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Trading similarity for proximity: trade-offs in advice seeking in a professional services firm.

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Abstract

This study examines patterns of advice seeking ties in professional services firms. We first propose that individuals purposefully seek advice from colleagues with whom they have substantial albeit not excessive similarity of expertise. Building on transactive memory theory, we then suggest two ?foci? ? office space and project space ? that steer individuals? advice seeking patterns away from these strategic considerations, towards more proximate colleagues. The greater salience associated with proximity may allow individuals to seek advice from colleagues with whom they share little expertise, whilst it may also weaken the tendency to stay away from colleagues with whom they may have too much expertise in common. Using rich, multi-source data from a professional services context, we find support for our predictions, and exploit information on changes in desk allocations and client site placements to help disentangle the complex interrelationships between our main variables.

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TRADING SIMILARITY FOR PROXIMITY
TRADE-OFFS IN ADVICE SEEKING IN A PROFESSIONAL SERVICES FIRM

Abstract

This study examines patterns of advice seeking ties in professional services firms. We first propose that individuals purposefully seek advice from colleagues with whom they have substantial albeit not excessive similarity of expertise. Building on transactive memory theory, we then suggest two "foci" – office space and project space – that steer individuals' advice seeking patterns away from these strategic considerations, towards more proximate colleagues. The greater salience associated with proximity may allow individuals to seek advice from colleagues with whom they share little expertise, whilst it may also weaken the tendency to stay away from colleagues with whom they may have too much expertise in common. Using rich, multi-source data from a professional services context, we find support for our predictions, and exploit information on changes in desk allocations and client site placements to help disentangle the complex interrelationships between our main variables.

Keywords: Advice seeking, organizational networks, expertise similarity, physical proximity, transactive memory, professional services firms

INTRODUCTION

Research on interpersonal networks embraces an array of theoretical mechanisms to explain patterns of advice seeking in organizations (Contractor, Wasserman, & Faust, 2006; Phelps, Heidl, & Wadhwa, 2012). One stream of research starts from the premise that individuals seek advice from colleagues they believe will be the most instrumental in helping them achieve specific outcomes (Nebus, 2006). This literature views tie formation decisions as strategic, emphasizing factors such as expertise similarity which may affect the valuation of a colleague's expertise and the effort of accessing it (Borgatti & Cross, 2003). Another stream of research views the formation of advice networks in organizations as the result of an opportunity driven process, and portrays such networks as "emergent" rather than the result of strategic actions (Ibarra, Kilduff, & Tsai, 2005; Kilduff & Brass, 2010). The opportunity driven nature of tie formation is manifested, for example, in a strong tendency to seek advice from colleagues in close physical proximity (Moenaert & Caeldries, 1996).

Both streams of research advance our understanding of organizational networks, but few efforts have been made to understand how different mechanisms interact to predict which colleague a person will contact when seeking advice (Nebus, 2006). As a result, we have limited knowledge on whether and how strategic decisions based on expertise similarity may be influenced by opportunity-driven advice-seeking mechanisms based on physical constraints. At the same time, both organizational network research traditions largely disregard the role of formal organizational structure, such as patterns of work (Barley & Kunda, 2001; McEvily, Soda, & Tortoriello, 2014). With work on strategic tie formation emphasizing individual agency and work on opportunity driven mechanisms focusing on emergence processes, little space is left for the idea of formal organization as a further constraint on the formation of advice seeking ties. Patterns of work are frequently seen as "control variables," which limits opportunities to include them in a comprehensive theory of advice seeking in organizations (McEvily et al., 2014).

Building on transactive memory theory (Hollingshead, 2000; Reagans, Argote, & Brooks, 2005) and the concept of "foci" – entities that increase exposure to some individuals and limit exposure to others (Dahlander & McFarland, 2013; Feld, 1981; Lomi, Lusher, Pattison, & Robins, 2014) – we investigate the conditions that may lead individuals to deviate from strategic decisions of advice seeking based on instrumental levels of expertise similarity. We start from the baseline expectation that individuals seeking advice purposefully choose colleagues with whom they have substantial, albeit not excessive similarity of expertise. This non-linear effect emanates from a trade-off between sufficient similarity to allow effective communication, and sufficient dissimilarity to ensure scope for novelty required to find solutions to complex problems. More specifically, we argue that colleagues who are proximate in two organizational foci – office space and project space – are more a salient advice target than distant colleagues. The greater salience related to proximity in a particular focus is associated with a higher likelihood that individuals will seek advice from a colleague with whom they share little expertise, whilst also making it more likely that they will not stay away from colleagues with whom they have too much expertise in common. Thus, individuals may steer away from strategic advice decisions based on relative expertise similarity under the influence of physical or project proximity, and forge ties with colleagues whose expertise similarity would otherwise be judged too little or too much.

We test these propositions using rich data on advice seeking networks in a large professional services firm. Our empirical setting is a sample of 114 individuals drawn from several closely located offices. We use information from a comprehensive network survey, the organization's expertise location system, office plans, and project repository. Since individuals in professional services firms frequently seek advice from colleagues about how to solve complex problems for their clients (Hitt, Bierman, Shimizu, & Kochhar, 2001; Von Nordenflycht, 2010), this setting appears suitable for our study. We also exploit information on recent changes in desk allocations and individuals who were working on site with the client to help disentangle the complex interrelationships between expertise similarity and physical proximity.

The study enriches our understanding of organizational networks in two important ways. First, it shows how advice seeking ties arise from the interplay between strategic considerations and opportunity structures in organizations. As such, our study contributes to building a more balanced view between research that conceptualizes networks as emergent structures and research that considers networks as strategic devices (Hallen & Eisenhardt, 2012; Ibarra et al., 2005). Individuals may trade (a lack or an excess of) similarity for high levels of proximity. These results hint towards alternative mechanisms for advice seeking decisions, which appear either motivated by productive levels of expertise similarity, or driven by the "law of least effort" whereby considerations of useful expertise similarity are driven to the background.

Second, in response to the observation that formal organizational structure such as patterns of work has received limited scholarly attention in network research (Barley & Kunda, 2001; Kleinbaum et al., 2013; McEvily et al., 2014), we incorporate the influence of formal organization as a factor influencing the opportunity structure for the formation of advice seeking ties. This study shows that fluid team membership influences the consideration set of colleagues that individuals may consult, facilitating the formation of ties with colleagues that have limited expertise similarity, whilst also making them gravitate to people who may be too similar to them.

THEORY AND HYPOTHESIS

Advice seeking in professional services firms

Professional services firms rely on staff applying their expert knowledge in developing solutions to clients' difficult and complex problems (Hitt et al., 2001; Von Nordenflycht, 2010). The ability to integrate knowledge from different specialists to solve problems is critical for professional services firms' success (Grant, 1996; Kogut & Zander, 1992). Individuals are rewarded on the basis of their ability to generate useful and timely solutions to client problems (Teece, 2003). In this context, a reputation for creative and inventive problem-solving increases status within the organization and may lead to promotion opportunities (Lazega, 2001).

An important sub-category of professional services firms is engineering consultancies. Professionals in these organizations work in flexible and diverse teams organized around distinct but overlapping practice areas. Consultancy engineering projects often generate complex problems that require the integration of different sets of engineering knowledge (Gann & Salter, 2000; Von Nordenflycht, 2010). For example, designing a new sewage treatment facility in a foreign country may require knowledge about local planning regulations, hydrology, chemistry, structural engineering, geotechnics, concrete, and project management. Such a diverse set of knowledge is rarely possessed by one individual and engineers, mostly working under severe time and financial constraints, thus frequently consult colleagues for advice and support (Cross & Sproull, 2004; Schon, 1991). Over time, these patterns of exchange give rise to a dense advice seeking network among individuals within the organization.

Expertise similarity and advice seeking

Research on networks has a long tradition of studying the role of homophily, defined as the largely implicit, individual tendency to associate with similar others (McPherson, Smith-Lovin, & Cook, 2001). However, when we examine network formation within organizations, homophily can be at odds with more strategic, deliberate considerations underlying individuals' decisions about whom to consult for advice (Ingram & Morris, 2007; Lawrence, 1997). Unlike friendship ties, instrumental ties (those achieving specific personal and professional objectives) appear to be driven less by homophily (Ibarra & Andrews, 1993), as individuals may overcome homophily tendencies in advice-partner choices for strategic reasons (Ibarra et al., 2005). In settings where advice-seeking may be crucial for job effectiveness, individuals are likely to deliberately seek out individuals they believe will help them solve their problems most successfully (Lazega, 2001; Nebus, 2006).

Following a body of work on the effect of expertise similarity in patterns of communication (Borgatti & Cross, 2003; Clark, 1996; Cramton, 2001; Reagans & McEvily, 2003), we suggest that the individual's advice source is a function of the extent to which colleagues have similar expertise. Expertise similarity refers to commonalities "in the knowledge and skill domains in which members of an organization are specialized as a result of their work experience and education" (Van Der Vegt & Bunderson, 2005: 533). Our baseline expectation is that individuals tend to seek advice from colleagues with sufficient similarity of expertise to facilitate effective communication and sufficient dissimilarity of expertise to ensure scope for novelty.

