Closure vs. Structural Holes: How Social Network Information and Culture Affect Choice of Collaborators

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ABSTRACT
Collaboration is important to successful organizations and how coworkers are selected is crucial to the dynamics of effective collaborations. In this study we explore how people use social network information, which is increasingly accessible on enterprise systems in organizations, to choose people with whom to collaborate. We conducted a scenario-based study of 459 respondents in a global high-tech company. Our data indicate cultural differences in how social network information was valued when choosing a collaborator. The Chinese, consistent with the cultural value of Guanxi, more closely followed a *closure* model, whereas Americans favored neither a *closure* nor a *structural holes* model. These results provide new insights into how needs for social network information may vary between cultures and how social networking sites might support workers in choosing collaborators from within and across national cultures.

Author Keywords
Social network sites (SNS); closure; structural holes; guanxi; national culture; willingness to collaborate.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

A central purpose of organizations is to coordinate among coworkers so that complex tasks can be accomplished [31]. Extensive research on coordination, dating back to at least the 1960's [8], provides insight into the formal and informal mechanisms through which coordination occurs. Little attention, however, has been paid to the formation of collaborations, despite evidence that how people choose coworkers is crucial [16, 24].

With the emergence of more distributed organizations and virtual work in recent years, teams are continually being reconfigured and, as a result, people are constantly working with new collaborators [24, 27]. Mortensen describes the emerging phenomenon of *recombinant collaboration* in which teams are highly dynamic and continually recombining resources, including project members [27]. Based on interviews with 21 employees of a large technology company, Matthews and colleagues similarly conclude that teams are increasingly dynamic with team members frequently participating on multiple teams [24]. This research on new forms of collaborative work, suggests higher levels of dynamism, but also a more central role for team members in identifying and recruiting new collaborators. Finding appropriate collaborators in modern organizations is, therefore, both more frequent and more important. Unfortunately, little is yet known about the basis on which people make these choices.

Although studies examining choice of collaborators are rare, several relevant studies are instructive. McDonald, for example, investigated how people respond to recommendation systems that used social networking information as a basis for recommending collaborators [25]. He concluded that people have mixed feelings about using social network information to find collaborators, in part because of their more nuanced understanding of their own social networks, which is hard to capture in technology. Matthews and colleagues also examined the recruiting process by which people find collaborators for dynamic projects [24]. They report that networking played a central role in finding expertise. Extensive research also examines the role of social network information in locating expertise [19, 28, 40], but with less of a focus on choosing collaborators. Another study that bears directly on our research examined the formation of student teams and concluded that people select collaborators based on reputation for competence, similarity (especially race), and familiarity [16]. Hinds and colleagues concluded that reputation is a key determinant in the selection process [16], but none of these studies directly examine how social networking information is being valued, especially how potential collaborators' connections to others affects collaboration seekers' choices.

One important way of learning about potential coworkers is by using enterprise social network sites. Here, we are interested in if and how an individual's desire to collaborate with a potential collaborator is shaped by social network information available on such sites. We also examine this question across cultures for both practical and theoretical reasons. As regards the practical aspect, although the use of social networking systems is increasingly global, little is known about how the interpretation of different social network information might vary between cultures. In terms of theory, competing theories predict different bases on which social networks are formed, thus making the predictions ambiguous for how people will use social networking information when choosing collaborators.

In this study, we investigate 1) how people's willingness to collaborate with a potential collaborator is influenced by the existence of shared contacts between the collaboration seeker and the potential collaborator, the type of network connections in the potential collaborator's network, and the size of the potential collaborator's network, and 2) if and how the value of social network information is affected by the national culture of the collaboration seeker. To answer these questions, we conducted a scenario-based study of employees of a global high-tech company in the U.S. and China.

A surprising finding in this study is that neither the U.S. nor the Chinese respondents' reaction to the social network information could be entirely predicted by structural holes theory, which has been supported by numerous studies in U.S. organizations. The Chinese data more strongly support a closure model which favors more interconnected networks, consistent with the cultural value of Guanxi. On the U.S. side, our data suggest more complexity than predicted by structural holes theory, in particular respondents sought resources through their networks, but followed neither a closure or a structural holes model entirely.

Insights gained from this study provide inspiration for designing better enterprise software to support collaborative work in modern organizations, particularly regarding which type of network information -should be included, highlighted or made visible in social profiles. In particular, we aim to inform the design of enterprise software to support diverse cultures and intercultural collaborations.

BACKGROUND AND RELATED WORK

Collaboration is crucial for the success of organizational endeavors. As a result, the factors that affect collaboration have long been examined by researchers from a variety of disciplines, including organizational behavior, communication, sociology and information science. In the CSCW and HCI communities, the impact of technology on collaboration has been emphasized [3, 14, 20, 37]. Studies in these fields have talked extensively about how the process of collaboration can be facilitated by modern technologies, but both the genesis of the collaborations and the role of culture have largely been ignored.

In fact, more broadly, few studies have examined the impact of culture on work collaboration [17]. Some research has examined the effect of cultural values on aspects of organizational behavior, such as views of autonomy and task orientation, although mostly neglects collaboration [15]. Scholars have also discussed global collaboration across cultures [32, 36], but their focus has been on the dynamics between team members rather than on the practices of each cultural group engaged in the collaboration. Some exceptions include cross-cultural research examining the effect of different media types on communication and collaboration behaviors [12, 35]. In an interview based study, Setlock and Fussell [34], for example, found that Asian users of communication media make more deliberate choices about when to use technology that conveys emotional information. Although a move in the right direction, these studies tend to emphasize communication media rather than social networking systems. To understand how design requirements for social networking systems might vary across cultures, it is critical to more deeply understand the meanings and values associated with information and interaction processes supported by technology [17, 18].

