Where do weak ties come from?  
An empirical investigation of the antecedents 
of weak network ties  

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Abstract

While the management literature provides much evidence of the role of weak network ties in a variety of organizational outcomes, it has paid relatively little attention to examining the processes which lead to the emergence of such ties. In this paper we begin to fill this gap by theorizing and empirically testing to what extent, in a given dyad, the presence of different types of homophily - i.e. the extent to which similar individuals tend to create ties with each other - leads to the emergence of a weak network tie. We go past previous views of homophily by arguing that similarity may emerge not only from demographic variables (such as gender and ethnicity), but also from common background (social similarity) and from elements of the formal organizational structure (such as physical location and project membership). We also theorize about the role played by other types of ties - advice and dependency - for the emergence of weak ties in a given dyad. We tested our hypotheses with data we collected in a US software development company. Results provide partial support for the different homophily hypotheses and full support for hypotheses associated with the type of tie, and help us outline implications and directions for future research that should lead to better understanding of the emergence of weak network ties.

Key words: weak network ties; homophily; advice ties; dependency ties; communication networks

1. Introduction

In recent years, a growing amount of research coming from a variety of disciplines - such as management, sociology, and psychology - has focused on the role of networks to explain organizational phenomena. Most of these studies have

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used networks purely as a methodology to envision and to help clarify statements deriving from other organizational theories (Galaskiewicz and Wasserman, 1989, Mizruchi, 1989, Jones et al., 1997, Monge and Contractor, 2003). A few of these studies, though, have gone further, providing what could be seen as elements of a nascent network theory of organizations (Borgatti and Halgin forthcoming). Works on the advantages of brokering structural holes (Burt, 1992), on the positive and negative implications of network embeddedness (Granovetter, 1985, 1992; Uzzi, 1996, 1997), and on the relevance of tie strength (Granovetter, 1973, 1974; Krackhardt, 1992; Hansen, 1999) can be seen, if not as part of a full-fledged network theory of organizations, at least as building blocks of a theoretical framework that uses networks to explain organizational phenomena (Borgatti and Halgin forthcoming). These works have shown original explanatory power, in the sense that they go beyond what could be posited using more traditional organizational theories by complementing them in explaining what happens in and between organizations. Thus, a better understanding of such initial elements of a network theory of organizations is likely to help the advancement of organization theory as a field.

Among these mechanisms, the strength of weak ties has been shown to have particularly important organizational implications (Granovetter, 1973, 1974, 1983). Scholars have emphasized the influence of weak network ties on a number of individual and organizational outcomes (Granovetter, 1983; Krackhardt, 1992; Constant et al., 1996; Yakubovich, 2005). One of the most critical advantages afforded by weak ties is access to non-redundant information, which is a precursor for a variety of important outcomes, both at the individual - e.g., finding a new job (Granovetter, 1973, 1974) - and at the organizational level - e.g., innovation (Hansen, 1999). Recent work on the re-activation of dormant or latent ties (Levin et al., 2011; Mariotti and Delbridge forthcoming) provides additional evidence of the individual and organizational benefits of leveraging very weak ties. Given its relevance for organizations, it is surprising to notice that the managerial literature has paid little or no attention to theorizing and empirically investigating the antecedents of weak network ties. Given its relevance for organizations, it is surprising to notice that the managerial literature has paid little or no attention to theorizing and empirically investigating the antecedents of weak network ties. Aside from one work that has looked at the antecedents of ties' strength by envisioning it as a continuum, going from low to high (Reagans, 2005), we were hard pressed to find any studies that specifically focused on understanding the determinants of the emergence of a weak tie in a given network dyad. Further evidence of this lack of attention is that, when we looked up “antecedents of weak ties” or “antecedents of weak network ties” on Google, we obtained zero results for both searches.

Given the relevance of this network-based mechanism, the goal of this paper is to extend the organizational literature by theorizing and empirically testing the possible antecedents of weak network ties. If weak ties are so relevant to individuals and organizations, then it is important to understand where they come from. Specifically, we investigate the role of two different mechanisms in the emergence of weak network ties. First we look at the role that homophily - the fact that similar people are more likely to have strong ties among them (for a comprehensive review,
Homophily, which is reflected in the properties of each network dyad, is a driver of social relations that ensues from people feeling similar to others. While research has shown that it is a basic driver of ties’ formation and ties’ strength (McPherson et al., 2001; Reagans, 2005), it has mostly overlooked its role in the emergence of weak ties. Furthermore, it has mostly viewed it as similarity over demographic variables, such as gender and ethnicity. In this paper, we argue that dissimilarity between the individuals involved in the dyad on a variety of dimensions - including but not limited to demographic ones - may have an impact on the emergence of weak ties. Second, we consider the role that other types of ties linking the members of a dyad - namely work-related advice and dependency - may have in the emergence of weak ties. Specifically, we posit that while the presence of work-related advice is more likely to lead to the emergence of weak ties, the opposite is true for dependency ties. A simultaneous investigation of the determinants of weak ties that are intrinsic to the nature of the dyad - that is, its level of homophily - and to other types of ties existing among dyad members - that is, work-related advice and dependency - is likely to further our understanding of the process leading to the emergence and maintenance of weak network ties. We test our hypotheses using data we collected in a software development company in the Midwest of the United States.

