AN ACE IN THE HOLE: THE EFFECTS OF (IN)ACCURATELY OBSERVED STRUCTURAL HOLES ON ORGANIZATIONAL REPUTATION POSITIONS IN WHOLE NETWORKS

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ABSTRACT

A large body of the literature has found that occupying structural holes positively affect organizational outcomes. Structural holes pose strategic opportunities for organizations that are knowledgeable of their advantageous position. However, most studies do not take into account whether organizations observe their structural holes accurately. Such observational (in)accuracy might explain variation in return-on-structural-holes. This study investigates the effects of accurate and inaccurate perceptions of organizations' structural holes position on organizational reputation. We consider scenarios where organizations (correctly) observe or (incorrectly) miss existing structural holes or where they incorrectly observe structural holes in the network. We collected data in two whole networks in the healthcare industry in the Netherlands. We find that accurately observing one's structural hole position increases organizational reputation. On the flip side, organizations that perceive structural holes that actually do not exist, suffer negative reputation effects. Our research implies that similar network positions can yield differential reputation effects depending on the accuracy of the knowledge of the organization occupying this position.

INTRODUCTION

Organizations operate in increasingly complex environments (Vasconcelos & Ramirez, 2011). As interconnectedness and interdependence increases in business environments, organizations need to make sense of the overall structure of interdependence they are part of and, perhaps most significantly, of their own ability to deal with environmental complexity (Kirman, 2011). In the present paper we consider a situation in which organizations need to collaborate (to jointly achieve enough funding from the government), while, at the same time, they compete against each other (for the scarce resources available). Perhaps the main competitive edge these organizations have is their reputation. We study how organizations behave as they make sense of their ambiguous position in their complex environment and how this behavior affects their reputation vis-à-vis their peers. We address this issue from the viewpoint of social network analysis, which has become one of the common approaches to study complexity in organizational settings (Castellani & Hafferty, 2009; Mischen & Jackson, 2008). In particular, we focus on the attempts of organizations to exploit their position within their networked environment.

One of the dominant theoretical perspectives that relates a firm's network position to its outcomes is structural hole theory (Burt, 1992, 2005). Rather than only focusing on ties that are present in a network, structural hole theory also reasons about the *absence* of links. An organization ("ego") spans a structural hole when it is connected to two other organizations ("alters") that are not mutually connected. This definition of structural holes is purely triadic; it considers structural holes independently of the position of the alters within the network. Structural holes constitute a valuable resource to the focal organization by imbuing it with access to information, resources, and opportunities that other firms lack and need (Burt, 1992; 1997). As such brokers, have been shown outperform those not occupying a brokerage position (Burt, 2000; Zaheer & Bell, 2005; Uzzi, 1996; McEvily & Zaheer, 1999).

Structural holes can bring benefits to organizations in two ways. The lion's share of studies consider the structural benefits only; being located between unconnected alters provides the relative advantage of being presented with more varied information than others.This confers to ego the benefits of having access to knowledge faster, from more varied resources, and across a wider range of network positions (occupied by the alters) than firms that span fewer structural holes. This stream of research is purely structural in nature as it assumes that being located on fertile ground provides benefits to ego, irrespective of whether ego is conscious of being in such an advantageous position or not. Soda, Tortoriello & Iorio (2018) label this as the 'vision' benefit of structural holes. Brokerage positions, thus, offer to actors opportunities, knowledge, and information.

A second way in which ego can benefit from spanning structural holes is by actively and consciously exploiting one's strategic position in the network (Obstfeld et al., 2014). Although spanning structural holes may by itself already confer advantages to ego, those organizations that actively play their alters against each other and exploit the fact that they have informational advantages over their network partners are likely to increase their relative performance even further. This control argument is of an agentic nature as it requires organizations to be cognizant of the latent competitive advantage of their position and take action to exploit it.

In social network analysis it is commonly (and implicitly) assumed that actors have complete and accurate information of the network they are part of. However, a complexity view holds that environments are ambiguous (Ferraro, Iovanella, and Pyka, 2018; Johnson, 2015) and their structure may not be known or knowable a priori (Vasconcelos & Ramirez, 2011). This position is supported by extant research which shows that even in relatively small networks organizations are usually highly inaccurate about the structural characteristics of the network they are part of (Bondonio, 1998; Casciaro, 1998; Casciaro et al., 1999; Kilduff et al., 2008;

Fonti et al., 2015; Knoben et al., 2018; Marineau et al., 2018). In other words, the inherently complex nature of business environments is likely to cause firms to misinterpret the actual structure of the network and, hence, to have an incorrect view of their own position it.