As discussed earlier, few studies in CSCW or HCI discuss the collaborator-seeking phase (for an exception, see McDonald, 2003) which is prior, but essential to the main process of collaboration. Considering the increasing spread of social networking sites in modern organizations and their presumed role in supporting the selection and recruitment of collaborators [25], it is important to consider how social network information is used during the process of choosing collaborators.

With these points in mind, our study examines how people in both China and the U.S. use social networking information as a basis for choosing collaborators. We propose and find that people from different cultures respond differently to potential collaborator's social network information when considering a potential collaboration.

Closure vs. Structural Holes

Theories that explore the development and use of social capital treat network information as an important resource. The value of social network information comes from "its representation of the social structure, of either an individual or a group, which is a kind of capital that can create, for certain individuals or groups, a competitive advantage in pursing their goal"[33]. In general, better-connected people enjoy higher returns and facilitate more coordinated actions.

The theoretical model used to explain what it means to be "better connected" has, however, been a matter for debate. Two competing models – the network closure model and the structural holes model – propose different mechanisms driving how social network information is perceived and

interpreted. The strategy for choosing collaborators predicted by each model is, therefore, quite different.

The network closure model (also called the bonding model) suggests that people tend to connect with others who are located in the same collective network [1, 11]. In this model, a network with higher closure is described as a network in which more people are mutually connected. In this type of closed network, social capital is enhanced in two ways. First, information-sharing between people is more effective due to the establishment of more direct connections and communications. Second, and more importantly, a higher level of trust and cohesiveness are established within the network to facilitate the pursuit of collective goals because more redundant ties create stronger bonds and a more acute sense of obligation [6].

The structural holes model (also called the bridging model), however, implies a very different strategy. According to this model [1, 10, 11], being connected to people who are not connected to each other creates holes in the network. People can therefore construct themselves as brokers, whose relationships and connections span the holes between two disconnected groups. By becoming a broker, one's power to access and control more, otherwise inaccessible, resources increases.

Although these two competing models are not typically focused on collaboration seeking, different assumptions between the models predict two different strategies for choosing collaborators. The closure model puts more emphasis on collective achievements and interpersonal-emotional harmony. The structural holes model, however, pays more attention to the enhancement of individual achievements and task achievement realized by obtaining more unique resources and doing so more efficiently.

Although previous studies of social capital generation in the U.S. have offered support for the benefits of the structural holes model rather than the closure model, quite the opposite has been found in Asian settings [4, 7, 39]. In Xiao and Tsui's [39] study investigating how social networks influence career development in China, this contrast was explained by the cultural context in different societies. In Eastern cultures, the value of intra-group relationships and Guanxi (an enduring network of relationships characterized by reciprocity) are key to career and business success. These cultural values suggest a strong appreciation of network closure. That is, people are tightly connected in networks characterized by harmony and reciprocity. Furthermore, in Asian society, a 'broker' positioned at the boundary of two groups is generally distrusted by both groups [39], which means people might hesitate about allowing structural holes when developing collaborations. In contrast, the effect of the structural holes model is more aligned with the Western culture of open markets, free competition and an individualistic orientation [6].

The value of shared contacts

The first type of network information we examine when predicting how people will use social network information for choosing collaborators is *shared contacts*, defined as the extent to which people are connected to the same other people. If, for example, John and Joe are both connected to Jane, they have a shared contact in Jane. It is surprising that, although shared contacts have been recognized as an indispensable social profile information resource on almost all popular social network sites (e.g. Facebook, Twitter and LinkedIn), there remains little empirical knowledge about how this information facilitates further interaction and/or collaboration between people.

The network closure and structural holes models offer two theoretical approaches for analyzing the value of shared contacts in choosing collaborators. To improve the interconnections between people, the closure model would suggest that people will choose potential collaborators with whom they have shared contacts because it will strengthen closure. In contrast, the structural holes model would predict collaboration between people who do *not* have shared contacts, as the potential collaborator could enhance the seeker's social capital by getting access to resources to which others in the network do not have ready access.

Studies further suggest that workers in China and the U.S. might favor different models when choosing collaborators. As an essential value in Chinese Confucian capitalism [7, 23, 39], Guanxi represents the nature of a Chinese individual's life as living in an intricate web of personal and social interconnections [13]. In organizational settings, Guanxi is manifested in strong emotional involvement, which is often accompanied by instrumental exchange of favors between people [23]. Members highly value interpersonal harmony, cohesiveness and achieving collective goals by meeting each other's needs. It is clear that the nature of Guanxi overlaps significantly with the goal of achieving network closure, particularly the emphasis on interpersonal cohesiveness and emotional bonding. Based on this, we hypothesize that Chinese workers will follow strategies predicted by the closure model, e.g. capitalizing on shared contacts, when choosing collaborators.

The national culture manifested in organizational settings in the U.S., in contrast, is characterized by an exchange-oriented market transaction model which leads to more instrumental vs. affective ties [26]. As has been pointed out by Xiao and Tsui [39], the structural holes model better predicts how people perform in a more instrumental culture. For both a more instrumental culture and the structural holes model, focusing on self-interest and task achievement are driving considerations. Since the structural holes model enables more efficient access to unique resources, we hypothesize that U.S. workers will favor a structural holes model by creating networks devoid of shared contacts when seeking collaborators.

H1: Chinese workers will choose collaborators who share contacts with them, whereas workers in the U.S. will choose collaborators with whom they do not have shared contacts.