The paper is organized as follows. First, we review the literature on weak network ties, both in terms of their relevance and of their correlates. Then, we discuss how different instantiations of homophily as well as the simultaneous presence of other types of ties may lead to the emergence of a weak tie in a given network dyad. After we describe our methods (empirical context, data, variables operationalization, and type of analysis used), we report and discuss our results. We close by outlining theoretical implications of our study, its limitations, and directions for future research.

2. Theory

Starting from the seminal work of Mark Granovetter in the early 70’s (Granovetter, 1973, 1974), the role of weak network ties and of their influence on the perception and the behavior of individuals in organizations has become increasingly central, both for network and organizational scholars. Granovetter defined the strength of a tie between actor A and actor B as “a probably linear combination of the amount of time, the emotional intensity, the intimacy … and the reciprocal services which characterize the tie” (1973, p. 1361). Drawing from balance theory (Heider, 1958), he showed that weak ties are usually bridges, connecting portions of the network that would otherwise be disconnected (or at least connected only indirectly, via several links - which is especially true of larger networks, where it is less likely to find totally disconnected parts of it). In addition, since the amount of time each individual can devote to maintain his/her network is limited, people with a network rich in weak ties can contact many more individuals
than those whose network has mostly strong ties. These features of weak ties lead to
the advantages weak ties have for organizations and their members (Granovetter,
1973). First, they benefit the organization by increasing the likelihood of innovating
by allowing a more effective diffusion of ideas and knowledge throughout the
organization: as they tend to connect relatively unconnected portions of the
organization, weak ties represent conduits through which ideas and information can
circle far within the network (Granovetter, 1973, 1974). Second, they benefit
individuals by facilitating their gathering of new information; if an individual’s
network is rich in weak ties, its high diversity allows him/her to gather information
that is relatively new with respect to what s/he already knows, providing him/her
with an advantage over individuals who have fewer weak ties in their networks. The
organizational literature provides plenty of evidence of such benefits. In his study of
a large electronics company, Hansen (1999) found that weak ties between different
units sped up projects by allowing a project team to search for knowledge which is
relevant to its project, at least when such knowledge is not exceedingly complex. In
their study of a large computer manufacturer, Constant and his colleagues found that
weak electronic ties allowed individuals with specific requests to tap into the
knowledge-base of people who were more experienced or had more knowledge
about a specific problem, thus benefitting their problem solving activities (Constant
et al., 1996). In a study of three divisions of three different companies (a US
pharmaceutical company, a Canadian oil and gas company, and a UK bank), Levin
and Cross (2004) found that, once controlling for the role of trust, weak ties were
more beneficial than strong ties for the transfer of useful knowledge. In his analysis
linking personal networks to the likelihood of innovation, Ruef (2002) found that
entrepreneurs who rely on weak ties as a source of ideas are more likely to be
innovative than those relying on stronger ties, as the former have the double benefit
of not constraining their range of action - individuals with whom they had weak ties,
such as acquaintances, had less expectations regarding their course of action than
those with whom they had stronger ones, such as family and friends - and provided
more diverse information. As he put it, “the reduction of information redundancy
and conformity in weak-tie networks creates a milieu where attempts at creative
action are more likely than in strong-tie contexts” (Ruef, 2002, p. 443). This finding
is consistent with the central role of dyads in the entrepreneurial process (Lorenzoni
and Ferriani, 2008) and especially with the importance of weak ties for innovation
(Cattani and Ferriani, 2008). In his analysis of the Russian labor market,
Yakubovich (2005) found support for the original strength of weak ties argument
(Granovetter, 1973, 1974), i.e. that weak ties help individuals find jobs. Using a very
large sample, he demonstrated that workers were more likely to get a job via their
weak ties rather than their stronger ones, due to the access to non-redundant
information they afforded as well as their role in directly influencing prospective
employers. Weak ties can also be weak, in the sense of dysfunctional: for example,
Haythornthwaite (2002) has shown that networks made of weak ties are more
susceptible to dissolution when change is introduced into the system.
If weak network ties are this critical for such a variety of important organizational outcomes, then investigating their antecedents is very important. Understanding what factors affect weak ties could help managers who are trying to advantageously position either themselves or their organizations in their respective networks to shape and forge the most effective mix of weak and strong ties for the specific context in which they operate. This could also help employees who are trying to strategically position themselves in their organizational network to get the most from their relational activities. However, very little has been said on the antecedents of weak network ties. The only study that has focused on the antecedents of ties’ strength (Reagans, 2005) found that the strength of a tie is a combination of three different mechanisms, i.e. homophily, identification, and competition (with the latter two basically moderating an underlying homophily effect, i.e. an overall tendency of people who are similar over certain demographic characteristics, such as tenure or gender, to create stronger ties). However, as the dependent variable in this study was tie strength and the three driving mechanisms somehow compounded (as the author himself acknowledges by saying that his results “represent the combined influence of three causal forces, which introduces some causal ambiguity”; Reagans, 2005, p. 1381), it is hard to understand what the specific drivers of weak ties were. In this study, we take a step back and focus on the impact of two different mechanisms - i.e. homophily and the nature of other existing ties - on the emergence of weak network ties, in the belief that this more narrow scope will allow us to get at a deeper understanding of the factors which are related with the emergence of these ties.