The fact that active exploitation of a structural hole position requires that a firm correctly realizes that it spans structural holes also leads to interesting scenarios. What happens, for example, when ego believes to be spanning a structural hole when in reality it does not? Its attempts to play alters against each could very well backfire as the alters take issue with being played against each other. We therefore argue that structural hole benefits are likely to only fully accrue to those firms that can accurately assess the structural holes they span. Strategic exploitation of structural holes is only beneficial when they are correctly observed and might harm performance when an attempt is made to exploit a structural hole that does not exist.

To date, research studying the effects of the accuracy of structural hole perception on organizational outcomes is scarce. Numerous studies have presented inconclusive or contradictory results concerning the outcomes of structural holes (Perry-Smith, 2006; Zhou et al., 2009) and some studies have tried to identify the situations in which these performance benefits do or fail to materialize. These studies point, for example, at the importance of the stability of the environment (Koka and Prescott, 2008), the specific functions that brokers are in (Stea & Pederson, 2017), initial performance and absorptive capacity (Martinez-Chafer et al., 2018), and the nature of the network ties (Tang et al., 2017). However, to our knowledge, no study has examined the impact of (in)accurately observing structural holes as a key determinant of organizational outcomes, and therefore as a possible explanation for varying organizational outcomes.

We distinguish scenarios in which accuracy levels as to the observations of structural holes vary and addresses the question to what extent (in)accurately observed structural holes affect organizational reputation. By doing so we reveal the importance of the accurate perception of one's structural holes. We contribute to the literature on organization-level network strategies by including network information accuracy and its outcome implications. We also extend structural hole theory by including the outcome effects of accurate and inaccurate structural hole observations. This makes structural hole theory more realistic since the commonly used assumption of perfect perceptional accuracy is rarely realistic. Finally, this study brings together research on structural holes and organizational reputation as an outcome thereof, which are not often connected in empirical research (Ravasi, Rindova, Etter & Cornelissen, 2018). Non-financial indicators such as reputation are important organizational outcomes in many sectors and affect (future) success and survival of organizations.

We conduct our empirical tests in the non-profit voluntary health care industry. In this industry, organizations collaborate to provide health care services, while at the same time fiercely compete over a decreasing budget and number of volunteers (Bekkers, Boonstoppel, De Wit, 2017). Recruiting and retaining volunteers is essential to these organizations, yet the number of volunteers is declining (Dekker & de Hart, 2009). Having better knowledge and information on how and where to attract and retain volunteers before they join another organization in the industry is essential to the outcomes and ultimately the survival of these organizations. The organizations in the networks strategically search to enhance their knowledge regarding the attraction and retaining of volunteers; this includes keeping an eye on the recruiting strategies that are employed by the other organizations in the network, to learn from their experience. Those firms that have the most useful and timely information about where and how to recruit new volunteers have a clear competitive advantage over other firms. This creates a situation where specific knowledge about the opportunity structure provided by the network is of great importance to the organizations and creates a situation of tension and uncertainty in which 'tertius gaudens' (Simmel 1950; Obstfeld et al., 2014) orientations can benefit those organizations spanning structural holes. Therefore, this setting provides a natural setting to test to what extent return-on-structural-holes is affected by their accurate identification.

THEORY

In this paper, we study the relationship between (perceived) structural network positions and organizational reputation in goal-directed networks. Reputation has its origin in economics and is determined, for example, by consistent past performances, especially in situations in which information on products, services, or performance is incomplete and asymmetric (Sorenson, 2014). In a review paper, Ravisa et al. (2018) concluded that in the past decades, six perspectives informed research on the formation of reputation: A game-theoretic, a strategic, a macro-cognitive, a micro-cognitive, a cultural-sociological, and a communicative view. In the same article, these authors make a plea for blending combinations of these perspectives while studying reputation formation. In this paper, we answer this call by combining the micro-cognitive and macro-cognitive views on reputation formation with structural holes theory. These reputation views are relevant for our purposes because both stress that the formation of reputation is an interactive exchange process with other social actors. The links with links and flows in social networks is easy to make.

In the macro-cognitive perspective, reputation formation is a product of the exchange of information and influence among a range of actors in an organizational field (Rindova, Williamson, Petkova & Sever, 2005). This implies that, the formation of reputation is a bi-directional process in which organization's actions convey signals to the environment, which are communicated to and interpreted by other social actors in the field. In this way, an organization can become prominent and it can enjoy favorable assessments in an organizational space.

The micro-cognitive perspective on the formation of reputation complements the macro view as the former focuses on how individual social actors access and process reputation related information to form assessments. Whereas the signaling approach used in the macro-cognitive perspective assumes that actors react similar to similar signals, the micro-cognitive perspective allows for individual variation in reputation judgement. Differences in reputation judgements come about due to for example incomplete information, bounded rationality, the use of heuristics, and individual beliefs (Zhelyazkov and Gulati, 2016; Mariconda and Lurati, 2015).