The value of access to expertise and interpersonal resources

The second type of network information we examined is the type of network connections of the potential collaborators. Since the process of choosing collaborators requires seeking certain informational and/or interpersonal resources [19, 25, 40], we are especially interested in whether choice to collaborate varies based on different types of resources in the candidate's network.

In both the network closure model and the structural holes model, the value of a potential collaborator is manifested in one's social network, or more specifically, in the informational and interpersonal resources contained in his/her social network [5]. Connections to important others confer resources, but also contribute to a positive reputation by validating the legitimacy of the candidate [9]. It could therefore be inferred that connection to others who have informational and interpersonal resources will increase the capital held in one's own social network and will consequentially be a basis on which to choose collaborators. In our study, we examine access to expertise, an informational resource, and access to those in important positions, an interpersonal resource.

When taking national culture into consideration, the relationship between network connections of the potential collaborator and choice to collaborate may turn out to be more complex. As we argue in previous sections, the strategy for choosing collaborators among the Chinese is likely to be based on the cultural value of Guanxi. In Confucian society, Guanxi influences how people interact with each other in the hierarchy of social relationships. In Chinese society, social hierarchy and interpersonal connections are highly valued and intertwined. It is worth noting that Guanxi links two individuals of unequal social status such that "the weaker partner can call for special favors for which they do not have to equally reciprocate" [2]. In other words, Guanxi may create more benefits for people if they can find a way to connect with those who hold important positions (e.g. managerial positions). In the U.S., however, expertise may be more tied to access to information resources necessary for the immediate and successful completion of tasks, so U.S. workers may prefer collaborating with others who have experts in their networks.

Combining this consideration with Chinese employees' assumed strategy for choosing collaborators based on the network closure model, we also hypothesize an interaction between common contacts and the type of network connections of the target candidate on the willingness of Chinese employees to collaborate with a particular candidate. In particular, we anticipate that common contacts will be more important to Chinese employees when the candidate's network includes people in important positions vs. people with expertise. We do not anticipate the same effect for U.S. employees.

H2a: Chinese workers will more strongly favor choosing collaborators who are connected to those who hold important positions whereas U.S. workers will favor collaborators who are connected to those with expertise.

H2b: For Chinese workers, connections to people in important positions will be more valuable when collaborators also have shared contacts whereas U.S. workers will not show this preference.

The value of network size

Another type of network information we examine is network size. It is surprising that, although network size has been recognized as an important piece of social information, there remains little empirical knowledge about how this information facilitates further interaction and/or collaboration between people. Many previous studies, however, have demonstrated that network size plays an important role in the process of forming an online impression. Utz's experimental study of 124 American participants, for example, found that people with more friends were perceived as more popular [38]. In another study of friends on Facebook researchers found a significant but inverted U-shape relationship between number of friends and perceived attractiveness [37]. Until the number of friends exceeded 300-500 (depending on the dependent variable), more friends were associated with more positive impressions. In an analysis of 30,773 natural Facebook profiles, Lampe and colleagues further point out that information in social profiles [20], such as user characteristics (e.g. gender and age of the account) and profile fields (e.g. high school information, birth date) can predict the person's number of friends. In sum, people with larger networks in their social profile often earn better evaluations from others.

Both the closure and the structural holes models emphasize the accumulation of social capital [5]. The value of network size is, therefore, evaluated mainly by how much it guarantees the access to resources. Holding all else equal, a higher number of connections (up to a point) should yield access to more resources, both informational and interpersonal. As a result, when choosing collaborators, workers should favor collaborators who have large rather than small social networks. We posit that this will be consistent across cultures.

H3: Workers will choose to collaborate with people who have large, rather than small, networks.

METHOD

To test our hypotheses, we conducted a scenario-based survey with a 2×2×2×2 between-subject design. In the scenario, we asked each respondent to assume the role of someone choosing a collaborator (team member) for a new project and were asked to indicate to what extent they would like to collaborate with a given candidate on a work

project. Three types of social network information in the candidate's profile were presented, including the existence of shared contacts between the respondent and the potential collaboration candidate (without vs. with shared contacts), the type of connections in the potential collaboration candidate's network (e.g. whether the candidate was connected to others with expertise or others in important positions), and size of the candidate's network (large vs. small). The fourth independent variable was national culture of the respondent (Chinese vs. U.S.).

Previous research has found that a scenario-based approach is effective for studying cross-cultural differences [41]. Given technology differences across the U.S. and China, scenarios enable researchers to understand preferences independent of the technology currently available to respondents. This method has been used in HCI studies as diverse as understanding responses to breakdowns in robots [21], information demands in context-aware applications [22], and self-disclosure behavior [42]. In our study, we provided a written scenario describing a situation in which the respondent needs to choose a collaborator for a new project, followed by questions about the extent to which the respondent would like to collaborate with the candidate being evaluated. It was a between-subjects design and each respondent was presented with only one candidate and that candidate's social network information. The effectiveness of the scenario and some of the measures were pre-tested in a pilot study.

Pilot Study

Our pilot study was conducted to verify that the scenarios with social network maps were understandable and sensitive enough to detect Chinese and U.S. respondents' preferences with regard to choosing a collaborator. We also evaluated whether or not Chinese and U.S. respondents could clearly distinguish between the two different levels of social network size.

The sample consisted of 6 Chinese respondents (3 male, 3 female, M_{age} = 23 years) and 6 U.S. respondents (3 male, 3 female, M_{age} = 22 years) who were born, grew up and lived in China or the U.S., respectively. All respondents answered questions about their background so that we could discern cultural identity (e.g. *countries in which they were raised, to what extent they identified with their own culture*, etc.), read two scenarios with social network maps (see Table 1), indicated to what extent they would choose to collaborate with the given candidate in the scenario, and rated the social network information given in both textual scenarios and the social network maps. All materials were translated and back-translated by professional translators into Chinese and English.