On the one hand, similar expertise creates 'common ground' and shared understanding (Clark, 1996; Cramton, 2001; Nahapiet & Ghoshal, 1998). In the specific context of engineering, expertise similarity includes a shared design language; there is often a common set of tools, methods, and heuristics for problem solving that is specific to each engineering field (Vincenti, 1990). Expertise similarity allows the individual to describe the problem dimensions to a colleague in a succinct and comprehensible manner. Moreover, individuals working in the same expertise area likely have dealt with similar problems in the past and can draw on their experience in order to advise, often at little personal effort. If advice is sought from a colleague operating in a completely different expertise area, the time required to communicate the nature of a problem in a form that the other engineer will understand, increases.

On the other hand, if both individuals involved have very similar expertise, this may limit the potential for learning (Ancona & Caldwell, 1992; Nooteboom, 2000). In relation to a challenging and complex problem, there is only so much to be learned from a colleague with very similar expertise. Consulting someone with very dissimilar expertise can introduce the individual to new perspectives and result in cross-fertilization of ideas (Van Der Vegt & Bunderson, 2005). A degree of 'creative abrasion' may be necessary to realize new perspectives (Leonard-Barton, 1992). A degree of dissimilar expertise between individuals may be required to ensure that a solution to the problem is found.

Based on the above, we expect that expertise similarity will be positively associated with advice seeking up to a certain threshold above which the perceived interest in seeking advice will become smaller. That is, beyond that threshold, greater expertise similarity will have an increasingly smaller positive and potentially even a negative association with the probability of seeking advice. Thus, we hypothesize that:

> Hypothesis 1: The level of expertise similarity of ego relative to alter is positively associated with the probability that ego seeks advice from alter up to a threshold value beyond which the association will show diminishing or negative returns.

The role of 'foci' in advice seeking

The trade-off between ease of communication (expertise similarity) and scope for novelty (expertise dissimilarity) suggests that individuals make informed, strategic decisions about whom to consult for advice (Nebus, 2006). This view assumes that individuals have relatively complete knowledge of 'who knows what' in their organization, and that all colleagues are equally 'salient' as a person to consider seeking advice from. However, despite the introduction of knowledge management systems such as organizational 'yellow pages', it is clear that many people in organizations lack reliable knowledge about what their colleagues know and can do (Borgatti & Cross, 2003; Bunderson, 2003). In other words, the organization's transactive memory – aggregate knowledge of who knows what in the organization – is far from complete. Decisions about whom to consult for advice, in part are based on individual awareness of a potential contact's characteristics and abilities, awareness that is formed amidst the 'fog' of organizational life (Nebus, 2006; O'Reilly & Roberts, 1976).

Following recent work on organizational foci (Dahlander & McFarland, 2013; Kleinbaum et al., 2013; Lomi et al., 2014), we maintain that the salience of colleagues as potential sources of advice is shaped by the focused nature of organizational ties. These foci are "the social, psychological, legal, or physical entities around which joint activities are organized" (Feld, 1981: 1016). For example, individuals are more likely to become friends if they attend the same church, or belong to the same neighborhood or sports club; their foci constrain with whom they interact. The concept has been used, for example, to show that homophily – the tendency to associate with similar others – is often partly induced by homogeneity of foci and is not exclusively the result of deliberate choice or preference to form bonds with similar individuals (McPherson & Smith-Lovin, 1987).

In organizational settings, examples of foci include membership of organizational sub-units (Dahlander & McFarland, 2013; Lomi et al., 2014), work relationship patterns (Barley & Kunda, 2001; Brass, Galaskiewicz, Greve, & Tsai, 2004), and office space (Borgatti & Cross, 2003; Kleinbaum et al., 2013; Reagans, 2011). The main mechanism underlying the greater salience of colleagues with shared foci, is exposure (Dahlander & McFarland, 2013). Being more "exposed" to certain colleagues gives individuals a greater awareness of what these colleagues know, promotes increased understanding of the (dis)similarity of their expertise, and can provide confidence about their level of competence. As a result, foci shape transactive memory and the potential pool of colleagues that individuals may consider seeking advice from – i.e. the consideration set (McEvily et al., 2014). This makes some colleagues appear more salient than others as potential sources of advice (Feld, 1981; Kossinets & Watts, 2009; McPherson & Smith-Lovin, 1987).

We argue that, in the context of advice seeking in professional services firms, there are two main foci influencing advice ties: the organization's physical space – the office layout – and project space as captured by the web of prior shared working relations among colleagues. We propose that the curvilinear association between expertise similarity and advice seeking will be moderated by the proximity of individuals in physical and project space. These foci will make certain colleagues more salient as potential sources of advice than others; however, the precise mechanisms through which this saliency develops are different. Table 1 summarizes the arguments.

INSERT TABLE 1 ABOUT HERE

Physical proximity

The effect of physical proximity on communication in organizational networks has attracted considerable managerial and theoretical interest (Contractor et al., 2006). An early study by Allen (1977) examines the effect of spatial distance among members of a research and development (R&D) team accommodated in a single office, and finds that the likelihood of communication declines sharply with the distance between people's desks. Studies on the micro-geography of the workplace show that visibility and accessibility of colleagues creates greater mutual awareness, which in turn, affects patterns of communication (e.g. Moenaert & Caeldries, 1996; Rashid, Kampschroer, Wineman, & Zimring, 2006; Van den Bulte & Moenaert, 1998). Borgatti and Cross (2003) show that the association between proximity and communication is explained in part by better information among proximate individuals of what each knows relative to the others. Proximity in office space thus is an important focus for the creation of intra-organizational ties. However, we expect that the effect of the greater awareness associated with physical proximity on advice seeking will not be equal for all but will depend on the level of expertise similarity.

First, we posit that physical proximity helps the formation of advice seeking ties with colleagues of low expertise similarity disproportionately more than it promotes ties with colleagues with intermediate levels of expertise similarity. Physically proximate individuals develop greater awareness of what others know relative to themselves, even if they do not directly communicate or work together (Borgatti & Cross, 2003; Toker & Gray, 2008; Wineman, Kabo, & Davis, 2009). The simple fact that colleagues – with whom they have low levels of expertise similarity – are proximate and visible promotes exposure, and therefore increases "transactive memory". This may lead to an individual consulting this colleague for advice even in the case of low level of expertise overlap. Were the same colleague located further away, he or she would just not have been considered as a potential candidate for advice seeking.

Second, physical proximity may redirect an individual's choice about whom to consult for information in relation to individuals with highly similar expertise. Individuals would normally be little inclined to seek advice from such colleagues since there may be too limited scope for novel solutions. However, we propose that physical proximity might deter individuals from staying away from these colleagues in the interest of saving 'shoe leather' when seeking advice. In other words, professionals may compromise on the novelty value of the advice in return for its ease of access. This suggestion is consistent with the idea that individuals often obey the 'law of least effort' (Gerstberger & Allen, 1968), satisfying rather than optimizing their choices of advice target.

Therefore, we hypothesize that physical proximity facilitates advice seeking from colleagues whose expertise similarity would normally be judged too low to allow effective communication, and thus valuable advice, leading to a flattening of the upward curve of the expertise similarity-advice seeking relationship. At the same time, we expect that physical proximity dampens the negative effect (or weakens the decreasing returns) of high levels of expertise similarity on advice seeking, as individuals still turn to proximate colleagues whose excessive similarity of expertise limits the scope for novelty.

Hypothesis 2a: At low levels of expertise similarity, physical proximity dampens the positive association between expertise similarity and advice seeking.

Hypothesis 2b: At high levels of expertise similarity, physical proximity dampens the negative association (or weakens the decreasing returns) between expertise similarity and advice seeking.

Project proximity

Formal organizational structures form another important focus for tie formation (McEvily et al., 2014). Similar to office plans, project structures in organizations shape patterns of "exposure" of colleagues to one another. Working together makes some colleagues relative to others more salient as potential advice targets (Reagans et al., 2005)[1]. The literature on transactive memory systems (see Lewis & Herndon, 2011 for an overview) suggests that relative expertise recognition depends on prior patterns of communication and collaboration (Brandon & Hollingshead, 2004; Brass et al., 2004; Reagans et al., 2005). Such prior shared working relations among colleagues form the "project space". Proximity in project space is an effective means of achieving better awareness of what other people know, and promotes a shared sense of each individual's relative expertise (Faraj & Sproull, 2000). In other words, 'standing shoulder-to-shoulder in the trenches' engenders a common understanding of how much the specialist expertise of the individuals involved in the project is overlapping or complementary. In line with the prediction about the interaction between physical proximity and expertise similarity, we hypothesize that project proximity has a different effect at each end of the expertise similarity continuum.