Benefitting from accurate information about structural holes in the network has a positive effect on the organizational reputation for several reasons. First, (accurate) information about the structural holes makes organizations (ego) know better who (does not) know(s) what; this increases the *efficiency* of finding organizationally relevant and non-redundant information. Consequently, organizations that are more accurate can attract better and more varied resources or are more knowledgeable about strategies for attracting these resources. These outcomes and abilities are signaled to other actors in the network, which enhances ego's reputation. Second, there is also a *timing* advantage of being accurate. Accurately perceiving existing structural holes provides an organization (ego) with quick access to information; ego can find relevant information faster than other actors in the network that are not aware of their information position. Third, being (more) accurate about structural holes enables ego to distill *higher quality information* as the connections to the alters function as antennas and information-processing devices that assist ego in sorting out relevant and important information. This higher quality information helps ego to perform better and build a better reputation. Fourth, previously we argued that ego can benefit from spanning structural holes by actively and consciously exploiting its structural network position, which is the control perspective in structural holes theory. For building a higher reputation this implies that ego takes deliberate actions to signal information about its unobservable attributes and in this way influences alters' beliefs (Weigelt and Camerer, 1988).

Brokerage advantages and organizational structural hole position

A tenet in social network research is that some structural positions are more advantageous than others (Hahl et al., 2016). One particularly valuable position is that of the broker: an actor who links two otherwise disconnected "alters" across a structural hole (Burt, 1992). The idea is that being in-between-others confers strategic advantages over those whose relation is bridged by the broker. Underlying this idea is the (often-implicit) assumption that actors who occupy strategically advantageous positions consciously make use of them and actively engage in strategic behavior as brokers (Easley and Kleinberg, 2010). Recent publications call this a "brokerage orientation" (Soda, Tortoriello, Iorio, 2018; Grosser, Obstfeld, Labianca, Borgatti, 2018). Obstfeld et al. (2014) argue that the concept of brokerage should distinguish between the structural patterns by which the broker connects two otherwise disconnected alters (the "brokerage structure") and the social behavior of third parties (the "brokerage process"). While spanning structural holes creates the context in which a broker can effectively exploit the absence of ties between alters, the broker can make use of structural holes in several ways. Without appropriate action, brokers may gain little from their favorable position (Halevy, Halali and Zlatev, 2019). However, appropriate action can only be employed if structural holes are accurately observed. Below, we distinguish three scenarios of perceptional (in)accuracy and build hypotheses on their differential impact on organizational performance.

Structural hole position and (in)accurate observations

The literature suggests that stable structural hole positions are likely to occur under knowledge asymmetry between the broker and the disconnected alters. As Hahl et al. (2016) argue, structural holes are likely to occur in the situation when brokers realize they are spanning disconnected alters, but alters may not be aware of their disadvantaged position. This reduces the risk of disintermediation by alters and increases the benefits for brokers. However, an organization's structural hole perception might not be (completely) accurate. For example, an organization might not be aware that it is spanning a structural hole or it might erroneously assume that it is spanning one. Consequently, three scenarios describe perceptual accuracy of one's structural hole position: (1) the organization accurately observes that it spans a structural hole ("correct positive"); (2) the organization inaccurately does not observe the structural hole it spans (”false negative"); (3) the organization inaccurately observes that it spans a structural hole ("false positive"). We summarize the three scenarios in Table 1.

An organization can occupy multiple cells (see Table 1) since it can have several structural hole positions within a network and accurately observe some and inaccurately observe others. Below, we consider the performance implications of each scenario separately and then combine them in the empirical test.

Table 1: Scenarios of (in)accurately observing structural holes and related reputation effects

<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="2">Structural hole observed by the focal organization</td></tr>
<tr><td>Yes</td><td>No</td></tr>
<tr><td rowspan="2">Structural hole in the objective network</td><td>Yes</td><td>Variety of information, timeliness, , quality, and control benefits, highest reputation effects
(Scenario 1 “correct positive”)</td><td>Variety of information benefits, positive reputation effect

(Scenario 2: “false negative”)</td></tr>
<tr><td>No</td><td>No information benefit, negative behavioral effect, decreased reputation
(Scenario 3: “false positive”)</td><td></td></tr>
</table>

Scenario 1 ("correct positive"): Accurate observations of structural holes

In this scenario, the organization spans a structural hole within the objective network and observes that it does so accurately. We propose that this accurate observation creates the highest reputation effect since the focal actor can fully exploit the fact that it is bridging unconnected alters by engaging in a "tertius gaudens" strategy or acting as an appreciated "conduit" (Obstfeld et al., 2014).