The first mechanism we believe to be leading to weak ties’ emergence is homophily (McPherson et al., 2001). Evidence that similar people develop stronger ties among themselves is widely available in the organizational literature (e.g., Ibarra, 1992, 1995; Tsui and O’Reilly, 1989; Zenger and Lawrence, 1989; Lincoln and Miller, 1979; Pfeffer, 1982). In fact, the homophily mechanism as a driver for network activity has become so permeating in organizational research that it has been “considered by many to be a law of social relationships” (Reagans, 2005, p. 1381). However, this mechanism has mainly been characterized as similarity over demographic characteristics, such as gender or ethnicity. As we believe that this is a limited view of the types of similarities that may drive network evolution, we extend the idea of homophily to include similarity due to common background (or social similarity) and to formal aspects of the organizational structure (such as physical location and project membership). Overall, we believe that homophily affects the emergence of weak ties to the extent that people who are similar in different characteristics are less likely to have such ties (McPherson et al., 2001; Reagans, 2005). Below, we outline how we expect this mechanism to be at play with regards to demographic, background, and formal organizational characteristics over which individuals in a network dyad may feel more or less similar.

One of the first characteristics of the dyads that may affect the strength of a specific network tie is their gender mix. On the basis of a homophily argument (McPherson et al., 2001), according to which people tend to interact more with
others of the same gender, previous studies found that while men tend to form strong homophilous ties, women tend to obtain social support and friendship - i.e. strong ties, given their affective component - from other women (Ibarra, 1992). Therefore, our expectation is that dyads made of individuals of different gender are more likely to lead to the emergence of weak ties.

Hypothesis 1: Gender heterogeneity leads to the emergence of weak ties among network members.

Of course, homophily works not only for gender, but also for other demographic variables under which two individuals can identify themselves as similar to each other. Another demographic variable for which homophily has been found to lead to stronger ties is ethnicity. In fact, evidence has been provided for the fact that the effect of ethnic similarity on tie strength may be even stronger than that of gender (Skvoretz, 1983), which may be due to the fact that ethnic similarity yields stronger identification among network members (Reagans, 2005). Thus, we expect weak ties to be more likely to emerge among people of who belong to different ethnic groups.

Hypothesis 2: Heterogeneity in ethnic background leads to the emergence of weak ties among network members.

In addition to demographic factors, homophily may also arise from the degree of social similarity between two individuals. A few authors have shown that social similarity plays a very strong role in determining relationships: in each dyad, the greater the similarities between the two actors’ background and shared past experiences are, the higher their likelihood of attracting each other (Belliveau et al., 1996). Thus, we can see social similarity as another way in which people may see each other as similar: this time not simply on the basis of demographics or formal organizational structure, but because of their shared background. Therefore, in line with our view of the role of homophily, we expect weak ties to emerge in dyads whose members are more socially dissimilar.

Hypothesis 3: Network members who are more socially dissimilar are more likely to develop weak ties among themselves.

While the homophily argument has been mostly applied to demographic variables, we believe that similarity among network members may also arise out of factors related to how the organization is formally structured. One of them is location. Organization members who are physically located close to each other are more likely to develop frequent, high-quality communication (Hagstrom, 1965; Kraut et al., 1990), i.e. strong ties. By increasing exposure to each other, spatial proximity facilitates the emergence of much stronger relationships if compared to other dyads where the individuals involved are not physically co-located (Rice, 1993). Thus, we expect weak ties to be more likely to emerge between individuals who are not physically co-located.

Hypothesis 4: Network members who are not physically co-located are more likely to establish weak ties among themselves.

Finally, another element related to the formal organizational structure that may lead to similarity between two individuals is the extent to which they are involved in similar organizational activities. According to activity focus theory (Feld, 1981;
McPhee and Corman, 1995), interpersonal relationships are organized around common activities. Individuals involved in common activities are more likely to develop interpersonal relationships, given that working on the same things results in much higher exposure to each other. In this sense, common projects could represent a good example of common activities. Additionally, as members of a specific project are likely to look at other projects for new ideas and ways to solve project-related problems, especially in innovative contexts, we expect them to develop weak ties with them to get access to their knowledge and ideas. Thus, we expect that people who belong to different projects are more likely to develop weak ties among themselves.

Hypothesis 5: Network members belonging to different project are more likely to establish weak ties among themselves.

A second mechanism we believe to affect the emergence of weak network ties is the presence of other types of ties among individuals who are part of a given dyad. To clarify, by looking at this mechanism we want to investigate to what extent the presence of different types of flows between two employees may increase the likelihood that the tie between them stays weak and does not become stronger. Specifically, we consider the role that two different types of ties - work-related advice and dependency - play in this process. The managerial literature provides little guidance as to how one type of tie may lead to the emergence of another (for an exception, see Shipilov and Li forthcoming). Nonetheless, the radically different nature of the two types of ties we consider may provide us with evidence as to their role for the emergence of weak ties.