Project proximity disproportionately helps individuals to seek advice from colleagues with whom they have little expertise similarity relative to colleagues with intermediate similarity. This leads to a dampened positive effect of expertise similarity on tie formation. Direct exposure to the dissimilar expertise of colleagues promotes individuals' understanding of what that colleagues' areas of expertise are (Reagans et al., 2005), which in turn, makes them more salient in the individuals' "consideration set" as potential advice sources. In a setting in which there is a colleague with very dissimilar expertise, the greater awareness of this expertise enabled by prior experience of working together, helps the formulation of questions and provision of advice in mutually understandable forms (Goffman, 1981), which in turn may help individuals reach greater depths of exchange. Such expected benefits may incentivize individuals to forge advice seeking ties with colleagues with lower levels of expertise similarity, who in

[1] In this paper, we focus on what Yakubovich and Burg (2014) call "tight foci", where exposure results from joint activities. In loose foci the exposure effect is driven by joint memberships, which may or may not incur joint activities. Shared divisional membership is an example of a loose focus, which, although important, falls outside the scope of this study. Given the multidisciplinary nature of teams in our study firm, we judged shared work experience to be a more relevant focus for the formation of ties in this context.

the absence of experience working together, would not have been considered useful as a source of advice. The same colleague, were he or she distant in project space, would not come to mind – or, if so, would be considered too unfamiliar.

At the same time, high levels of project proximity may make colleagues with strongly similar profiles the default choice when seeking advice. Extensive experience of working together not only improves knowledge about “who knows what” it also increases mutual knowledge of “how to work together” through the development of relation-specific heuristics (Cramton, 2001; Reagans et al., 2005). We argue that knowing how to work together reduces the effort and potentially increases the value of asking advice from colleagues with highly similar expertise, leading to consideration of colleagues whose expertise might otherwise be deemed too similar to supply useful advice. Shared contexts based on prior participation in the same projects induces common norms of behavior, which have been shown to reduce conflict in geographically distributed teams for example (Hinds & Mortensen, 2005). Working together also stimulates the development of similar approaches to problem-solving (Vincenti, 1990). Greater familiarity with how colleagues approach their work stems from shared past experience and may create the perception that it is easier to ask advice from familiar colleagues who are proximate in project space. This is manifested in weakened decreasing returns or a dampened negative effect of expertise similarity on tie formation.

> Hypothesis 3a: At low levels of expertise similarity, project proximity dampens the positive association between expertise similarity and advice seeking.
>
> Hypothesis 3b: At high levels of expertise similarity, project proximity dampens the negative association (or weakens the decreasing returns) between expertise similarity and advice seeking.

DATA AND METHOD

Research setting

Our study was conducted in a firm that provides consulting engineering services. Professionals in this organization work on several projects simultaneously, and encounter a range of complex and difficult tasks that may be beyond the range of their current knowledge and experience, resulting in frequent consultation of colleagues for advice (Gann & Salter, 2000; Schon, 1991; Von Nordenflycht, 2010).

The organization has a strong culture of advice-seeking, underpinned by a promotion system that rewards individual as well as collective contributions. The organization has developed a reputation for being able to solve complex problems, and attracts some of the most difficult engineering projects. Critical for maintaining this reputation is the firm's ability to bring together different disciplines to develop innovative solutions for clients. It maintains a wide range of central resources to support knowledge development, including a highly advanced information and knowledge management system which involves a range of tools, including expert yellow pages, electronic networks of practice, and searchable project repositories. Its information technology systems are complemented by a range of human resource practices designed to encourage knowledge sharing, such as mentoring, job rotation, experience sharing, etc.

The study focuses on one of the company's subsidiaries. The site was established in the late 1980s and includes consultant engineers and administrative staff whose size had reached some 230 people at the time of our study. The site is specialized in several engineering fields, covering a wide selection of the company's worldwide business areas. The subsidiary operates with a high level of autonomy from the headquarters, bids for and manages its own projects, and recruits its own personnel. Given our interest in the role of physical proximity in advice seeking, it should be noted that the staff members are spread over three office buildings. Two buildings are close to each other; the third is a short walk from them. One of these buildings has one floor; in the other buildings employees were spread over two floors. Management of the focal subsidiary expressed concern that the distribution over several locations hampered effective communication and advice seeking among staff. Also, as a result of rapid growth, seating and desk arrangements were somewhat haphazard which had escaped the attention of management. Project teams are assembled on the basis of staff availability and competence and are extremely fluid, as they are reconfigured from project to project in response to client requirements. As in the rest of the company, the projects carried out in this subsidiary are multidisciplinary in nature. Among all the projects that involved three or more engineers from this subsidiary, almost all (93%) included individuals specializing in different engineering domains. Most projects also have high levels of inter-organizational collaboration as engineers work with external architects, quantity surveyors, developers, and other engineers in the delivery of a specific project. In addition, the projects are often limited in duration, with individuals reassigned to new projects once their contribution to a project has been completed. The fragmentation, fluidity and outward facing nature of project work in this environment is different from traditional organizational networks based on relatively stable, divisional, and internaly facing organizational structures (Barley & Kunda, 2001).

Data

To test our hypotheses we collected data from five different sources: (1) a comprehensive network survey, (2) the organization's internal expert pages, (3) office layouts, (4) human resources records, and (5) the project repository.

Network survey – We conducted a network survey to map the advice seeking network of the members of the focal subsidiary. The questionnaire was developed following several interviews with senior staff responsible for different business areas, and was piloted with a group of 12 engineers with diverse backgrounds. Following the pilot, the survey instrument was substantially revised in order to better reflect the organization's language and frame of reference. The survey was administered electronically to the 231 engineers and administrative staff in the subsidiary. It yielded 204 responses, corresponding to an 88% response rate. The analysis in this paper excludes administrative staff, engineers who work on site with the client, and those with missing information for their skills profile, reducing our sample to 114 engineers. To check for non-response bias, we compared grade, tenure, and location of non-respondents and respondents and found no significant differences.

In line with extant social network research (Burt, 2004), we used name generators to detect the network connections of individuals. We selected three name generator questions from Podolny and Baron (1997) and Hansen (1999), and adapted them to the specific context of advice seeking within professional services firms (see Appendix A for the exact wording of these questions): (1) searching for new ideas, (2) problem-solving, and (3) implementation of new ideas or solutions. For each network, respondents could select up to 15 colleagues from a dropdown list of those in the subsidiary. The threshold was pre-tested in the pilot study. We also obtained communication frequency for all ties reported.

Internal expert pages – To derive a measure of expertise similarity, we extracted the information stored in the organization's expertise location system (or expert yellow pages) for the survey year. Each staff member in the organization is encouraged to complete descriptions of their areas of expertise, and keep them updated. These descriptions are available only to other employees, and act as staff members' internal webpages. All the information on these pages is self-declared, and there is no compulsion to complete it. Although there is no central monitoring of the information, the descriptions are reviewed annually during staff appraisals, and there is a strong expectation that the information provided is accurate and complete. Individuals are expected to be able to respond to colleagues who consult them after reading the information provided on their page. Given the reputational costs of exaggerating skills, informants suggested that these descriptions could be considered accurate descriptions of actual capabilities. Most descriptions are around 30 words on average, although some ran to 260 words.

Office plans – The physical proximity measure used in this study is based on the floor plans of the three buildings. The plans provide details of desk layouts in the buildings and the various floors, and who occupied them at the time of our survey. The desk arrangements had remained relatively stable in the six months prior to our study. Information on grade, tenure, and education was retrieved from the organization's **human resource dataset**. The list of projects an individual has worked on was collected from the company's **project repository**.

Measures

Dependent variables – Our main dependent variable is advice seeking. The unit of analysis is the dyad or actor pair. Advice seeking is a binary variable that specifies whether or not the ego has sought advice from alter in the previous six months. Since relationships in advice networks tend to be asymmetric and non-reciprocal (Carley & Krackhardt, 1996), we retained the directionality of the tie: if ego reported a tie with alter the dependent variable is equal to 1 irrespective of whether alter also reported a tie with ego.

That is, following Nebus (2006: 617), we define advice seeking as requesting information, which does not automatically imply that the person consulted provided a satisfactory response.[2]

Independent variables – All our main dyadic independent variables are measured in relative terms, from the perspective of ego. That is, the proximity or expertise similarity of ego to alter is not equal to the proximity or expertise similarity of alter to ego. The decision on whether to seek advice from a colleague depends on ego's assessment of the expertise similarity as well as physical and project proximity with a colleague. For example, with regard to expertise similarity, suppose that ego has expertise in five different engineering domains while alter has expertise in only one, and that ego and alter have that one domain in common, then alter will perceive ego to be very similar while ego will perceive alter to be only moderately similar. This asymmetry in expertise similarity (and physical and project proximity) might better explain the formation of ties in our directed advice-seeking network, where ego may seek advice from alter but not vice versa. To build asymmetric measures, we weight the proximity and expertise similarity measures with ego's "endowments" along different dimensions: breadth of ego's expertise (expertise similarity), ego's spatial density with colleagues on the same floor (physical proximity), and ego's total number of colleagues with whom he/she collaborated (project proximity).[3]

Expertise similarity. We derive the expertise similarity of ego relative to alter using the information stored in the company's internal expert pages, using a cut-off point of 10 occurrences. We identified 574 keywords representing engineering expertise areas, using the most frequently occurring words. Pairs of words (such as 'traffic calming') and triplets of sequential words (such as 'corporate social responsibility') in the descriptions were considered as single terms. Appendix B reports an example of expertise area descriptions and related keywords. The expertise similarity of ego relative to alter is expressed as the relatedness of the keywords of ego and alter divided by the breadth of ego's expertise.