First, the focal organization enjoys the "passive" benefits of spanning structural holes as it receives more diverse and less redundant information from its alters (Koka & Prescott, 2008). Because the organization is also aware of its advantageous position, it can draw additional benefits by actively exploiting these structural holes. Being cognizant of its competitively beneficial position makes the organization's information search processes more efficient, as it is better able to figure out who knows what in the network. This allows ego to locate which organizations are the most likely to provide it with high-quality information and knowledge (Gargiulo and Benassi, 2000) and to more easily separate the informational wheat from the chaff. Furthermore, structural hole accuracy yield quicker access to sought information and resources held by alters. As a result, sought-out information is likely more timely. Furthermore, ego can actively influence its alters by consciously signaling cues enhancing its reputation.

In sum, awareness of spanning structural holes confer both the and active advantages to firms; this should allow them to build better strategy and make better and more sustainable choices. Overall, organizations that are aware of the structural holes they span are expected to have stronger reputational benefits than those firms that lack this awareness (scenario 2):

H1: The more accurately observed structural holes the organization spans, the higher its reputation. This effect is stronger than that of non-observed structural holes.

Scenario 2 ("false negative"): Non-observed structural holes

In this scenario, a focal actor spans a structural hole, but does not know this. Although the focal organization does not recognize the advantageous position it is in, it still is in an advantageous position relative to its disconnected alters. As Soda et al. (2018: 899) argue "In fact, irrespective of strategic orientation [= tertius gaudens or iungens orientations], positions that offer preferential access to others' resources increase the broker's probability of deriving individual benefits". This implies that ego receives a higher volume of varied information and knowledge than do organizations that lack structural holes (Burt 1992; 1997; 2000). Whether they are aware of it or not, firms that span structural holes interact with alters that tend to be more mutually varied and that tend to connect to diverse pockets of the network; this provides the focal firm with an increased variety of knowledge and information that it can subsequently use to generate successful strategy. These "passive" informational benefits are likely to make firms more knowledgeable and reputable (due to increased strategic performance) than firms that lack structural hole advantages. Put differently, due to its structural position, ego benefits from a higher search efficiency, better timing, and a higher information quality leading enabling ego to perform it activities in a better way and maybe even leading to higher performance levels. The ties with ego enable the alters to observe this, increasing their reputational judgements of ego.

In the setting of the health care industry, being confronted with more varied approaches to and experiences with recruiting and retaining volunteers should enable the focal firm to develop successful strategies to recruit volunteers themselves. In turn, this enhances their reputation as being knowledgeable and successful recruiters. Hence, our first hypothesis is:

H2: The more non-observed structural holes are spanned by the organization, the higher its reputation. This effect is weaker than that of accurately observed structural holes.

Scenario 3 ("false positive"): Mis-observed structural holes

Contrary to the previous scenarios, organizations can see themselves as spanning structural holes when they really are not. In this case, the focal organization does not span the structural hole it believes it has and therefore does not receive the structural hole benefits of receiving non-redundant, varied, information from its alter organizations. More importantly, this mis-observation might cause the focal organization to attempt to control the information between its alters, which is likely to backfire since both alters are mutually connected. Alters that are connected are likely to engage in frequent mutual communication, create shared norms, and can easily observe each other—hence, they are likely to both discern that ego is trying to play them. This provides the basis for the alters to sanction behaviors they deem as inappropriate (Coleman, 1988; Fehr and Fischbacher, 2004; Mulder et al., 2006). Sanctioning can take different forms like for example loss of reputation, (information) exclusion, or disapproving. As a result, the level of trust in the focal organization by its alters is likely to decrease dramatically (Coleman, 1988; Burt, 2001). The alter organizations might assume that the focal organization is acting on self-interest by trying to control the information between them, resulting in a decrease of their willingness to exchange information with the focal organization in the future. Moreover, this negative behavior by ego may trigger its alters to share their experience with ego with their own network partners, which is likely to have a detrimental effect on ego's reputation in the network.

Mis-perceiving structural holes can also make organizations incorrectly believe that they receive valuable information from the alter organizations that is not available elsewhere. As a result, they might refrain from searching for alternative knowledge partners. In this regard, Stuart and Podolny (1996) and Rosenkopf and Almeida (2003) found evidence for organizations to be (in geography and technology) locally bounded in their search for new knowledge. These arguments suggest that an organization that acts on incorrectly observed structural holes is likely to experience lower organization reputation:

H3: The more non-existing structural holes the organization believes to span, the lower its reputation.