We believe that the presence of work-related advice from a given employee to another - i.e. a situation where the focal employee provides work-related advice - is likely to keep the tie between these two individuals weak. The rationale for this expectation comes from the literature on work overload. Employees routinely receive different work-related requests from their colleagues, which place an increasing level of constraint on what they can accomplish at work. As the number of these requests for help and professional advice increases, they may lead to the emergence of role strain - in the form of role overload (Newton and Keenan, 1987; Kahn, 1980) and/or role conflict (Rizzo et al., 1970) - and burnout (Leiter and Maslach, 1988; Maslach et al., 2001). To minimize the negative influence of these emerging states, which all relate to having too much to do in too little time, a focal employee’s likely reaction is to keep at a minimum interactions with colleagues whose requests for advice s/he ends up attending to. Thus, we expect that advice relationships are positively associated with the presence of weak ties among dyad members.

Hypothesis 6: Dyads where a focal employee provides work-related advice to another employee are more likely to be weak network ties.

The role of dependency ties in the emergence of weak network ties is more straightforward. As these ties express the degree to which other employees are dependent upon the focal employee in the execution of their work tasks, it is likely that they will generate relatively high levels of interaction in the dyad, thus making...
it less likely for it to be a weak tie. In fact, while in the case of the advice tie the focal employee has some degree of freedom both on whether to provide the advice and, if so, on the intensity of such interaction (as we posit above), when other employees depend directly on him/her to perform their task s/he has much less discretion as to how much to engage in an interaction which is mandated by the formal organizational structure. Furthermore, as task interdependence brings people who are connected through some type of work-related dependency in constant contact, such continuous interaction favors an increasing integration of the involved actors, both in terms of sheer communication and of the more affective components of the relationship (such as trust). Therefore, our expectation is that dependency relationships are negatively associated with the presence of weak ties among dyad members.

**Hypothesis 7:** Dyads where other employees are dependent upon the focal employee to execute their work are less likely to be weak network ties.

### 3. Methods

#### 3.1 Data and variables

The object of this investigation was a software development company located in the Midwest of the United States, which employed 71 people. Of these, 79% were males and 21% females, with a mean age of 30.4 years (ranging from 16 to 57). The average tenure in the group was 2.06 years (ranging from .08 to 9.58). Data were collected via a questionnaire that was administered in person to all members of the organization. After asking a few demographic and background questions, the questionnaire mostly focused on network questions, using an organizational roster to collect data on the whole organizational network.

**Dependent variable.** When it comes to the operationalization of weak network ties, from a conceptual standpoint the original definition (Granovetter, 1973) calls for both an objective - amount of communication - and subjective - the affective side, given by the emotional intensity and intimacy entailed in the tie - component. However, capturing both these components is quite difficult and requires very fine-grained data on the existing network ties. In particular, the affective component is probably better captured using a qualitative methodology, like participant observation. Thus, previous works have used frequency to operationalize tie strength (Granovetter, 1973); even when measuring both frequency and closeness, research has found that network members are not able to meaningfully distinguish between frequency and emotional closeness (Reagans, 2005). Therefore, we decided to operationalize weak network ties using the frequency of communication in a dyad; as in Granovetter’s case, anecdotal information from our interviews showed that tie strength may be captured well by this measure. The communication dyads we focused on were generated by asking each employee to estimate the average number of hours or minutes per week s/he communicated with any other individual on the
organizational roster over the previous two months. In this sense, the maximum possible N - all the communication dyads in the organization - was 4,970, as the number of dyads in a network is equal to its size times its size minus one (i.e., \(71 \times 70 = 4,970\)). This is our sample size. Such dyads may fall into one of four different possible categories, as to the possible communication tie between a focal employee (ego) and those s/he interacts with (alters). Ego may not know alter (null tie), know alter but not communicate with him/her (zero tie), know alter and have a limited amount of communication with her (weak tie), or know alter and have a moderate to high level of communication with him/her (medium-to-strong tie). We choose to operationalize weak ties by coding as one the bottom 25% of the existing ties in the network - all ties except for the null and the zero ones - and as zero all the others. This procedure to split a sample between different levels is widely used in the psychological literature, and it strongly resembles the operationalization followed by Granovetter in his original work on the strength of weak ties (Granovetter, 1973, 1974).

As a final note, we need to point out that weak ties were measured not in relation to the network as a whole, but to each specific individual belonging to it. By not considering a weak tie as something absolute, with the same threshold for all network members, we allowed each individual to have his/her own weak ties that were relative to the intensity of his/her communication flows. By using a measure of tie strength that is relative to each individual and scaling it on his/her range of responses, we avoided bias produced by people who tend to over- and/or under-report their communication flows.

**Independent variables.** Gender and ethnicity were directly observed and recorded by the interviewer. Gender similarity was operationalized by a variable that equaled one if both employees in the dyad were of the same gender, and zero otherwise. Similarly, Ethnic similarity was captured by a variable coded as one if both members of the dyad were of the same ethnicity, and zero otherwise.