Our pilot study results indicated that respondents in both cultures understood the scenario and were able to answer questions about the collaboration decision they would make in these scenarios. Moreover, the respondent's ratings on the social network information given in textual scenarios and social network maps showed clear distinctions between two network sizes (large network of 350 contacts, small network of 50 contacts) in both cultures.

Main Study

The main study was a survey with demographic questions, a scenario with the social network map followed by questions asking respondents to indicate the extent to which they would choose to collaborate with this candidate, and questions evaluating the effectiveness of our manipulations.

In cross-cultural experiments, one challenge is conducting controlled research with representative samples from the cultures of interest. Many cross-cultural studies rely on international students who study in U.S. universities, although limitations include a possible selection bias (e.g. students who come to the U.S. may not be representative of the average person in that culture) and concerns that the students have adapted to the U.S. culture. To avoid these issues, we conducted our study at a global company with employees in both China and the U.S.. All materials were presented in English for the U.S. respondents and Mandarin Chinese for the Chinese respondents. Materials were first developed in English by the entire multi-cultural research team and then translated into Chinese by a professional translator who was blind to the study design. Finally, consistent with practices for cross-cultural research, the materials were back-translated into English by two other professional translators to ensure that there was no change in meaning.

Participants

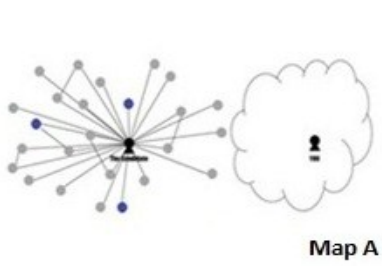
The survey request was sent via email to a total of 1,100 employees from a global IT company who were randomly chosen based on their work locations (China or the U.S.). The response rate was 43.64% (480). We further restricted our sample using two filter questions, including where the respondent was raised and what language(s) they spoke fluently before the age of 10, to make sure the cultural identity of each respondent in this study was strictly Chinese or American. The final sample consisted of 459 respondents (247 Chinese, 212 U.S.). There were 51 females and 156 males included in the Chinese sample and 58 females and 154 males in the U.S. sample. The mean ages of these two samples were 32.39 years (SD = 5.50) for the Chinese and 39.55 years (SD = 8.43) for the U.S.

Manipulations

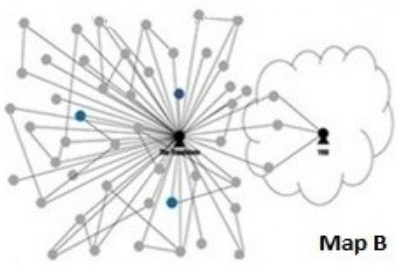
We had four primary independent variables in this study, including the existence of shared contacts between the candidate and the respondent, type of network connections of the potential collaborator (expertise vs. position), size of the network, and national culture. Culture was not manipulated, but varied based on our sample of Chinese and Americans. We used the scenario and network map for our remaining manipulations by changing the content of the scenarios and presenting different network maps (as depicted in Table 1). To manipulate shared contacts, respondents were shown either a map in which they were connected to three of the same people as the candidate or

Scenario: The team you are currently working with is preparing for a new project and needs to recruit some new members from outside [The Company] over the next few months. The graph below is the social network map of a potential candidate from outside [The Company] who has been pre-screened and invited for an onsite interview. This candidate [text from manipulation 3 inserted here] for someone at this stage in their career and for this position.

The social network map show a subset of this candidate's overall network with information about all of his/her relevant contacts including the number of contacts the candidate has in common with you, information about types of the candidate's connections, and the candidate's social network size. The meaning of each shape and color in the map is listed in table.



Map A



Map B

Manipulations:

Shared contacts	Manipulated in network maps (see Map A vs. B)	Social network map with contacts *(see grey dots)* connected with the candidate but not the collaboration seeker. [Map A]	Social network map with contacts *(see grey dots)* connected with both the candidate and the collaboration seeker. [Map B]
Type of network connections	Manipulated in network maps (see Map A)	Social network map with contacts *(see blue dots)* that are recognized as international leaders in a technical field relevant to the project.	Social network map with contacts *(see blue dots)* that hold high level administrative positions.
Size	Manipulated in text (above) and in network maps (see Map A vs. B)	Has about 50 contacts, which is a small number of contacts. [Map A]	Has about 350 contacts, which is a large number of contacts. [Map B]

Table 1. Scenario (top) with descriptions of the manipulations in the text and the network maps.

none of the same people as the candidate. To manipulate the type of network connections of the potential collaborator, the respondents were informed that the candidate was either connected to three people who were recognized as international leaders in a technical field relevant to the project (expertise) or to people that held high level administrative positions (position). Note that none of these connections were among the contacts shared with the respondent (see Table 1). Also, the candidate was depicted as being connected to someone who either had connections to someone with expertise or someone at a high administrative level, but was not her/himself described as having such expertise or position. Finally, network size was manipulated in the text as well as through the network map. Respondents were shown either a network map with few nodes or a network map with many nodes and told (in the text) that the candidate either had about 350 contacts (large) or 50 contacts (small). To control for density of the network, both the large and the small networks were constructed to have the same network density.