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[2] We ran robustness checks using communication frequency to dichotomize the networks. When we excluded ties between individuals who communicated less frequently than monthly, we obtained similar results to those presented here.

[3] We obtained consistent results to the ones reported when we used the un-weighted version of our main independent variables. However, we preferred the weighted specification because the asymmetric variables can better account for non-reciprocal advice seeking ties.

A simple count of overlapping keywords is not sufficient to capture similarity in the expertise profiles of two individuals since individuals could mention different albeit related keywords. Our expertise similarity measure takes account of the relatedness of non-overlapping keywords, where keyword similarity is based on their co-occurrence. That is, we derived a measure of keyword similarity using the skill descriptions of all employees in the company who provided this information in the expert yellow pages (N=3,948). The degree of similarity between two keywords x and y is calculated using the Salton cosine measure defined as:

$$\text{cosine}(x, y) = \frac{\sum_{i=1}^{n} x_i y_i}{\sqrt{\sum_{i=1}^{n} x_i^2}\sqrt{\sum_{i=1}^{n} y_i^2}} \text{ with } n = 3{,}948 \text{ expertise description}$$

where the numerator represents the co-occurrence of each pair of keywords and the denominator is the product of the square root of the respective occurrence frequencies. Cosine similarity is a well-established measure of the relatedness of academic publications (e.g. Leydesdorff, 1989), and patent portfolios (Jaffe, 1986). Pairs of keywords that co-appear frequently in skills descriptions have a cosine nearer to 1, while keywords that rarely appear together have a cosine nearer to 0. In our context, the cosine value for ‘noise’ and ‘acoustics’ is equal to 0.53, while the cosine between ‘noise’ and ‘fire’ is only 0.01.

Since the cosine between two keywords that individuals have in common is equal to 1, the similarity in expertise of two individuals in a dyad is equal to the number of keywords they have in common plus the sum of the cosine measure for all combinations of the keywords mentioned by these individuals. To capture the magnitude of expertise similarity relative to the expertise profile of ego, we weight expertise similarity by the breadth of ego’s expertise. Our measure of breadth is expressed as 1 over the sum of the cosine between each pair of keywords divided by the total number of keywords in the expertise profile of ego. Expertise breadth is low if ego’s skills are focused around a few related areas of expertise, and high if they are spread across unrelated engineering domains. As a result, the measure of expertise similarity increases as ego's profile focuses on a more limited set of related domains of engineering.

Physical proximity. Following Rice and Aydin (1991), we constructed a continuous measure of physical proximity by calculating the inverse of the walking distance between two individuals' desks. This operationalization enables us to take account of the fact that one of the office buildings is 15-minute walk away, while the other two buildings are next to one another. This continuous measure also allows us to compute a relative physical proximity which weights the physical proximity measured by the density of individuals within the same floor as ego. In line with Sorenson and Audia (2000), the within-floor density measure is equal to the inverse of the sum of all interpersonal distances between ego and its colleagues working on the same floor, regardless of whether they are in our final sample. Interpersonal distances are calculated using the walking distance between desks. The resulting physical proximity measure is higher for individuals with fewer within-floor proximate colleagues.

Project proximity. We define project proximity as the number of projects on which ego and alter have worked together in the 5 years preceding the survey.[4] We weighted this measure by the total number of colleagues the ego worked with in these previous 5 years excluding the focal alter.

Control variables

We include three sets of control variables. First, we include several dyadic control variables that capture differences in personal and social resources of the person consulted relative to the advice seeker (Constant, Sproull, & Kiesler, 1996). Differences in the level of seniority can have a strong influence on patterns of communication in professional services firms, since individuals in senior positions are often expert problem-solvers whose status has been achieved based on their high level of technical expertise (Lazega, 2001). Two dummy variables – ego senior to alter and ego junior to alter – capture this effect based on a 9-point hierarchical scale obtained from HR records. Same seniority is the reference category. Likewise, difference in education – university degree/diploma, master's degree, and PhD – is captured by

[4] We experimented with a different temporal cut-off value to derive this variable. We derived the project proximity variable using number of shared projects between ego and alter in the 7 and 10 years before the survey, and since joining the company. Results obtained using these alternative measures were consistent with those reported.

two dummy variables ego higher education than alter and ego lower education than alter. The reference category corresponds to ego and alter having achieved the same level of education. Second, to account for homophily effects such as gender homophily (McPherson & Smith-Lovin, 1986) and tenure homophily (Rollag, 2004; Zenger & Lawrence, 1989), we include two binary variables that are equal to 1 if ego and alter are of the same gender and have the same tenure.[5] Third, to control for other forms of common knowledge, we derived a dummy variable (same division) indicating whether two persons belong to the same engineering specialism such as geotechnics or acoustics out of 15 in the focal subsidiary. Another way that individuals can learn what colleagues know is through membership in one of the firm's 27 electronic communities of practice (eCOPs) (Hwang, Singh, & Argote, 2012). These eCOPs are open to all firm employees, and members of these online discussion forums receive email prompts when a question is posted. Shared membership in eCOPs counts the number of the same eCOPs to which ego and alter belong.

Estimation procedure

We apply a logistic regression procedure to explain advice seeking. Given that we have 114 nodes and the network is not symmetric, we have 12,882 (114x113) unique dyads, 941 of which are realized dyads. Since our observations are at the dyad level, each individual influences multiple observations. Hence, observations are not statistically independent, which can lead to underestimation of standard errors (Krackhardt, 1988; Lincoln, 1984). To account for the interdependence of dyads, we include dual individual fixed effects (Mizruchi, 1989; Reagans & McEvily, 2003): for each dyad ij the dummy variables of ego i and alter j are equal to 1 while all the other dummies are set to 0. The dual individual fixed effects estimation adjusts the standard errors and controls for unobserved individual-level heterogeneity in both members of the dyad separately.[6] Finally to account for the reciprocal

[5] Other demographic characteristics, such as race or ethnic origin, could not be collected because UK law restricts use of such information.

[6] We also estimated our models including ego and alter fixed effects separately. Results were consistent with those shown here. However this estimation technique leads to the exclusion of five alters from our sample as these people were never chosen by the egos in our dataset.

autocorrelation in the data (Kenny, Kashy, & Cook, 2006), we clustered the errors by the undirected ij dyad.

Table 2 reports the descriptive statistics and correlations for the variables used in the regression. Correlations between our main independent variables – expertise similarity, physical proximity, and project proximity – are low to moderate. To shed further light on the interrelationships between these variables, Figure 1 depicts how often high values of one variable (75th percentile and higher) tend to co-occur with low values of another (25th percentile and lower). Such low-high combinations must occur often enough to ensure the interactions between these variables are meaningful. The figure shows that colleagues with very similar expertise do not necessarily sit near each other, nor do they necessarily have many shared past projects. It also shows that a substantial share of closely located colleagues have little similarity of expertise and few shared projects, and that a substantial share of colleagues with many shared projects have highly dissimilar expertise and may be seated far apart. These initial findings are consistent with our contextual interviews, which suggested relatively haphazard seating arrangements, flexible and mobile working patterns in project teams, and diverse sets of skills within the offices.

The regression results are presented in Table 3. To avoid high correlation between the main effects and their interaction terms, we standardized the variables by subtracting the mean and dividing by their standard deviation (Neter, Wasserman, & Kutner, 1990). To test for the possibility of multicollinearity among the expertise similarity variables and both the physical and project proximity variables, we derived the variance inflation factors (VIF). We obtained an average VIF of 2.5 and a maximum VIF of 7.6 between the squared term of expertise similarity and project proximity, which indicates that multicollinearity might be a concern. To assess the extent of the multicollinearity problem, we Echambadi et al. (2006) and randomly extract subsets of the data to test the stability of the coefficients. Since we cannot detect significant changes in the sign and significance levels of the main and interaction effects, we conclude that multicollinearity does not affect our estimates.

INSERT TABLES 2 AND 3 AND FIGURE 1 ABOUT HERE

Model 1 is a baseline model that includes only the control variables. Estimates of this model show that individuals are less likely to seek advice from colleagues junior to them and more likely to ask colleagues who have either a higher or a lower (but not the same) educational level. Also, engineers in our sample are more likely to seek advice from colleagues in their own division, from colleagues with whom they share membership in electronic communities of practice, and from those of the same gender. The main effects of physical and project proximity are both positive and significant.

In Model 2 we include the main effect of expertise similarity and its squared term. Consistent with Hypothesis 1, we find a non-linear relation between the likelihood that ego seeks advice from alter and their expertise similarity: the coefficient of the main effect is positive and significant, while the squared term is negative and also significant. The log-likelihood ratio test shows that this model is a significant improvement to the model including only the control variables. The inflexion point of the curve is observed at a relatively high value of expertise similarity (5.52, where the maximum value of this standardized variable is 17). However, as the data is skewed towards low levels of expertise similarity, the number of observations beyond the tipping point of the curve amounts to less than 1%. Therefore, we hold that the significant squared term signals decreasing returns to the likelihood of advice seeking rather than negative returns.