Social similarity was assessed by looking at the overlap of the background of the members of the dyad. The Social Similarity Index we used (SS Index) was a modified version of the one used by Belliveau and her associates (Belliveau et al., 1996):

\[
SSIndex = \sum_{i=1}^{n} \sum_{j=1}^{m} \left[ \left( \frac{shared_{ij} - Mshared_{j}}{s_j} \right) \right] \times know_{ij}
\]

where \(n\) is the number of dyads in the network (in our case, 4,970), \(m\) is the number of dimensions on which social similarity was assessed (in our case, 2), \(shared_{ij}\) is the dyad’s \(i\) score on the social similarity measure \(j\), \(Mshared_{j}\) is the mean score of all the dyads on the social similarity measure \(j\), \(s_j\) is the standard deviation of all the dyads on the social similarity measure \(j\), and \(know_{ij}\) is a value equal to one if both
members of the dyads report to know each other, and zero otherwise. Social similarity was assessed over two dimensions: highest level of education obtained and field of education in which the degree has been obtained. Our addition to the index developed by Belliveau and her colleagues (Belliveau et al., 1996) is the multiplicative relationship: our rationale for adding this term to the original index was that, no matter how much two individuals are similar, unless they know each other they will not be able to leverage this similarity. In fact, as a network becomes bigger and not spatially co-located, it cannot be taken for granted that everybody knows everybody else, even if they potentially have a lot in common due to their personal background. Thus, this variable takes maximum values for dyads made of two individuals who know each other and have exactly the same level and field of education.

Spatial similarity was obtained from a question asking the respondent’s office location (which could have been in one of three different buildings or locations). This information was supplemented with data from another variable, reflecting how much of one’s work was done via telecommuting. Respondents who telecommuted for more than 40% of their time were considered as working mainly from their own homes, which were therefore coded as separate locations. The spatial similarity variable equaled one if both members in the dyad were working from the same location, and zero otherwise. We obtained data on the project/s each employee was assigned to from the organization and operationalized Project similarity by creating a variable equal to one if both employees in the dyad were working on at least one joint project, and zero otherwise.

The Advice tie variable represents the extent to which the focal employee provided work-related advice to other employees and was operationalized using data we collected by asking employees who approached them for work-related advice, coding as one dyads where ego gave work-related advice to alters, and zero otherwise. Finally, the Dependency tie variable represents the extent to which other employees depended on the focal employee to execute their work. It was operationalized using data we collected by asking employees who depended on them to execute their tasks, coding as one dyad where alters depended on ego, and zero otherwise.

Control variables. Status may play a role in whether or not a weak tie emerges in a dyad. More specifically, there could be reasons to expect either that employees with higher status will be less likely to instantiate weak ties with ones with less status - as they are not interested in what the latter have to offer - or that employees with lower status will be less likely to have weak ties with employees with higher status - as they do not have the leverage to initiate ties with them\(^1\). For this reason,\(^1\)

\(^1\) Notice that although the components of the hypothesized dyad - an individual with more status and one with less status - and the mechanism evoked - status - here are the same,
we included three variables that are proxy for the status differential in a dyad in our models. As age may be an indicator of status, we included an *Age differential* variable in our analysis, which was operationalized as the difference between the age of ego and the age of alter in each dyad. Tenure may also approximate status, with people who have been on the job longer having more of it. Therefore, we included a *Tenure differential* variable in our models, which was operationalized as the difference in tenure between the two members of each dyad. Finally, as position in the organizational hierarchy is reflective of one’s status, we also included a *Hierarchy differential* variable in our models, which was built as difference in hierarchical levels between the two actors involved in each dyad.

### 3.2 Analysis

We used logistic regression models to test our hypotheses. Categorical data analysis, and more specifically logistic regression models are the most appropriate choice, given that our dependent variable was dichotomous, expressing either the presence or absence of a weak network tie. While it is true that the specific operationalization we chose is based on the level of dyadic interaction (in terms of communication between ego and alter), it has to be acknowledged that weak ties differ from other network ties - such as strong network ties - in many other ways (for example, in the affective component; see Granovetter, 1973; Krackhardt, 1992; Uzzi, 1997). Hence, weak ties should not be seen as part of a continuum or conceptualized as segments of the same continuous variable (tie strength), but rather as an independent class, characterized by very different levels and types of specific attributes, which justifies our treatment.

To correct for non-independence of network data we included N-1 dummies in our models - where N is the number of actors - and coded as 1 the two actors involved in the dyad and everybody else as a zero (Reagans, 2005; Mizruchi, 1989). By doing so, we basically introduced a fixed-effect for each person who sent or received a tie, which controls for particular patterns that a given individual may have in sending or receiving (accepting) ties (Reagans, 2005), removing the autocorrelation and thus resulting in consistent and efficient estimates (Mizruchi, 1989).