It is worth noting that we did not specify a particular social networking site in our scenarios for three reasons. First, there is no single dominant online social network site that spans China and the U.S. with all the functions and settings we were interested in for our study. Second, if we had referenced particular social software in the study (e.g. LinkedIn), we would not have been able to determine whether the differences we found in the current study were caused by culture or by specific design features of this social networking system (some of which may be culturally biased). Third, we are interested foremost in how people value social networking information, not in how they respond to a particular technology or display of the information, so having our manipulations as technology-neutral as possible enabled us to better understand peoples' underlying preferences. Consistent with this, our manipulations are not meant to replicate the way that one might see this information in a social networking system, rather to test basic assumptions about how people value social networking information when choosing collaborators

and how this varies across cultures, so that design decisions can be made from a solid foundation.

To evaluate the effectiveness of our manipulations, we conducted ANOVAs which included the control variables. In evaluating our manipulation check for the existence of contacts shared by the candidate and the collaboration seeker, we found significant differences. That is, respondents in the *shared contacts* condition recognized that the candidate in the scenario shared contacts with the respondent (F[1,430] = 815.69, p = .000). In evaluating our manipulation check for connections to experts versus connections to those in important positions, respondents in the expertise vs. position conditions were significantly more likely to detect that the candidates were connected to those with expertise (F[1,425] = 385.04. p = .000) and not to those in important positions (F[1,430] = 200.10, p = .000). In evaluating our manipulation check for the size (large vs. small) of the candidate's social network, we found that those presented with the large vs. the small network recognized that the candidate in the scenario had a large (vs. small) social network (F[1,430] = 192.46, p = .000).

Although we did not manipulate culture, we validated through survey questions that 100% of our Chinese respondents were raised and lived in China and 100% of our U.S. respondents were raised and lived in the U.S.. Further, considering that both the Chinese and U.S. participants in the global high-tech company might be exposed to and influenced by each other's cultures, we measured the culture-based thinking style of all respondents based on Nisbett and Masuda [29, 30]. In our survey, we presented respondents with two photographs and asked them to choose which photo they would prefer to take of a friend. One photo was of a person sitting in a chair with office details visible in the background. The other photo was of the same person, but was only a "headshot" with a neutral background. As expected, all the U.S. respondents chose the second photo. Among the Chinese respondents, most people (91.9%) chose the photo in which the office was visible. The result show that above 90% of Chinese participants had a typical relation-based thinking style and 100% U.S. participants had a typical individual-based thinking style. In other words, participants in our study could be seen as both demographically and culturally representative Chinese and Americans regardless of their exposure to other cultures.

Dependent Variables

To test our hypotheses, we used as our dependent variable the extent to which respondents expressed a desire to collaborate with that candidate. We measured desire to collaborate using a 5-item scale (α = .91) in which we asked about the extent to which the respondent would want to collaborate with the given candidate (on a 7-point scale anchored by 1 = *strongly disagree* and 7 = *strongly agree*).

Mediating Variables

In the logic leading up to our hypothesis, we argued that the relationships between network connections (shared contacts and type of connections) and desire to collaborate would be a result of a better reputation and access to expertise and interpersonal resources. To explore the mechanisms underlying our hypotheses, we measured general reputation by asking respondents to rate their impressions of the candidate as positive (=7) or negative (=1). We also measured three types of resources perceived as being available to each respondent through the candidates' social network, including access to *technical knowledge/advice*, *influence in the organization*, and *expanded social networks*. The three variables were measured with the items in Table 2. All items were measured on a 7-point scale where 1 = strongly disagree and 7 = strongly agree and averaged across items.

Control Variables

We measured and included as control variables respondents' demographic characteristics and experience with social networking sites. Demographics included age, gender, position in the company (individual contributor vs. management), and education (below vs. above undergraduate). For online experience, we generated a 5-item scale (α = .79) and used the average of these items as a control variable. We also included job role as a control variable (including administrative, product manager, program manager, marketing product support, testing, design, development, research, sales, and other) in our analysis to test if different respondents may have been thinking differently in terms of what type of candidate was needed by the team. Job role was not significant so we

Technical Knowledge, α = .91	**Influence in Organization, α = .93**	**Expanded Social Network, α = .89**
This candidate could offer good technical suggestions.	This candidate could use the authority of his/her position to influence others.	This candidate could introduce me to someone from whom I could get support.
This candidate could share with the team his/her considerable experience and/or training.	This candidate could influence the resources available to this team.	I could enlarge my social circle with the help of this candidate.
This candidate could provide team members with sound job-related advice.	This candidate could use his/her power to get access to special benefits for people on the team.	I could be informed about useful non-technical information by this candidate.
This candidate could influence the team by his/her professional technical knowledge.	This candidate could influence peoples' chances to get promoted.	This candidate can leverage his social network to get things done.

Table 2. Survey items used to measure types of resources.

		M	*SD*	1	2	3	4	5	6	7	8	9	10
1.	Age	35.66	7.84	-									
2.	Gender (male vs. female)	-	-	.08	-								
3.	Job position (subordinate vs. management)	-	-	.26**	-.04	-							
4.	Education (below vs. above undergraduate)	-	-	.01	-.04	-.05	-						
5.	SNS experience	3.69	1.39	-.018**	-.00	-.03	.01	.79					
6.	Shared contacts (without vs. with shared contacts)	-	-	-.01	.05	-.06	-.03	.06	-				
7.	Type of network connections (expertise vs. positional connections)	-	-	-.02	.05	.02	-.01	.07	.06	-			
8.	Size of network (small vs. large)	-	-	.06	-.12**	.02	-.02	.06	.06	.04	-		
9.	Culture (China vs. U.S.)	-	-	.46**	.08	.20**	-.20**	-.20**	-.07	.02	.07	-	
10.	Choice to collaborate	4.25	1.07	-.26**	-.03	-.17**	.06	.11*	.10*	-.14**	-.12	-.33**	.91

Table 3. Descriptive statistics and correlations between the primary variables.

removed it from our final analysis.