Model 3 tests Hypotheses 2a and 2b which predicted that physical proximity will dampen both the positive and the negative association of the curvilinear relationship between expertise similarity and advice-seeking. The interaction of physical proximity with both the linear and the squared term of expertise similarity are significant at 1%. However, only the linear-by-linear interaction remains significant at 5% when we include all the interaction effects in Model 5. Model 4 includes the interaction effects between project proximity and expertise similarity to assess the validity of Hypotheses 3a and 3b. Both the interactions with the main effect for expertise similarity and with its squared term are statistically significant at 1% in Model 4 as well as in the full Model 5.

The results presented in Table 3 are obtained imposing a parabolic relationship between expertise similarity and advice seeking. However, we did not find evidence of negative returns (a downward slope), but only of diminishing returns. This suggests that the non-linear relationship between expertise similarity and advice seeking cannot be appropriately modeled with the inclusion of a quadratic term. We therefore explored the functional form between these two variables re-estimating the model using a piecewise linear spline transformation. This non-parametric approach assumes a linear association between expertise similarity and advice seeking, but allows the slope to vary across segments of the variable's range. The transformed variables, each representing a particular segment, describe a linear increase or decrease in that segment whilst being held constant elsewhere. We tried several specifications which allow the slopes to change at different points, but decided to report the results obtained when we include only two segments around the 75th percentile of the expertise similarity variable. This choice was determined by two factors. First, this model specification appears to fit our data better than other models including a higher number of linear transformations of the expertise similarity variable[7]: it produced the lowest Bayesian information criterion (BIC= -116,549.6) (see Raftery, 1996 for a justification of this statistic for comparing the fit of non-nested logit models). Second, we are interested not only in assessing the non-linearity between expertise similarity and the likelihood of forming advice seeking ties but also in testing for the presence of interaction effects of our proximity variables. Therefore, we wanted to keep the model simple and allowed for the slope to change only at one point. We used the following two transformations of the expertise similarity (ES) variable:

$$ESmin75pc = \begin{cases} ES & \text{if } ES < 4.7 \\ 4.7 & \text{if } ES \geq 4.7 \end{cases}$$

$$ES75pcmax = \begin{cases} 0 & \text{if } ES < 4.7 \\ (ES - 4.7) & \text{if ES} \geq 4.7 \end{cases}$$

The results of this alternative piecewise linear spline transformation are reported in Table 4. Model 1 includes only our control variables whose estimates are consistent with those in Table 3. In Model 2, we add the new variables and found that the marginal effect of expertise similarity decreases as

[7] The Bayesian information criterion of the piecewise linear transformation model we choose is also considerably smaller than that for Model 2 in Table 3 (BIC = -116,509.51) confirming that a parabolic relationship between expertise similarity and the probability of forming advice seeking ties does not appropriately describe the pattern in our data.

this variable increases: for each 1%-increase in expertise similarity below its 75th percentile the likelihood of advice seeking increases by 2.5%, while above its 75th percentile the probability of forming an advice seeking tie increases only by 0.1%, which provides support to our Hypothesis 1. We can also reject that the coefficients of ESmin75pc and ES75pcmax are equal ($\chi^2 = 85.20$, p-value=.00). This suggests that the slope of these two lines is significantly different, consistent with the presence of marginal decreasing returns. So, there is little perceived additional value to seeking advice from colleagues who are increasingly similar.

In Models 3 and 4 we include the interaction terms with the physical proximity variable. Both these interactions terms are negative and significant at 1% and they remain significant also in the full Model 6. These findings are in line with our Hypotheses 2a and b which stated that an increase of physical proximity would diminish the effect of expertise similarity at low and high values of this variable. This is evident in Figure 2 where we show how the predicted probability of advice seeking is affected by a change in physical proximity from low to medium and high values. The flattening of the line below the 75th percentile suggests that physical proximity drives considerations of instrumental levels of expertise similarity into the background. Physical proximity makes colleagues with low levels of expertise similarity more salient advice targets relative to equivalent colleagues sitting further away. The flattening of the line after the 75th percentile shows that the marginal decreasing returns are stronger when seeking advice from colleagues far away than from those nearby. When colleagues are nearby, it seems to matter less that colleagues may be perceived too similar to provide valuable advice.

INSERT FIGURES 2 AND 3 ABOUT HERE

In Models 4 and 5, we assess the validity of our Hypotheses 3a and 3b by including the interaction terms between the two expertise similarity variables and project proximity. In Model 4, we do not find support for an interaction effect of project proximity at low levels of expertise similarity: the interaction term between this variable and ESmin75pc is not significant. However, in Model 5 the negative and significant interaction term between project proximity shows that a dampening effect occurs at high levels of expertise similarity, supporting our Hypothesis 3b. This is also evident in Figure 3 where we show how an increase in project proximity from its minimum to 1 and 2 standard deviations above the mean influences the curve that describes the relationship between expertise similarity and advice seeking. In line with Hypothesis 3b, we see that the slopes of the lines to the right of the 75th percentile of expertise similarity become flatter as the shared work experience increases, whereas to the left of the 75th percentile of expertise similarity these lines are almost parallel.

INSERT TABLES 4 ABOUT HERE

Robustness of our results

Our reliance on a broad range of data sources for our dependent and independent variables virtually eliminates the risk that common-method bias affects our estimates. However, in the absence of an experimental set-up where interrelationships between variables can be carefully controlled, our study design poses a number of empirical challenges.

When estimating the effect of expertise similarity on advice seeking, we face the problem of "bad controls" (Angrist & Pischke, 2008); those variables that are influenced by the main independent variable of interest. Their inclusion in the regression model may introduce upward or downward bias of the coefficient of the main independent variable of interest, whereas their exclusion would introduce omitted variable bias. In our case, physical proximity may be partly determined by expertise similarity (see equation 1 below): the physical location of people in an organization could depend on their expertise and its similarity to the expertise of people seated nearby.

$$Physical\ Proximity = \alpha + \beta Expertise\ Similarity + \varepsilon \qquad (1)$$

$$Advice\ Seeking = \gamma + \delta Physical\ Proximity + \theta Expertise\ Similarity + \varphi \qquad (2)$$

Under the assumption that physical proximity has a positive effect on advice seeking (δ>0), the dependence of physical proximity on expertise similarity introduces a bias in the coefficient θ in equation 2. Two distinct principles may underpin the relationship between expertise similarity and seating allocation decisions in organizations: either individuals with very similar expertise might be located close to one another to facilitate the performance of highly specialized tasks (i.e. β> 0), or individuals with very different expertise might be seated in proximity to enable interdisciplinary collaboration (i.e. $\beta<0$). To assess the sign of the β coefficient, we estimated equation 1 using the dyads in our sample. We found that for a one standard deviation increase in expertise similarity the expected change in physical proximity equals 0.315 standard deviations, and an R^2 of 0.06, which implies that expertise similarity does not explain much of the variation in physical proximity.

The positive sign of β suggests that the coefficient of expertise similarity in equation 2 may be downward biased. Taken to the extreme, θ may fail to be significant even when colleagues with high levels of expertise similarity have strong tendencies to seek advice from one another. When running our main models including and excluding physical proximity we found that, as expected, the coefficient of expertise similarity was greater when physical proximity was omitted than when it was included. In other words, inclusion of physical proximity in equation 2 leads to conservative estimates of the effect of expertise similarity on the probability of advice-seeking. Thus, our findings must be interpreted as a lower bound of the association between expertise similarity and advice-seeking.

To further disentangle the effects of expertise similarity and physical proximity on advice seeking, and uncover the mechanisms through which they operate, we exploit information on four engineers who work on-site with the client, and on a recent rearrangement of an office that saw 16 of 26 engineers move desk. We argue that people on site, who are not often in the office, would attribute less importance to physical proximity when making advice-seeking decisions. We ran models including a dummy variable indicating "being on site" but using physical proximity values computed on their desk location prior to going on site. Model 1 in Table 5 shows that the association between physical proximity and advice seeking is indeed weaker for people on-site.

One of the offices had undergone slight rearrangement of desks one year prior to the survey. The old and new office plans are illustrated in Appendix C. One could argue that people who moved desk recently have been seated near to a greater number of colleagues at their old and new location jointly. As such, they may have higher exposure to the expertise of more colleagues and thus let their advice-seeking decisions be guided more strongly by expertise similarity. In Model 2 in Table 5, we include an interaction term between expertise similarity and a dummy variable “moved desk” which is one for those dyads where one or both members moved desks. The results support our expectation that the association between expertise similarity and advice seeking is stronger for people who moved desk recently. Both these results support the idea that physical proximity and expertise similarity have separate effects on advice seeking. It also lends support to the key mechanisms through which physical proximity operates. Ease of access and visibility underpin the physical proximity effect, because in their absence (i.e. for engineers on-site) physical proximity plays a weaker role. Physical proximity also helps build transactive memory, because people “exposed” to more colleagues seem to rely more on expertise similarity when seeking advice.