### 3.3 Results

Means, standard deviations and correlations for all the variables included in the analysis are available in Table 1. Tests of the hypotheses using logistic regression models for the presence of weak network ties are presented in Table 2.

these two situations are different as directionality is important in our models. That is, in one case we discuss the likelihood that an individual with higher status will initiate the weak tie, while in the other we hypothesize the possibility that such tie will be initiated by the individual with lower status.
Table 1: Descriptive statistics

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<th>Variables</th>
<th>Mean</th>
<th>SD</th>
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<th>9</th>
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<tbody>
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<td>1. Weak network ties</td>
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<td>2. Age differential</td>
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<td>3. Tenure differential</td>
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<td>7. Social similarity</td>
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<tr>
<td>8. Spatial similarity</td>
<td>0.317</td>
<td>0.465</td>
<td>0.062</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.042</td>
<td>0.097</td>
<td>-0.008</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Project similarity</td>
<td>0.140</td>
<td>0.347</td>
<td>0.006</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.058</td>
<td>0.005</td>
<td>0.130</td>
<td>0.261</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Advice tie</td>
<td>0.139</td>
<td>0.346</td>
<td>0.070</td>
<td>0.019</td>
<td>0.042</td>
<td>0.070</td>
<td>-0.006</td>
<td>0.079</td>
<td>0.029</td>
<td>0.189</td>
<td>0.340</td>
<td></td>
</tr>
<tr>
<td>11. Dependency tie</td>
<td>0.152</td>
<td>0.443</td>
<td>0.000</td>
<td>-0.011</td>
<td>0.007</td>
<td>-0.016</td>
<td>0.011</td>
<td>0.063</td>
<td>0.033</td>
<td>0.147</td>
<td>0.223</td>
<td>0.536</td>
</tr>
</tbody>
</table>

N = 4,970

Source: Our analysis
Table 2: Logit models predicting the emergence of weak network ties\(^{ab}\)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-2.083**</td>
<td>-1.822**</td>
<td>-1.892**</td>
<td>-2.006**</td>
<td>-2.022**</td>
</tr>
<tr>
<td></td>
<td>(0.046)**</td>
<td>(0.093)</td>
<td>(0.094)</td>
<td>(0.099)</td>
<td>(0.099)</td>
</tr>
<tr>
<td>Age differential</td>
<td>-0.019**</td>
<td>-0.018**</td>
<td>-0.017**</td>
<td>-0.017**</td>
<td>-0.016**</td>
</tr>
<tr>
<td></td>
<td>(0.005)**</td>
<td>(0.005)</td>
<td>(0.005)</td>
<td>(0.005)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>Tenure differential</td>
<td>0.000**</td>
<td>-0.002**</td>
<td>-0.003**</td>
<td>-0.003**</td>
<td>-0.004**</td>
</tr>
<tr>
<td></td>
<td>(0.017)**</td>
<td>(0.017)**</td>
<td>(0.017)**</td>
<td>(0.017)**</td>
<td>(0.017)**</td>
</tr>
<tr>
<td>Hierarchy differential</td>
<td>0.171**</td>
<td>0.168**</td>
<td>0.166**</td>
<td>0.163**</td>
<td>0.151**</td>
</tr>
<tr>
<td></td>
<td>(0.031)**</td>
<td>(0.031)**</td>
<td>(0.031)**</td>
<td>(0.030)**</td>
<td>(0.031)**</td>
</tr>
<tr>
<td>Gender similarity</td>
<td>-0.656**</td>
<td>-0.587**</td>
<td>-0.609**</td>
<td>-0.609**</td>
<td>-0.593**</td>
</tr>
<tr>
<td></td>
<td>(0.091)**</td>
<td>(0.092)**</td>
<td>(0.093)**</td>
<td>(0.093)**</td>
<td>(0.093)**</td>
</tr>
<tr>
<td>Ethnic similarity</td>
<td>0.206*</td>
<td>0.192*</td>
<td>0.165**</td>
<td>0.140**</td>
<td>0.140**</td>
</tr>
<tr>
<td></td>
<td>(0.097)**</td>
<td>(0.097)**</td>
<td>(0.098)**</td>
<td>(0.099)**</td>
<td>(0.099)**</td>
</tr>
<tr>
<td>Social similarity</td>
<td>-0.274**</td>
<td>-0.268**</td>
<td>-0.268**</td>
<td>-0.257**</td>
<td>-0.257**</td>
</tr>
<tr>
<td></td>
<td>(0.044)**</td>
<td>(0.044)**</td>
<td>(0.044)**</td>
<td>(0.044)**</td>
<td>(0.044)**</td>
</tr>
<tr>
<td>Spatial similarity</td>
<td>0.393**</td>
<td>0.372**</td>
<td>0.372**</td>
<td>0.369**</td>
<td>0.369**</td>
</tr>
<tr>
<td></td>
<td>(0.098)**</td>
<td>(0.098)**</td>
<td>(0.098)**</td>
<td>(0.098)**</td>
<td>(0.098)**</td>
</tr>
<tr>
<td>Project similarity</td>
<td>0.059**</td>
<td>0.059**</td>
<td>0.071**</td>
<td>0.071**</td>
<td>0.071**</td>
</tr>
<tr>
<td></td>
<td>(0.135)**</td>
<td>(0.135)**</td>
<td>(0.135)**</td>
<td>(0.135)**</td>
<td>(0.135)**</td>
</tr>
<tr>
<td>Advice tie</td>
<td>0.592**</td>
<td>0.592**</td>
<td>0.592**</td>
<td>0.592**</td>
<td>0.592**</td>
</tr>
<tr>
<td></td>
<td>(0.143)**</td>
<td>(0.143)**</td>
<td>(0.143)**</td>
<td>(0.143)**</td>
<td>(0.143)**</td>
</tr>
<tr>
<td>Dependency tie</td>
<td>-0.288**</td>
<td>-0.288**</td>
<td>-0.288**</td>
<td>-0.288**</td>
<td>-0.288**</td>
</tr>
<tr>
<td></td>
<td>(0.122)**</td>
<td>(0.122)**</td>
<td>(0.122)**</td>
<td>(0.122)**</td>
<td>(0.122)**</td>
</tr>
</tbody>
</table>