RESULTS

Table 3 shows the descriptive statistics and correlations between the primary variables in this study. To test our hypotheses, we used a 2×2×2×2 ANOVA analysis predicting the extent to which participants expressed a desire to collaborate with the candidate presented (Table 4).

Our first hypothesis predicted that choice to collaborate would be influenced by the existence of shared contacts and that shared contacts would be a stronger predictor for the

	F (1, 424)	*Sig.*
Age	6.13	.014
Gender	.27	.602
Education	.03	.859
Job position	2.93	.088
SNS experience	.51	.477
Shared contacts	1.71	.192
Type of connections	13.40	.000
Size	.02	.885
Culture	19.95	.000
Shared contacts × type of connections	1.07	.302
Shared contacts × size	1.08	.300
Shared contacts × culture	.04	.846
Type of connections × size	.85	.356
Type of connections × culture	.11	.736
Size × culture	1.69	.194
Shared contacts × type of connections × size	2.48	.116
Shared contacts × type of connections × culture	4.74	.030
Shared contacts × size × culture	2.91	.089
Type of connections × size × culture	.00	.957
Shared contacts × type of connections × size × culture	.40	.528

Table 4. ANOVA analysis predicting desire to collaborate with the candidate.

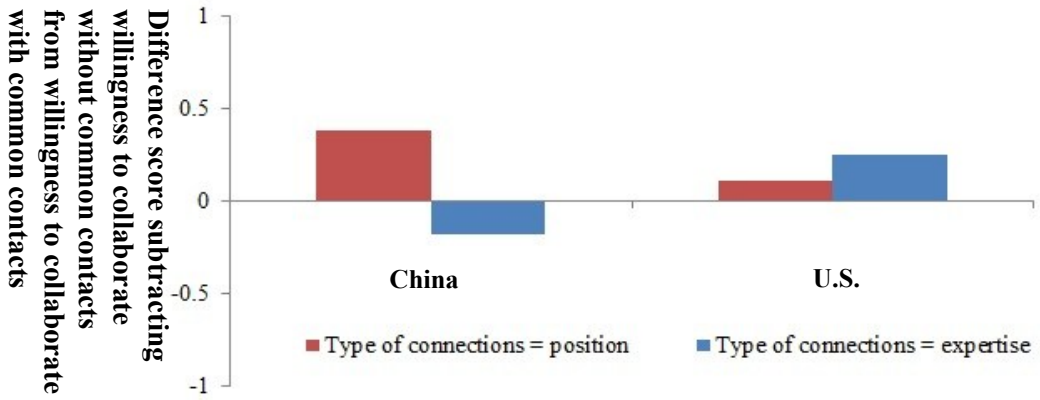


Figure 1. The 3-way interaction showing the willingness to collaborate with common contacts (vs. without common contacts) by type of connections.

Chinese as compared to U.S. participants. To test this hypothesis, we examined the two-way interaction between the existence of shared contacts (without vs. with) and national culture of the respondent (Chinese vs. U.S.). The results of the ANOVA partially support our hypothesis. Although the two-way interaction between shared contacts and culture was not significant, we found a significant three-way interaction between shared contacts, the type of network connections and the respondent's national culture (F[1,424] = 4.74, p = .03). This finding indicates that the influence of shared contacts on choice to collaborate was stronger for Chinese respondents, but only when the potential collaborator also had connections to people in important positions.

Our second set of hypotheses predicted that workers from China would choose to collaborate with candidates when the potential collaborator had access to resources by virtue of being connected to people in important positions whereas U.S. workers would choose potential candidates who were connected to those with expertise (H2a). We also hypothesized that having shared contacts with candidates who had connections to those in important positions would be important for the employees in China (H2b). A significant three-way interaction between shared contacts, type of network connections and the respondent's national culture (F[1,424] = 4.74, p = .03) was found to partially support H2a and H2b.

To explore this effect further, we tested the simple two-way interaction between the existence of shared contacts and the type of network connections in each cultural sample. For respondents from China, a significant interaction was found between shared contacts and type of network connections when predicting choice to collaborate (F[1,231] = 6.12, p = .01). To be specific, when there were connections to those in important positions included in the candidate's network, Chinese respondents preferred to collaborate with candidates who had shared contacts (M = 4.62, SD = 1.14) rather than with those who did not have shared contacts (M = 4.25, SD = .91). However, although the main effect of type of network connections is significant (F[1, 192] = 6.91, p = .009) for respondents from the U.S., the interaction was not significant (F[1,192] = .59, p= .44). The main effect of shared contacts is not significant neither (F[1,192] = 1.20, p= .27) for the U.S. respondents. That is, the Americans had a stronger desire to collaborate with candidates connected to people who were recognized as international leaders in a technical field relevant to the project (expertise, M = 4.07, SD = .94) compared to candidates connected to people who held high level administrative positions (position, M = 3.76, SD = .96) regardless of the existence of shared contacts (interaction term, F[1,192] = .59, p= .44). The mean value of desire to collaborate for the U.S. respondents when the candidate was connected to those with expertise (with shared contacts, M = 4.20, SD = 1.02, without shared contacts, M = 3.95, SD = .85) vs. important positions (with shared contacts, M = 3.82, SD = 1.09, without shared contacts, M = 3.71, SD = .84) reaffirms that U.S. respondents favored connections with experts vs. those in important positions, regardless of shared contacts.

Figure 1 illustrates these relationships by showing the difference score subtracting willingness to collaborate *without* common contacts from willingness to collaborate *with* common contacts by type of connection. As can be seen from figure 1, Chinese respondents valued common contacts when connecting to a candidate with contacts in high positions, but not when connecting to a candidate who had contacts with expertise.