DATA SAMPLE

We collected data on two regionally bounded whole goal-directed networks (of 35 and 31 organizations, respectively) in the non-profit health care industry in the Netherlands. Both networks are part of a platform with two formal goals. Externally, the platform wants to speak with one voice to actors outside the network and jointly lobby for funding from (local) governments. This lobbying is crucial because government funding is under heavy pressure due to Dutch austerity policy. Internally, the goal of the platform is to stimulate cooperation and knowledge exchange among organizations in the non-profit health care industry (Human & Provan, 1997). The main focus of the organizations in both networks is on the recruitment and retaining of volunteers since they make extensive use of volunteers for their daily operations.

Both networks are part of a national platform of eleven regional networks spread across The Netherlands. We selected the two networks informed by a few characteristics. First, both networks have clearly defined boundaries since membership of these networks is registered; therefore they represent whole networks (Provan, Fish & Sydow, 2007). Even though organizations join and leave over time, we were able to determine the network members at a particular point in time. This is essential as we need to ask every network member about their observations of the relations between every other pair of organizations in the network, which is undoable when the boundaries of the network are unclear.

Additionally, in unbounded networks knowledge about the relationships of others may be useful; however, in goal-directed whole networks, the relationships of other organizations in the network are at least partially dependent on the other relations in the same network.

Therefore broad network knowledge in goal-directed whole networks is important. Secondly, both selected networks are medium-sized, with 35 and 31 organizations respectively. When networks become too large, asking network members about their knowledge of the relationships between every other pair of organizations in the networks is unfeasible, since the number of potential network pairs increases quadratically with the number of network members.

In contrast, collecting data from too small networks would not be informative due to the lack of network complexity. Besides, in small networks, inaccurate observations of the network are less likely to occur, and negative organizational outcome effects based on exploiting network positions are higher since they are more visible to the other organizations in the network. In large networks, accurately observing the network structure is almost unfeasible. The size of our two networks is well above the level at which Kilduff et al. (2008) found large distortions in the network information accuracy (20 nodes), without being so large that data collection would be problematic.

We accessed both networks through the chairperson of the national platform, who connected us to the regional coordinators of the networks. Both networks had regular meetings in which the organizational representatives came together to discuss matters related to the network. These representatives are the most knowledgeable and representative agents for our research purposes. The representatives of the organizations all had a sufficient tenure (e.g., team-leaders, managers, directors) within their organization to be able to observe well the network in which they are active. They are also all well-aware of the importance of inter-organizational collaboration, and they are knowledgeable about the opportunities collaboration brings to their organizations. Confidence in the representativeness and knowledgeability of the respondents is further strengthened by the fact that most organizations in these networks are rather small. Concerns regarding knowledge dispersion inside the organizations are thereby mitigated. Finally, in case a respondent deemed that another person in the organization was better suited to answer the questions we provided the opportunity to pass it on to that individual.

We attended meetings of both networks and informed the organizational representatives of our presence in advance. We did not, however, share the goal of our research. We explained how to complete the questionnaire and remained present to answer any questions; most questionnaires were completed during the meeting, and the respondents took the others home. Organizations that were absent at the meetings received the questionnaire by mail. To reach a high response rate, we sent email reminders after a week and made telephone calls; also, the network coordinator and the platform chairpersons helped us. The ultimate response rates were 97% for network A. There was one non-respondent, who was seriously ill and represented a small organization. The organization of our non-respondent was not observed by the other organizations to be reasonably central in the network; we, therefore, omitted this organization. The response rate was 100% for network B.

We collected data in two rounds: the first round was in March 2011 at network meetings as described above; the second round was in September and November 2011, probing for extra information from the alter organizations about the focal organization's knowledge about the recruitment and retaining of volunteers. This extra information gave us the opportunity to collect data on our dependent variable. Even though we sent email reminders and made phone calls, our response rate turned out to be lower: 84% of network A and 71% of network B. Nevertheless, this is still a high response rate considering the number of organizations selected and the task we have asked them.

Measures

Organizational reputation (dependent variable)

The organizations in our study heavily rely on volunteers as their main resource. Having a high reputation as a successful recruiter of volunteers (and, by proxy, as an organization that takes good care of its volunteers), in particular having a high reputation as being knowledgeable and able regarding the recruitment of volunteers is a key performance indicator in this sector. In our empirical context, reputation relates to the perceived quality of an organization's services or competences compared with the perceived quality of services or competences offered by other actors in the network (Sorenson, 2014). We asked organizations in the networks the following question: "In your opinion, which organizations in the network (excluding your organization) possess the most valuable knowledge regarding the recruitment and retention of volunteers? Please select a maximum of 5 organizations." Owning valuable knowledge about how to attract and retain volunteer is a crucial performance resource in this industry and is directly connected to the organization's reputation vis-à-vis volunteers.