Model fit (log likelihood) -1739.913**** -1712.625**** -1693.785**** -1684.640**** -1676.339****

\(N = 4,970\)

\(^{a}\) Standard errors in parentheses
\(^{b}\) Coefficients of individuals' dummy variables are omitted to conserve space

\(^* p < 0.05, ** p < 0.01\)

Source: Our analysis

All models are significant (\(p < .001\)). Model 1 includes our control variables. Two variables - age differential and hierarchy differential - are significantly associated with weak ties, confirming both situations that led us to include them as possible controls in our models. Age differential is significantly (\(p < .01\)) and negatively associated with weak network ties, indicating that older individuals are less likely to have weak ties with younger ones. Hierarchical differential is also significant (\(p < .01\)), but positively related to weak ties, meaning that individuals who are lower in the hierarchy are less likely to enact weak ties with people who are higher up in the organization. Model 2 adds the homophily variables connected with the shared demographics, i.e. gender and ethnicity. Gender similarity is significantly (\(p < .01\)) and negatively associated with weak ties; this means that people of different gender are more likely to create weak ties, which provides support for Hypothesis 1. On the other hand, ethnic similarity, while significantly associated with weak ties in this model, becomes not significant under better model specifications (Models 4 and 5), thus not supporting Hypothesis 2. In Model 3 we introduce homophily based on social similarity, which is significantly (\(p < .01\)) and
negatively associated with weak ties; this means that weak network ties are more likely to emerge among people who are more socially dissimilar, thus providing support for Hypothesis 3. We include the variables capturing homophily as deriving from the formal organizational structure in Model 4. Spatial similarity is significantly (p < .01) and positively associated with weak ties; this means that, differently from what we hypothesized, people who are co-located are more likely to create weak ties, a result that does not support Hypothesis 4. Project similarity is not significantly associated with weak ties, a result that does not support Hypothesis 5. Finally, Model 5 (our full model) includes the two variables capturing the influence of the presence of other ties among members of the dyad. The presence of an advice tie is significantly (p < .01) and positively associated with weak ties, which provides support for Hypothesis 6, while a dependency tie is significantly (p < .01) and negatively associated with weak ties, which supports Hypothesis 7.

Given the large size of our sample, it is meaningful to reflect not only on the significance of the variables included in our models, but also on their actual impact on the emergence of weak ties. We took the coefficients for the significant variables in the full model (Model 5) and exponentiated them (results can be seen in Table 3). These exponentiated parameter estimates can be seen as the odds of a weak tie being present or not per unit change in each independent variable, other things being equal. This way, we can see that while the influence of the two control variables is negligible (for example, older employees are 1.6% less likely to have a weak tie with a younger member), the impact of the explanatory variables is quite substantial. Specifically, as it pertains to our hypothesized effects, the stronger impact is the one coming from the presence of an advice tie (which makes a weak tie 80.7% more likely to be present in the dyad), followed by the role of gender similarity (individuals of different gender are 44.7% more likely to have a weak tie), the presence of a dependency tie (which makes a weak tie 25% less likely to emerge in the dyad), and finally by social similarity (where one additional unit in social dissimilarity increases the likelihood of a weak tie by 22.7%).

Table 3: Significant predictors of the emergence of weak network ties:
Summary of regular and exponentiated coefficient estimates

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age differential</td>
<td>-0.016</td>
<td>0.984</td>
</tr>
<tr>
<td>Hierarchical differential</td>
<td>0.151</td>
<td>1.163</td>
</tr>
<tr>
<td>Gender similarity</td>
<td>-0.593</td>
<td>0.553</td>
</tr>
<tr>
<td>Social similarity</td>
<td>-0.257</td>
<td>0.773</td>
</tr>
<tr>
<td>Spatial similarity</td>
<td>0.372</td>
<td>1.450</td>
</tr>
<tr>
<td>Advice tie</td>
<td>0.592</td>
<td>1.807</td>
</tr>
<tr>
<td>Dependency tie</td>
<td>-0.288</td>
<td>0.750</td>
</tr>
</tbody>
</table>

Source: Our analysis
4. Discussion and conclusions

As research has repeatedly shown, weak network ties have strong implications for organizations. While scholars have focused on the consequences of weak ties, little or no research has been carried out on the antecedents of such ties. This study focused on filling this gap by analyzing two mechanisms that may be driving the emergence of such ties: homophily, i.e. similarity among actors, driven by three different factors (demographics, social background, and formal organizational structure), and presence of other types of ties (advice and dependency) among the members of each dyad. Results from an empirical study of an US software development company provide partial support for the homophily drivers and full support for the influence of other types of ties.

