* (Oxford University Press, New York).
Wallace WL (1966) *Student Culture; Social Structure and Continuity in a Liberal Arts College* (Aldine Publishing Company, Chicago).
Wasserman S, Faust K (1994) *Social Network Analysis: Methods and Applications* (Cambridge University Press, New York).
Watts DJ (1999) Networks, dynamics, and the small-world phenomenon. *Amer. J. Sociol.* 105(2):493–527.
Wolff SB (2005) *Emotional Competence Inventory (ECI) Technical Manual* (Hay Group, Philadelphia). Accessed November 1, 2012, http://bit.ly/ECI_Tech_Man.
Yakubovich V, Burg R (2016) Formal task interdependence and the reproduction of informal relations in organizations. Working paper, ESSEC Business School, Cedex, France.
Yue LQ (2012) Asymmetric effects of fashions on the formation and dissolution of networks: Board interlocks with internet companies, 1996–2006. *Organ. Sci.* 23(4):1114–1134.
Zaheer A, Soda G (2009) Network evolution: The origins of structural holes. *Admin. Sci. Quart.* 54(1):1–31.