It is not the absolute level of knowledge that makes organizations in this industry thrive or fade away, but the extent to which one organization knows more than other network actors. If all organizations were to double their knowledge of volunteer recruiting, they would all still end up with the same piece of pie each had before, leaving their volunteer-recruiting performance unaltered. Rather, what matters is who is seen as the more knowledgeable and who has a lower reputation than others: organizations with the highest perceived *relative* levels of knowledge are in the best positions to sustain themselves and operate successfully. Hence, our operationalization of an organization's reputation as the extent to which it is considered by its peers to be among the most knowledgeable organizations of the network.

We counted how frequently each organization was mentioned as belonging to the reputation-top-5. To create the required *relative* measure, we divided this count by the total number of organizations in each network. The reputation variable thus captures the proportion of organizations in the network that indicate that the focal organization belongs to the top five knowledgeable organizations.

Since organizations were scored by all other organizations, the data are more reliable than when the score had been assigned by a single (outside) organization or when organizations had been asked to self-assess their reputation (Raub and Weesie, 1990; Glückler & Armbrüster, 2003). Furthermore, research has shown that such peer ratings are also predictive of attractiveness as a partner and subsequent performance (Fonti et al., 2017).

Structural hole observations

1) Real inter-organizational network structure

To obtain the required network data for the independent variable, all representatives received list of all other organizations in their network. They were then asked: "With which organizations do you share knowledge?" The answers allowed us to compile a locally aggregated structure (LAS, the procedure is identical to Krackhardt, 1990). The ties where both organizations confirmed that they exchanged knowledge are taken to represent the "objective network." Figures 1a and 1b show the two objective networks with the organizations with the highest degree centrality positioned in the middle.

Insert Figure 1a and 1b here

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2) Observed inter-organizational network structure

Subsequently, we asked the representatives about the (observed) existence of direct ties between all other organizations in the network (same method applied by Casciaro et al., 1999). The survey question was: "According to you, which of the following organizations share knowledge with each other?" We presented the representatives of the organizations in each network with a matrix with the names of all organizations in the network (except their own) in the rows and columns. We asked each respondent to put the letter 'x' or a '1' in each cell where, to their observation, a knowledge exchange relation was present. As knowledge exchange ties are undirected, we blackened half of the matrix (as it was redundant). By these responses, we could construct the relational structure as perceived by each focal organization. As our data contains 65 respondents, we constructed 65 unique perceived networks.

3) Calculating the *structural hole measures*

Using the level of overlap between the objective network structure and the network as perceived (which is unique to each focal organization), we computed the perceived structural holes. Three independent variables for each focal organization were computed:

1. The number of accurately observed structural holes (*scenario 1*). These are structural holes that are present both in the objective network structure as well as in the network as observed by the focal organization.
2. The number of non-observed structural holes (*scenario 2*). These are structural holes that are present in the objective network structure but do not occur in the network as observed by the focal organization.
3. The number of false positives (*scenario 3*). These are structural holes that do not occur in the objective network structure but are present in the network as observed by the focal organization.

Because the two networks differ somewhat in size, we divided the count variables by the possible number of structural holes in that particular network. Our independent variables, therefore, capture the proportion of all possible structural holes in the network and are thus corrected for network size.

Control variables

We include control variables based on the characteristics of both the focal and the alter organizations. First, we control for the size of the ego-network of the organization. Doing so is critical because the three types of structural holes that we distinguish are affected by it. The larger the ego-network of an organization, the more (potential) structural holes and the more potential for (in)accurately observing those. It is important to note that as the degree centrality of a node increases, the number of triads it is involved in and therefore has to evaluate for the (non-)existence of structural holes increases more than linearly. We control for this by including either the degree centrality in the objective network or the degree centrality in the network as observed by ego in our models. Including both at the same time resulted in substantial multi-collinearity problems and we, therefore, refrained from doing so.

Second, we control for organizational size, indicated by the number of employees (paid and volunteers) of the organization. The size of an organization might influence both the level of (in)accurate observations of structural holes and organizational reputation. Larger organizations with more employees have more (human) resources at their disposal and are likely to have higher reputation levels as a result.

Third, we controlled for whether the organization is part of a subsidiary or local branch of a larger national organization. Those organizations might be less dependent on knowledge of their network but might instead rely more on knowledge of their parent organization's knowledge and experience. Their reputation might also be influenced by the affiliation with, and the (financial) support of, the parent organization.

Fourth, to prevent isolates from distorting our findings we included control variables to capture whether an organization is an isolate (i.e., it is unconnected to any other organization) in the network or not.

Fifth, we control for the overall level of network accuracy of the focal organization. We control for this because the (in)accurate perception of structural holes could be the result of a low/high overall level of network accuracy, which could also influence organizational performance (Fonti et al., 2015; 2017). We compare the focal organization's observation of the network with the objective network. In such a comparison every dyad of organizations can be classified in a two by two table (see table below). A tie can exist between organizations and the focal organization accurately perceives this (cell d) or it can believe that the two organizations are unconnected (cell b). Alternatively, a non-existing tie can correctly be perceived by the focal organization (cell a) or it can be missed (cell c).