Finally, our findings might be affected by endogeneity bias due to reverse causality. One can argue that expertise similarity of two colleagues is a function of the extent to which they seek advice from one another rather than vice versa. The more people seek advice from one another, the more similar their expertise profile may become. Although we cannot completely rule this out as an alternative explanation, we believe it unlikely in the particular context of our study. In the case organization, project teams are assembled in response to the nature of clients’ problems and the availability of staff, as such they are relatively fluid. Moreover, many of the engineers in the office were hired in recent years. Moreover, if convergence in expertise similarity occurs, it is likely to relate to contextual knowledge rather than individual specialist expertise and emerge over a longer time among those stable patterns of co-working (Alavi & Leidner, 2001). In addition, as Lazega (2001) suggests, professionals tend to be ‘niche-seeking’ in that they attempt to obtain high-level expertise in a specific domain to enhance their status within the organization. Therefore, it is in the interest of professionals to deviate in important ways from the knowledge of their colleagues. Directly aligning one’s knowledge set with that of others will reduce one’s uniqueness and therefore one’s value to the wider organization. Despite these justifications of why reverse causality may not affect our results, we have taken care to interpret our findings as associations between variables without attempting to infer causal claims.

DISCUSSION

This study showed that high levels of physical or project proximity may be driving considerations of expertise similarity for advice-seeking decisions into the background. In principle, individuals prefer to seek advice from colleagues with sufficient expertise similarity to facilitate ease of communication, and sufficient expertise dissimilarity to provide potential for novel advice. This preference gives rise to a non-linear association between the level of expertise similarity between ego and alter and the probability that ego seeks advice from alter. That is, the association between expertise similarity and advice-seeking is characterized by decreasing returns that capture the decreasing value-added of asking for advice from evermore similar colleagues. Individuals may, however, deviate from these "strategic choices" if ego and alter are proximate. Physical proximity appears to be associated with advice seeking ties to colleagues one would otherwise not have gone to, given the limited similarity in expertise. Also, both physical proximity and proximity in project space may encourage individuals to consult colleagues with very similar expertise profiles despite the limited novelty of advice such colleagues may be able to provide. Individuals may place more weight on ease of access associated with physical proximity or experience of working together associated with project proximity than on the relative novelty of the advice. Taken together, physical proximity and project proximity appear to flatten the curve that describes the expertise similarity and advice seeking association, implying that considerations of useful levels of expertise similarity are driven to the background when seeking advice from proximate colleagues.

These findings contribute to our understanding of interpersonal networks in organizations in two ways. First, our study shows how strategic considerations and physical and project-based opportunity structures interplay in advice-seeking decisions in organizations. This approach strikes a balance between the established organizational network literature which views networks as emergent structures shaped by physical and social constraints, and more recent studies that conceptualize networks explicitly as strategic devices for achieving specific personal and professional objectives (Hallen & Eisenhardt, 2012; Ibarra et al., 2005). That is, one school of thought in organizational networks research portrays tie formation decisions as strategic decisions that individuals take based on an assessment of the utility of those connections (Kilduff & Brass, 2010). In the context of advice-seeking, the utility of asking advice from a colleague may in large part depend on the level of expertise similarity (Borgatti & Cross, 2003; Nebus, 2006). Another school of thought, which has traditionally dominated research on informal structures in organizations, views networks as "emergent" structures that largely emanate from opportunity driven motivations (Kilduff & Brass, 2010; Kleinbaum et al., 2013), for example, based on physical proximity (Phelps et al., 2012; Reagans, 2011). In this study, we have tried to bring these two schools of thought together. Although, in our study, strategic choices based on instrumental levels of expertise similarity may form the core mechanism, individuals deviate from these choices under the influence of differential exposure to certain colleagues. Individuals may trade off lack or excess of similarity against high levels of proximity. This trade-off implies that there may be two distinct mechanisms that individuals use when seeking advice. On the one hand, a convenience-based proximity mechanism may lead individuals to seek advice that is easily available. In that situation, the choice of advice target has little dependence on expertise similarity. This may lead individuals to approach colleagues with too low or too high levels of expertise similarity, which may compromise the quality of the advice. On the other hand, there is a more strategic expertise-based mechanism where people attempt to access the most helpful advice possible, even at a significant cost. This may lead individuals to hunt for the expertise they require. However, limited accessibility based on physical distance and limited familiarity due to a lack of shared project experience may compromise the quality of the advice. Future research may look further into how convenient advice nearby and purposefully sought advice further away qualitatively differ.

Second, we incorporate the influence of formal organization as an important conditioning factor of advice-seeking in organizations. Patterns of work that result from organizational structure – such as project allocation – have received limited scholarly attention in network research (Kleinbaum et al., 2013; McEvily et al., 2014). Many studies on knowledge sharing in organizations ignore the rich work context in which advice seeking takes place (Barley & Kunda, 2001). This study shows that flexible team membership influences the consideration set of colleagues from whom individuals may seek advice. Project proximity appears to be weakening the marginal decreasing returns of expertise similarity, dampening the tendency not to seek advice from colleagues which may offer too similar expertise. This suggests that 'brining work back in' can help to enrich our understanding of organizational networks.

Implications for practice

The findings from this study have several implications for managers seeking to support or enhance advice-seeking through the targeted use of the 'foci'. First, the micro-geography of the office bears a strong influence on patterns of communication. Physical vicinity encourages individuals to seek advice from colleagues who are dissimilar to them, but availability of highly similar colleagues nearby may discourage this. For organizations whose competitiveness depends heavily on interactions among members of staff with diverse backgrounds, it may be worth considering mixing rather than grouping professionals on the basis of expertise. This may help build transactive memory and avoid collocated individuals with very similar expertise seeking advice from each other. Grouping together similarly trained professionals may compromise the creativity and novelty of the solutions they develop for their clients.

Second, organizations could influence advice seeking behavior among their staff through promoting the fluidity and diversity of project teams. That is, the transactive memory of the organization is enhanced by its constituent individuals developing deeper and richer knowledge of what their colleagues know through experience gained from participation in different project teams with different colleagues. Although flexibility and diversity of teams will enlarge the colleague pool that employees use to seek advice, a potential danger may arise when highly similar colleagues have extensive shared work experience. Frequent project co-membership of highly similar colleagues may blind employees to colleagues with dissimilar expertise who may offer a new and distinct perspective. This suggests that the practice in professional organizations of creating teams based on individual availability and skills could be improved by pro-active attempts to blend the unfamiliar to generate stronger transactive memory within the organization.

Limitations of this study and recommendations for future research

This study has a number of limitations. First, the generalizability of our study is constrained by our focus on a single organization. Gaining access to high quality network data and information on the individuals within these networks remains challenging task for researchers. In our study, we have tried to blend data from a variety of sources to ensure that our measures were drawn from independent sources, avoiding the difficulties of drawing inferences from information taken from a network survey alone. However, this approach makes it hard to extend the analysis to other professional organizational contexts (Von Nordenflycht, 2010). Second, since we do not have information on how individuals appraise the usefulness of the advice they gain from colleagues, we cannot comment on the value of the information sought and received. Advice seeking is considered here as a relatively static process, whereas in reality it is a highly dynamic process involving individuals changing their partnering decisions over time, for example, based on experience of earlier requests for advice (Nebus, 2006). Third, we were careful in assessing the potential implications of reverse causality and bad controls for our findings. However, ultimately our research design does not allow us to make strong causal claims. Experimental research could help identify more directly the causal mechanisms underpinning the associations described in this paper (Yakubovich & Burg, 2014).

By highlighting how considerations related to expertise similarity and the constraints of physical and project proximity jointly condition patterns of advice seeking in organizational networks, we offer a balanced view on patterns of advice seeking in organizations. Such patterns are neither purely strategic decisions about which individuals are best placed to provide help, nor do they emerge merely as a result of who happens to be nearby or who one happens to know better based on experience of working together; they emanate from a complex interplay between strategic and opportunity driven factors. Future research should further explore how, in a dynamic process, strategic and opportunity-driven mechanisms may influence network evolution and decay in organizations, and for example, how changes in opportunity structures, as a result perhaps of organizational redesign, may reshuffle relatively stable patterns of advice-seeking.

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TABLE 1: Summary of theoretical mechanisms underpinning the interaction between proximity in two foci and expertise similarity

	Low expertise similarity	High expertise similarity
Physical proximity	Enhanced visibility and accessibility create a greater awareness of what colleagues with dissimilar expertise know, making them a more salient choice in the individual's "consideration set" for advice seeking than an equivalent colleague further away.	Enhanced visibility and accessibility decrease the "shoe leather cost" of advice seeking, causing them to turn to colleagues with highly similar expertise, despite a limited scope for novelty which would keep them from turning to an equivalent colleague further away.
Project proximity	Past shared working experience creates a greater mutual understanding of what colleagues with dissimilar expertise know, making them a more salient choice in the individual's "consideration set" for advice seeking than an equivalent colleague without shared work experience.	Past shared working experience leading to mutual knowledge how to work together decreases the effort of advice seeking, causing individuals to turn to colleagues with highly similar expertise, despite a limited scope for novelty which would keep them from turning to an equivalent colleague without shared work experience.