To examine the mechanisms underlying our hypotheses and results, we first analyzed the effect of general reputation. We conducted a mediation analysis which included a) establishing a link between our independent variable(s) and desire to collaborate, b) establishing a link between our mediator (general reputation) and desire to collaborate, and c) if both "a" and "b" were significant, running a regression to determine if the relationship in "a" diminished when the

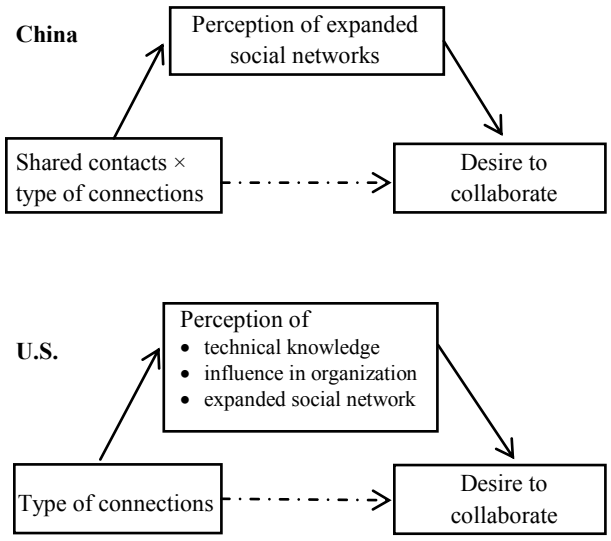


Figure 2. Mediation models for China (top) and U.S. (bottom).

mediator (general reputation) was added to the model. Our analysis indicates that although reputation was significantly related to desire to collaborate *(*F[1,424] = 221.53, p = .000), the effect of shared contacts on desire to collaborate was not reduced, thus ruling out mediation. This analysis establishes that reputation affects desire to collaborate, but eliminates reputation as an explanation for why shared contacts contribute to the desire to collaborate.

We also analyzed *technical knowledge*, *influence in organization*, and *expanded social networks* perceived as being available through the potential candidate as mediators. For Chinese respondents, perceiving that they would be able to enlarge their social circle through the candidate's network connections (Guanxi) served as a mediator (see figure 2). That is, the interaction between shared contacts and type of connections predicted the desired to collaborate (a), but when *expanded social network* was added to the model, it was significant (t = 7.76, p =.000) and the relationship between shared contacts/type of connections and desire to collaborate became less significant *(*t = 1.80 p = .073), see figure 2). In other words, Chinese respondents perceived a candidate who was connected to people in important positions and with whom the respondent had shared contacts as someone helpful to expand their own networks. This perception, in turn, lead to a desire to collaborate with that candidate. For the U.S. respondents, however, the choice to collaborate based on type of network connections was mediated by perceived access to all three types of resources. In other words, the U.S. respondents appear to perceive those who have expertise as compared to those who have positions of importance as having better access to technical knowledge, organizational influence, and expanded social networks and access to these resources affects their collaboration decisions.

To answer our research question about the relationship between network size and choice to collaborate, we examined the main effect of network size (large vs. small) within the full ANOVA. Contrary to our hypothesis, our analysis did not show any clear relationship between network size and choice to collaborate. Respondents presented with potential collaborators who had a small network reported slightly higher willingness to collaborate (M = 4.31, SD = 1.01) than those presented with candidates who had a large network (M = 4.25 SD = 1.07), but the difference was far from significant (F[1, 424] = .02, p = .88). The interaction between network size and culture was also not significant (F[1, 424] = 1.69, p = .19), although Chinese tended to prefer collaborators with smaller networks (large, M = 4.56, SD = 1.15; small, M = 4.60, SD = .92;) and Americans tended to prefer collaborators who had larger networks (large, M = 3.90, SD = .90; small, M = 3.84, SD = 1.06).

DISCUSSION

Overall, our results demonstrate the importance of national culture when using social network information to choose a collaborator. Generally, collaborator seekers from the U.S. based their decision largely on the type of connections (e.g. experts vs. people in important positions) in the candidate's social network whereas collaborators from China tended to consider the existence of shared contacts and type of connections in potential collaborators' networks together when making a decision.

Our mediation analysis further shows that how people perceive and value the resources available (access to technical information/advice, influence in the organization, or expanded social networks) determines how they attend to social network information. Although all three types of resources should contribute to the candidate's ability to get things done, Guanxi especially emphasizes one's ability to create lasting connections between people with benefits that play out over years, if not decades. Further, our measure of expanded social networks specifically included access to those who could provide support, suggesting someone who may be in a higher position hierarchically. In this sense, the mediating effect of expanding social networks for Chinese respondents is consistent with Guanxi and closure models. The U.S. respondents, in contrast, appear to value all resources equally, which is consistent with a structure holes model in which efficient, non-redundant access to a variety of resources is paramount. U.S. respondents, however, did not adhere to a structure holes model in their response to shared contacts. A structural holes model would suggest that workers prefer to collaborate with those who do *not* share common contacts, but shared contacts was not significantly related (positively or negatively) to U.S. respondents' desire to collaborate with the candidate. Finally, U.S. respondents did not significantly prefer to collaborate with a candidate who had a larger network. In sum, our results suggest that a closure model fits the

preferences of the Chinese respondents relatively well, but U.S. preferences reflect neither model completely.