		Objective relation between organizations 'i' and 'j'	
		Absent	***Present***
Perception of organization 'k' of relation between organization 'i' and 'j'	***Absent***	***a***	***b***
	Present	***c***	***d***

A simple approach would be to use percentages to assess network accuracy by, for example, calculating the percentage of existing relations that is accurately perceived (d/(d + b)) or the percentage of accurately perceived absent relations (a/(a+c)). Other options would be to use the percentage of identified relations that is accurate (d/(d+c)) or the percentage of absently perceived relations that is accurate (a/(a+b)). However, more nuanced measures incorporate these multiple 'types' of accuracy at the same time. Following a review by Gower and Legendre (1986) of 15 possible measures that capture the correspondence in such 2x2 tables Krackhardt (1990) opted to use a measure called 's14'. This measure was chosen for its high resolution (appropriate sensitivity to small changes in correspondence) and low nonlinearity (low distortion at extreme values). Mathematically 's14' takes the following form:

$$Network\ Accuracy\ = \frac{ad - bc}{\sqrt{(a + c)(b + d)(a + b)(c + d)}}$$

This formula can be rewritten to show how this statistic combines the four different 'types' of accuracy referred to in the above (Krackhardt, 1990):

$$Network\ Accuracy\ = \sqrt{\left(\frac{a}{a+c}-\frac{b}{b+d}\right)\left(\frac{a}{a+b}-\frac{c}{c+d}\right)}$$

ANALYSES

Since our dependent variable 'reputation' is an attribute-based ratio variable based on a count variable with over-dispersion (mean = 3.73, variance = 12.63), we used negative binomial regression models with clustered standard error (at the network level) (Woolridge, 2002). The choice for a negative binomial over a poisson model was further supported by a goodness-of-fit-test ran after running a poisson model (sig < 0.000). Nevertheless, to assess the sensitivity of our analyses to different model specifications we ran several robustness tests. Specifically, we performed Poisson regressions and OLS-regressions with a log-transformed dependent variable as these are often used as alternative model specifications for the type of dependent variable we have. All analyses were performed using StataSE 15. All models yield highly similar results in terms of the direction of coefficients and their significance (see Table 4). As such, we conclude that our results are not particularly sensitive to (small) changes in the model specification. We report our regression coefficients as elasticities to be able to compare the variables within a single model and detect any difference between the models. We include the descriptive statistics and bivariate correlations for all of our variables in Table 2.

Insert Table 2 here

The correlation matrix shows that several bivariate correlations are relatively high with the correlation coefficient between the number of accurately observed structural holes ("correct positive") and the number of inaccurately observed structural holes ("false positive") as the most striking example (*r* .94). However, the variance inflation factors (VIF) show values below

10 when all three scenarios are in the same model. This is below the upper threshold for multicollinearity problems. However, when we include the objective degree centrality and the perceived degree centrality in the same model the VIFs exceed this threshold. We, therefore, opted to present two sets of our models including one of these control variables per model.

Despite the VIFs remaining within the accepted boundaries, we explored the issue of the high bivariate correlations more in depth and found that two extreme scoring organizations partially cause them. Specifically, within the data set two organizations observed all organizations as connected. Therefore, they observed many triplets within the network and no structural holes. Excluding these organizations reduces the correlations considerably (e.g., from $r = .94$ to $r = .83$). However, the results of our negative binominal regression analyses remain unchanged. Therefore, we use our full sample in the analyses.

RESULTS

Table 3 shows the results of the negative binominal regressions. Models 1 and 6 include the control variables only and show that several of the control variables have a statistically significant influence on organizational reputation. Both organizational size (positive) and the network dummy (negative) impact on this variable. In model 1 (but not in model 6) the control variables capturing isolates (negative) and overall network accuracy (positive) are also statistically significant highlighting the importance of controlling for them.

Insert Table 3 here

Models 2-4 and models 7-9 show the results for each scenario. These models are presented to verify that the results are robust to the in- and exclusion of specific independent variables.

However, as the scenarios are logically dependent on each other, below we will mainly discuss the results based on the full models 5 and 10.

Correctly perceived structural holes (“correct positives”) have a positive and statistically significant effect on organizational reputation. Moreover, the effect of the objective degree centrality becomes statistically insignificant when the number of “correct positives” is included. As such, our results provide strong support for hypothesis 1.

The number of non-perceived structural holes (“false negatives”) has a positive influence on the level of organizational reputation. In model 10 this effect is statistically significant, whereas it is not in model 5. This provides weak support for hypothesis 2.