This study contributes to the research on weak network ties in at least two ways. First, it assesses the role that homophily-driven mechanisms have on the emergence of weak ties. Obviously, as confirmed by extant research, homophily drives people closer, thus our hypotheses have been looking at the absence of homophily - or dissimilarity - between actors as a factor in the emergence of weak ties. By specifying three different types of drivers of similarity among network members, we rely on a wider conceptualization of the homophily construct (McPherson et al., 2001), thus starting to open up the box of what type of homophily is really important when it comes to the creation of weak ties. Our results are interesting as they do not seem to point to the primacy of a specific type of homophily driver. Homophily driven by demographics - which is the one typically acknowledged in the literature - is partially responsible for weak ties, as our results concerning gender point out; however, we were not able to find the same effect for ethnicity, a dimension that according to the literature (McPherson et al., 2001) should lead to an even higher degree of similarity (hence, to an even lower likelihood of creating weak ties than gender). Such results point to the need for future studies to further investigate which of the demographic factors plays a role in the creation of weak ties and why. We also introduce the idea that homophily driven by social similarity and formal organizational structure can have an impact on the emergence of weak ties. We find support for the former effect, pointing to the need to include not only similarity based on demographics but also on shared background and experiences in future investigations of tie strength. Finally, we did not find any evidence for the role of homophily based on elements of the formal organizational structure on the creation of weak network ties. An explanation of this may lie in the strong spatial and project segregation that characterized the organizations we studied. While the offices of the organization were located in three different buildings separated by only a few yards, the fact that projects were strongly segregated by building (no project straddled more than one location), together with the fact that over 10% of the people mostly worked from their homes did not help in allowing the possibility for weak ties to emerge across locations and/or projects. We obtained anecdotal evidence of this inability to build bridges connecting different parts of the organizations during our interview process; for example, at one point one of the authors overheard two
individuals who were part of one project discussing how to tackle a certain problem, which the same researcher knew had already been solved by members of a different project just across the street. Thus, rather than discarding the idea that homophily driven by the organizational structure may not be related to the emergence of weak ties, future studies should try and re-examine this link, to make sure our results were not due to the specific context we analyzed. If that were the case, possible solutions that segregated organizations like ours may enact to foster the emergence of beneficial weak ties across projects and locations could be to lower the competition between different projects and to lead people from different parts of the organization to interact more, either formally (via the creation of cross-project task forces) or informally (via regular events that provide employees with the opportunity to socialize).

The second contribution of this study lies in the findings about the roles that different types of ties among dyad members can play in the emergence of weak network ties. Our hypotheses on the role of advice and dependency ties were supported, thus providing initial evidence of how other relationships may impact the formation of weak ties, as well as contributing to understanding how one type of tie may entail another, a possibility much discussed by organizational scholars (White, 1992) but which has so far received very little empirical support (Shipilov and Li forthcoming). Future studies should investigate whether other types of ties among network members are likely to enable or limit the emergence of weak network ties in a given dyad.

Of course, our study has a few limitations. Like all studies focusing on an intra-organizational network, it was based on a single organization. Thus, generalizability of our results is an issue; future studies looking to extend our work should think about collecting data in organizations of a different kind to see whether our results are context-dependent or not. Our operationalization of weak network ties could be improved. While what we did is in line with previous work on weak network ties (Granovetter, 1973), our measure is based only the intensity of the interaction, and does not consider the degree of emotional closeness. Although intensity seems a pretty robust proxy for measuring weak ties (Granovetter, 1973; Reagans, 2005), future studies should consider assessing weak ties considering both the frequency and the affective component of a tie. While the paper focuses on the emergence of weak ties, when a weak tie is not present we do not know if it does not exist to begin with or because it becomes stronger. As these are two conditions with very different implications, future studies should consider and/or model these different states. Finally, our study was cross-sectional. This should not affect our conclusions, due to the nature of the data we used for our variables. Data for our homophily-driven variables were based on dyadic features that either could not change (as in the case of gender, ethnicity, and common background) or were set from long before the time to which the weak ties refer to, which is the previous two months (such as for location and projects). Data for variables gauging the influence of other types of ties was also based on relationships (such as advice or work-dependency) that are likely to have been present for longer than the two months to
which the weak ties measurement refers to. However, future studies testing the antecedents of weak ties using longitudinal data may have the additional benefit of looking at how the structure of the communication network itself may endogenously drive the emergence of weak ties (Whitbred et al., 2011), as well as to what extent weak ties stay the same over time and, if not, whether - and why - they disappear or evolve into stronger ties.

References


WHERE DO WEAK TIES COME FROM?


WHERE DO WEAK TIES COME FROM?