Given extensive support for structural holes theory in the U.S., our research calls into question its relevance for choosing collaborators and perhaps challenges its validity more generally, at least as a normative vs. prescriptive model. Of course, people likely rely on hybrid models for creating social networks, e.g. with some structural holes and some network closure. We set up two competing models – a closure model and the structural holes model – although people's preferences are rarely so black and white. Overall, our results show that U.S. as compared with Chinese use more of a structural holes model even if they do not adhere to it completely.

Still, there are other possible explanations for why a structural holes model did not entirely fit the U.S. respondents. One explanation is that peoples' behavior when using social media is different than the way that they form social networks through other means. Most research on structural holes has not examined choices made based on online social network information. Further research will need to be conducted comparing online vs. offline collaboration choices to determine the extent to which social media affects networking behavior. For example, McDonald's [25] research would suggest that some of the more nuanced social network behaviors are hard to capture in technology. Another possible explanation is that U.S. participants simply valued all types of resources and believe that expertise was the best conveyor of social capital (as suggested by the data). Perhaps when seeking collaborators in the U.S., social capital of all types is valued, regardless of the uniqueness of the resource (as argued by structural holes theory) and expertise is seen as a carrier of social capital. This is consistent with an exchange oriented market transaction model as described by Morris and colleagues [26] in which relationships are primary instrumental and carriers of resources.

We were also surprised that network size, across cultures, was not a predictor of desire to collaborate, given our expectation that more connections would be perceived as conferring more resources. One question is how people perceived network size. Evidence suggests that connecting with someone in an online community does not always mean that people have a close connection in the real world [40]. In our current study, although our manipulation check showed a significant difference between large and small networks in the respondents' evaluation of network size, we do not know how respondents perceived the strength and validity of the connections. For candidates with a large network (which included 350 contacts in our scenario), it is possible that respondents did not perceive the contacts as being resource rich, which could explain why network size did not predict to desire to collaborate with a candidate. To evaluate this, we examined the relationship between network size and the three types of resources, e.g. access to technical knowledge/advice, influence in the organization, and expanded social network. Our results suggest that, in fact, respondents saw larger networks as conferring more access to organizational influence ($F[1,428] = 9.80$, $p = .002$) and to expanded social networks ($F[1,428] = 28.38$, $p = .000$) but *not* to technical knowledge/advice ($F[1,425] = .77$, $p = .38$). There were no interactions between culture, network size, and any of these three types of resources. Given the Chinese value for expanded social networks, we were somewhat surprised that they did not value larger networks. We suspect that although a larger network is perceived to provide more access to those with organizational influence, a larger network is less consistent with a Guanxi model of tightly connected networks characterized by reciprocity and harmony.

Our findings provide new insights for the design of better enterprise software systems to enhance collaborations at work. The type of connections, as elaborated above, play a more important role for a collaboration seeker than network size. However, if we look at the current social network websites (such as Facebook and LinkedIn), the available information on the type of connections is not highlighted or made easy for users to search or sort. A better design that makes the information more visible and accessible to users might enhance workplace collaborations. There are also design implications for the design of systems when people are working globally. If, for example, Jian in China wants to collaborate with John in the U.S., how do we make sure that Jian has the information about John that Jian values? How does John develop a social network that helps him to be perceived as a valuable collaborator to potential colleagues in China? Also, how does John choose a collaborator in China who is seen as a valuable collaborator by Chinese stakeholders? The answer may lie in providing more explicit information about how the information is being valued in different cultures and allowing enough flexibility in the system to visualize information specific to the culture(s) of interest.

Of course, there are limitations to the study we report here. First, our study only included respondents from China and the U.S. Cross-cultural research often relies on broad distinctions between East and West [30] so it is possible that our results would generalize to other Eastern and Western cultures, but future studies will be required to assess the extent to which these findings generalize beyond China and the U.S. Second, we studied a multinational company in which the Chinese employees may have had extensive exposure to Western culture. On one hand, this might suggest weaker effects than a more representative sample, but it is still important to assess its impact. To assess the effect of the Chinese being exposed to Western culture, we asked several relevant survey questions. Results show that exposure to Western culture did not affect the results for Chinese employees, suggesting that the results may be robust to exposure to the West and may therefore hold for employees outside of multinational companies. Our manipulation checks for cultural also

indicate that our Chinese sample was culturally Chinese and our US sample was culturally American, despite both having broad global exposure. Still, future research with a less cosmopolitan set of respondents would help to shed light on the representativeness of our results. Third, our scenario was intentionally vague about the exact work to be done by the collaborator being selected. This had the advantage of being meaningful for each individual responding to the study regardless of their situation, but it also had the possible disadvantage of being a noisy measure in that respondents may have interpreted the role of the potential collaborator and the team needs differently. To address this, future research may want to provide more specificity about the role of the candidate and/or capture more data on the mental model being held by the respondents regarding the needs of the team. Fourth, previous work indicates that reputation affects how collaborators are sought [e.g., 16]. In the current study, we examined how the relationship between general reputation of a team member candidate and desire to collaborate with this candidate would be influenced by the existence of shared contacts and other network information. To understand more specifically how reputation works in this context, future research could examine how the shared contact's impression of the team member candidate affects the attractiveness of the team member candidate. Finally, scenarios are an excellent way to get data from non-student populations and enabled us to access a fairly large sample of working professionals around the globe, but are not a substitute for capturing behavior. Future studies should validate and extend this work with laboratory experiments and observational studies. A controlled lab study would also help to validate the direction of causality between variables of interest in our study.

Despite the limitations, we believe that this work demonstrates a link between the use of social network information and national culture. Our research further suggests that selecting models that are culturally congruent (e.g. a closure for Chinese and an exchange oriented market transaction model for U.S.) may be helpful in designing culturally sensitive social networking systems.

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