TABLE 2: Summary statistics and correlation matrix

		Mean	S.D.	Min	Max	1	2	3	4	5	6	7	8	9	10
1	Ego senior to alter	0.433	0.495	0	1										
2	Ego junior to alter	0.433	0.495	0	1	-0.763									
3	Ego education higher than alter	0.269	0.443	0	1	0.145	-0.148								
4	Ego education smaller than alter	0.269	0.443	0	1	-0.148	0.145	-0.367							
5	Same gender	0.665	0.472	0	1	0.005	0.005	0.017	0.017						
6	Same tenure	0.096	0.295	0	1	-0.021	-0.021	-0.026	-0.026	-0.030					
7	Same division	0.075	0.263	0	1	0.003	0.003	-0.014	-0.014	0.012	0.001				
8	Shared membership in eCOPs	0.149	0.369	0	3	-0.008	-0.008	0.004	0.004	0.003	0.001	0.136			
9	Physical proximity	0.392	1.094	0.005	31.008	0.004	-0.007	-0.005	0.007	0.020	-0.005	0.316	0.090		
10	Project proximity	0.053	0.069	0	0.738	-0.003	0.014	0.000	0.022	0.045	-0.048	0.211	0.124	0.150	
11	Expertise similarity	3.724	5.092	0	89.911	0.023	-0.020	0.023	-0.001	0.070	-0.014	0.231	0.263	0.143	0.341

Correlations greater than |0.020| are significant at 5%. Number of observations: 12,882.

TABLE 3

Logit models predicting advice seeking ties

	1	2	3	4	5
Ego senior to alter	-0.510	-0.554	-0.549	-0.583	-0.571
	(0.150)***	(0.151)***	(0.152)***	(0.151)***	(0.152)***
Ego junior to alter	0.126	0.130	0.128	0.111	0.115
	(0.142)	(0.143)	(0.144)	(0.143)	(0.144)
Ego education higher than alter	0.247	0.265	0.262	0.268	0.268
	(0.111)**	(0.113)**	(0.112)**	(0.113)**	(0.113)**
Ego education smaller than alter	0.260	0.315	0.315	0.322	0.323
	(0.108)**	(0.109)***	(0.109)***	(0.109)***	(0.109)***
Same gender	0.371	0.359	0.335	0.358	0.337
	(0.151)**	(0.149)**	(0.152)**	(0.148)**	(0.150)**
Same tenure	0.173	0.203	0.217	0.204	0.217
	(0.172)	(0.172)	(0.170)	(0.173)	(0.171)
Same division	1.750	1.540	1.550	1.523	1.535
	(0.136)***	(0.137)***	(0.136)***	(0.138)***	(0.137)***
Shared membership in eCOPs	1.024	0.740	0.772	0.715	0.744
	(0.169)***	(0.164)***	(0.163)***	(0.164)***	(0.163)***
Physical proximity [a]	0.868	0.804	0.794	0.828	0.82
	(0.070)***	(0.070)***	(0.069)***	(0.075)***	(0.076)***
Project proximity [a]	0.495	0.461	0.511	0.448	0.494
	(0.056)***	(0.053)***	(0.054)***	(0.051)***	(0.053)***
Expertise similarity (ES) [a]		0.795	0.853	1.095	1.096
		(0.096)***	(0.088)***	(0.123)***	(0.119)***
Expertise similarity squared		-0.072	-0.078	-0.130	-0.123
		(0.012)***	(0.010)***	(0.029)***	(0.026)***
ES x Physical proximity			-0.141		-0.096
			(0.043)***		(0.046)**
ES squared x Physical proximity			0.013		0.006
			(0.004)***		(0.006)
ES x Project proximity				-0.149	-0.137
				(0.036)***	(0.040)***
ES squared x Project proximity				0.020	0.018
				(0.006)***	(0.006)***
Constant	-2.876	-2.034	-2.081	-1.617	-1.711
	(1.065)***	(0.977)**	(1.034)**	(0.984)	(1.028)*
Observations	12882	12882	12882	12882	12882
Mc-Fadden's Pseudo R2	0.360	0.375	0.377	0.379	0.380
Log-likelihood	-2154.58	-2104	-2097.65	-2092.4	-2088.4
Log-likelihood ratio test (d.f.) [b]		101.17(2)***	12.69(2)***	23.19(2)***	31.18(4)***

[a] Variable is standardized by subtracting the mean from the value and dividing by the standard deviation.

[b] Compares Models 2 to Model 1, and Models 3-5 to Model 2.Logit model with dyadic dummy variables and standard errors clustered by undirected ego-alter dyad in parenthesis.

* significant at 10%; ** significant at 5%; *** significant at 1%

TABLE 4

Logit models with piecewise linear spline transformation predicting advice seeking ties

	1	2	3	4	5	6
Ego senior to alter	-0.581	-0.596	-0.564	-0.589	-0.584	-0.587
	(0.154)***	(0.152)***	(0.155)***	(0.153)***	(0.154)***	(0.154)***
Ego junior to alter	0.109	0.088	0.120	0.105	0.111	0.100
	(0.146)	(0.145)	(0.147)	(0.145)	(0.146)	(0.146)
Ego education higher than alter	0.285	0.267	0.292	0.281	0.282	0.270
	(0.114)**	(0.113)**	(0.114)**	(0.114)**	(0.114)**	(0.114)**
Ego education smaller than alter	0.364	0.351	0.371	0.361	0.364	0.356
	(0.110)***	(0.110)***	(0.110)***	(0.110)***	(0.110)***	(0.110)***
Same gender	0.361	0.354	0.334	0.357	0.360	0.340
	(0.149)**	(0.152)**	(0.151)**	(0.149)**	(0.148)**	(0.152)**
Same tenure	0.195	0.205	0.210	0.200	0.192	0.211
	(0.171)	(0.169)	(0.169)	(0.172)	(0.172)	(0.170)
Same division	1.478	1.488	1.483	1.480	1.475	1.487
	(0.135)***	(0.133)***	(0.135)***	(0.136)***	(0.135)***	(0.133)***
Shared membership in eCOPs	0.691	0.719	0.713	0.695	0.684	0.724
	(0.163)***	(0.161)***	(0.162)***	(0.163)***	(0.162)***	(0.161)***
Physical proximity [a]	0.743	0.730	0.740	0.889	0.813	0.853
	(0.069)***	(0.069)***	(0.069)***	(0.122)***	(0.073)***	(0.123)***
Project proximity [a]	0.460	0.726	0.530	0.455	0.451	0.689
	(0.053)***	(0.100)***	(0.058)***	(0.053)***	(0.053)***	(0.100)***
ESmin75pc	0.532	0.553	0.524	0.550	0.514	0.536
	(0.052)***	(0.052)***	(0.052)***	(0.052)***	(0.052)***	(0.053)***
ES75pcmax	0.036	0.038	0.049	0.040	0.062	0.068
	(0.015)**	(0.015)***	(0.013)***	(0.015)***	(0.014)***	(0.013)***
ESmin75pc x Physical proximity [a]		-0.079				-0.059
		(0.026)***				(0.028)**
ES 75pcmax x Physical proximity [a]			-0.019			-0.011
			(0.005)***			(0.006)*
ES min75pc x Project proximity [a]				-0.046		-0.019
				(0.030)		(0.030)
ES75pcmax x Project proximity [a]					-0.013	-0.011
					(0.003)***	(0.003)***
Constant	-2.911	-3.041	-2.966	-2.838	-2.769	-2.886
	(0.995)***	(1.056)***	(1.029)***	(1.007)***	(0.992)***	(1.067)***
Observations	12882	12882	12882	12882	12882	12882
Mc-Fadden's Pseudo R2	0.381	0.383	0.383	0.381	0.383	0.386
Log-likelihood	-2083.95	-2077.4	-2077.15	-2081.83	-2076.6	-2068.12
Log-likelihood ratio test (d.f.) [b]		13.09(1)***	13.60(1)***	4.23(1)**	14.70(1)***	31.66(4)***

[a] Variable is standardized by subtracting the mean from the value and dividing by the standard deviation.

[b] Compares Models 3-6 to Model 1. Logit model with dyadic dummy variables and standard errors clustered by undirected ego-alter dyad in parenthesis.

* significant at 10%; ** significant at 5%; *** significant at 1%

TABLE 5
Disentangling the effect of physical proximity and expertise similarity

	1	2
Physical proximity [a]	0.478	0.575
	[0.051]***	[0.210]***
Expertise similarity (ES) [a]	0.35	0.138
	[0.077]***	[0.248]
On-site	0.149	
	[0.318]	
Physical proximity x On-site	-0.285	
	[0.136]**	
Moved desk		-1.614
		[0.753]**
ES x Moved desk		0.678
		[0.266]**
Ego senior to alter	-0.547	-1.235
	[0.147]***	[0.585]**
Ego junior to alter	0.146	0.238
	[0.139]	[0.519]
Ego education higher than alter	0.222	0.337
	[0.111]**	[0.449]
Ego education smaller than alter	0.269	0.451
	[0.106]**	[0.370]
Same gender	0.377	0.692
	[0.148]**	[0.314]**
Same tenure	0.189	-0.346
	[0.168]	[0.546]
Same division	1.601	0.886
	[0.132]***	[0.391]**
Shared membership in eCOPs	0.847	1.528
	[0.162]***	[0.527]***
Project proximity [a]	0.798	1.052
	[0.068]***	[0.248]***
Constant	-2.504	-2.145
	[1.001]**	[1.585]
Observations	13806	650
Log-likelihood	-2242.99	-172.08

[a] Variable is standardized by subtracting the mean from the value and dividing by the standard deviation. Logit model with dyadic dummy variables and standard errors clustered by undirected ego-alter dyad in parenthesis. * significant at 10%; ** significant at 5%; *** significant at

FIGURE 1: Co-occurrence of low (0-25th percentile) and high values (75th-100th percentile) of main independent variables

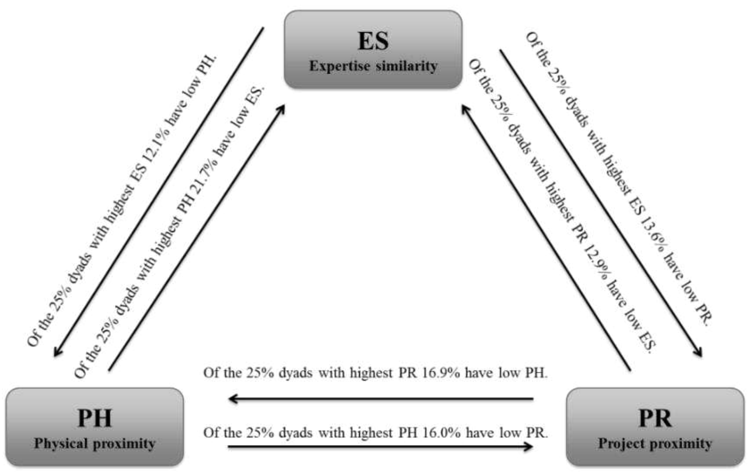
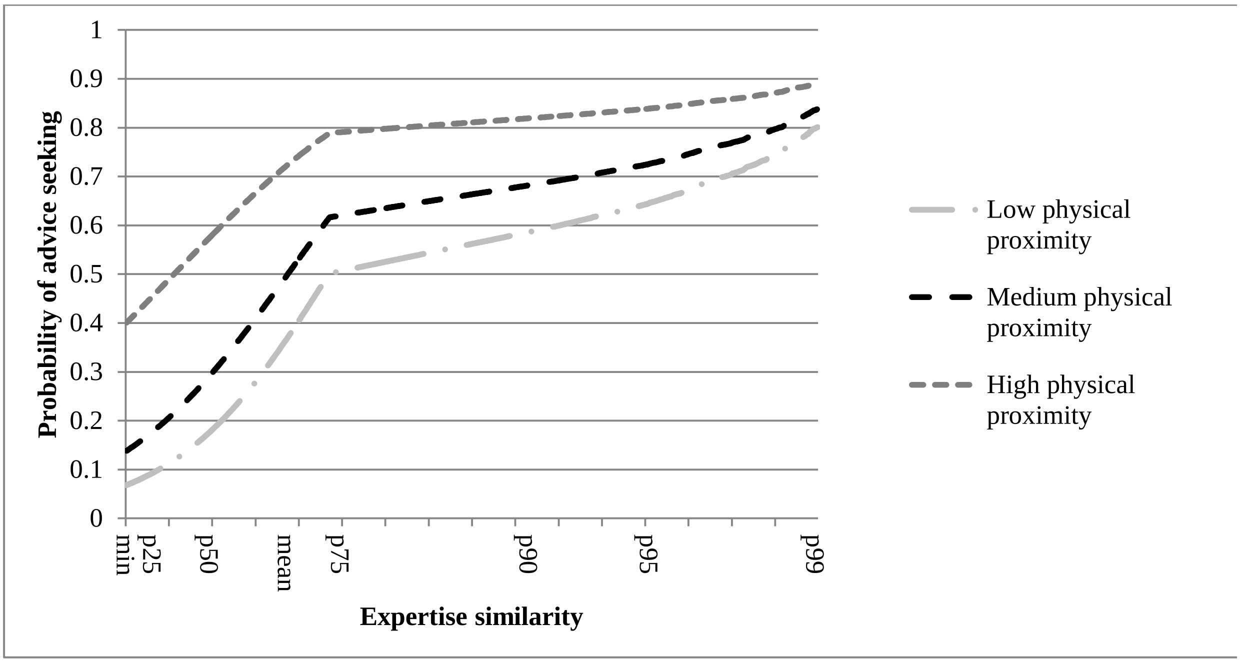
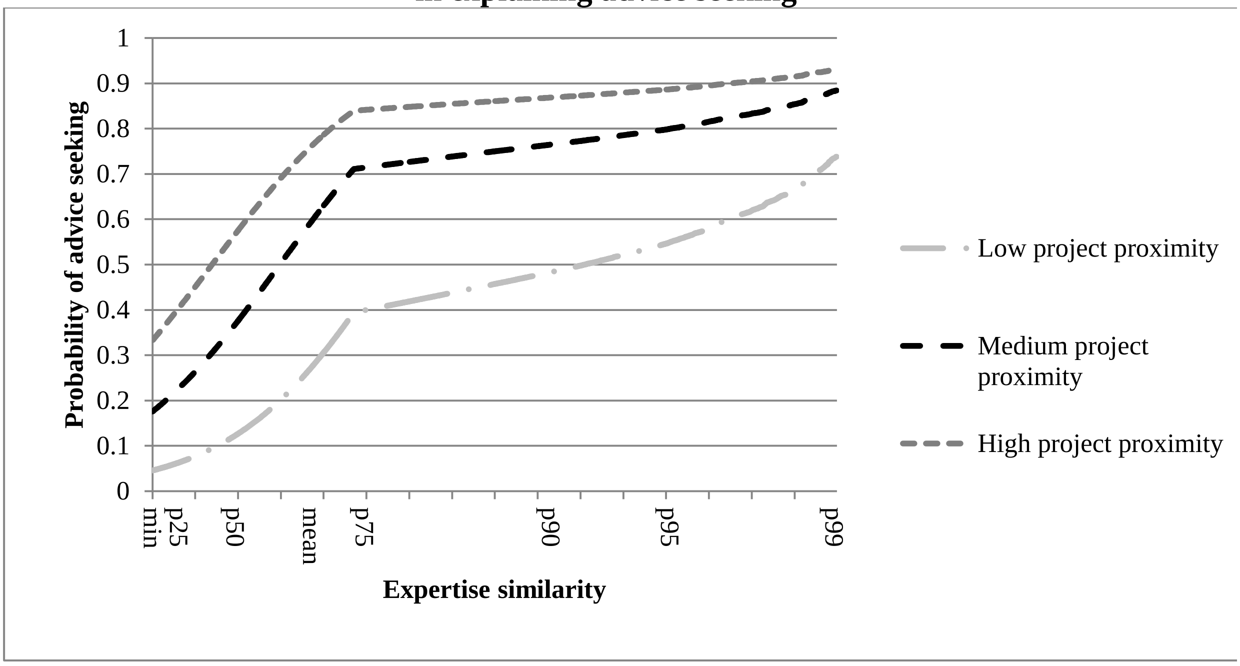


FIGURE 2: The interaction between physical proximity and expertise similarity in explaining advice seeking



Low values are equal to the mean of physical proximity between individuals in different building. **Medium** values are equal to mean of physical proximity between individuals in same floor but not in the same cubicle. **High** values are equal to the mean of physical proximity between individuals in the same cubicle. Significant dummy variables are set to 1 apart from the same division dummy. All remaining variables are set to their sample mean. The simulation is based on Model 5 in Table 4.

FIGURE 3: The interaction between project proximity and expertise similarity in explaining advice seeking



Low values are equal to the minimum of project proximity (i.e. having no experience working together). **Medium** values are equal to one standard deviation above the mean. **High** values are equal to two standard deviations above the mean. Significant dummy variables are set to 1 1 apart from the same division dummy. All remaining variables are set to their sample mean. The simulation is based on Model 5 in Table 4.

APPENDIX A: Name generator questions

Network type	**Name generator questions**
Problem Solving	Some people are particularly useful in helping you solve problems in your work activities (e.g. a simulation software tool does not work, you cannot find a solution to a formula that applies to a particular model, you cannot resolve a contractual issue). Who are the key people in the office who have helped you solve problems in the last 6 months by defining or redefining the dimensions of the problem and identifying relevant information?
Search	Some contacts are particularly useful in helping you to be creative in your job, such as helping you to explore new engineering solutions, ideas or concepts. Who are the key people in the office that have helped you formulate new ideas during the past 6 months?
Implementation	Often support from others may be needed to validate and implement your proposed solutions. Who are the key people in the office that provided support to you in validating and implementing your solutions during the past 6 months?

APPENDIX B: Example of skill description and related keywords

Skill description	**Keywords**
I joined in February 2004, previously working in the Pacific Northwest. My experience includes site supervision, traffic signs and road markings, traffic calming devices, Roadway Geometric Design using Inroads & Microstation, conceptual design of motorways and motorway junctions (functional design), preliminary design and final design of highways and streets, utility relocations, design-build, Capital Improvement Plans (CIPs), Transportation System Plans (TSPs) , roadway illumination design. I'm a Registered Professional Engineer in Washington and Oregon (US equivalent to Chartered Engineer). Feel free to contact me if you need any assistance with schemes in those states.	evaluation highway inroad junction microstation motorway road site supervision traffic traffic calming utility

Appendix C1 Floor plan 1 year prior to our survey	**Appendix C2 Floor plan at time of our survey**