We also hypothesized that observed structural holes had a more strongly positive effect on organizational reputation than structural holes that were unobserved. Indeed, the “false negative” effect is significantly lower than that of correctly perceived structural holes ($p = 0.03$ in model 5, $p < 0.001$ in model 10). Taken together this is strong evidence that organizations benefit most from bridging structural holes when they accurately observe that they are doing so.

Considering hypothesis 3, the number of falsely-perceived structural holes (“false positives”) has, as hypothesized, a negative influence on organizational reputation in all models. However, the effect is only statistically significant in model 10. We interpret the consistency of the point estimates with our hypotheses and the statistical significance of the effect in model 10 as weak support for hypothesis 3.

Table 4 summarizes the results of our hypotheses. Overall, the findings suggest that what an organization observes is key to gaining organizational reputation from its structural network position. Accurately observing structural holes results in large and positive reputation effects. Structural holes that do exist but are overseen convey much weaker, if any, reputation effects. On the other hand, observing structural holes that are not there can harm organizational reputation. This set of findings provides strong support for the importance of taking the perceptions of networks in consideration when explaining the (organizational) outcomes of network involvement.

Table 4: Results (in)accurately observing structural holes and organizational reputation

<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="2">Structural hole observed by the focal organization</td></tr>
<tr><td>Yes</td><td>No</td></tr>
<tr><td rowspan="2">Structural hole in the objective network</td><td>Yes</td><td>Scenario 1 (“Correct positive”):
Highest reputation effects
Supported</td><td>Scenario 2 (“False negative”):
Intermediate reputation effects
Weakly supported</td></tr>
<tr><td>No</td><td>Scenario 3 (“False positive”):
Negative reputation effects
Weakly supported</td><td>-</td></tr>
</table>

Robustness Tests

To assess the sensitivity of our analyses to different model specifications we conducted several robustness tests (see Table 4). First, we ran our models using several alternative model specifications. Specifically, we performed Poisson regressions (model 11-12) and OLS-regressions with a log-transformed dependent variable (model 13-14). All models yield highly similar results in terms of the direction of coefficients. The significance of the various coefficients reaffirms our conclusion that support for hypothesis 1 is strong, whereas the support for hypothesis 2 and 3 is weaker in the sense that statistical significance of the underlying coefficients is relatively sensitive to changes in the model specification.

Second, we ran our models excluding the isolated organizations (model 15-16), excluding the two most central organizations (model 17-18) and including only the organizations from network 1 (model 19-20) or network 2 (model 21-22). This, of course, causes the number of observations to drop substantially, which has implications for statistical significance. However, the fact that the point estimates maintain their expected signs and relative magnitudes indicates that our results also hold in the sub-samples under scrutiny.

Third, we reran our models using different computations of network accuracy. Gower and Legendre (1986) provide a review of such measures. As a test of our model sensitivity, we computed many of their measures and found them all to be extremely highly correlated (r > 0.90) for our data and, therefore, yielding results virtually identical to the ones reported in Table 3. For illustration, in models 23-24 in Table 4 we show the results for one exemplary alternative accuracy measure ("s9") that 'punishes' for mistakes more than our original measure:

$$alternative\ accuracy\ measure = \frac{a + d - (c + b)}{a + b + c + d}$$

The results are very similar to our original results.

Insert Table 4 here

DISCUSSION

In this study we assessed how organizations behave as they make sense of their ambiguous position in their complex environment and how this behavior affects their reputation vis-à-vis their peers. Specifically, we argued and tested the idea that the extent to which a firm can actually benefit from structural holes depends on whether it accurately observes that it spans those structural holes. Our main findings in this regard can be summarized as *'perception of the structure is everything.'* In this sense, we strike a balance between the structuralists' perspective *'structure is everything,'* and the behavioral perspective *'perceptions are everything'* (Fonti et al., 2015).

On the one hand, perception is critical to understanding the effects of structural holes on organizational outcomes like organizational reputation. Unnoticed structural holes do not significantly impact on organizational outcomes. In other words, return-on-structural-holes depends on their accurate observation. To truly understand the effects of the observation of structural holes they need to be compared with the actual structure. An organization that perceives itself to be bridging structural holes that do not exist suffers from adverse reputation effects. So perception and structure, and *perception of the structure* to be more precise, should go hand-in-hand if we want to explain the impact of network position on an organizational outcome like organizational reputation (Casciario et al., 2015).

These main findings signal that (the accuracy of) network and tie observations need to take center stage in both network theories and future network research. This need is underlined by the dual observation that 1) perceptions of networks can be highly inaccurate even in small networks (Casciaro, 1998; Casciaro et al. 1999; Kilduff et al., 2008; Fonti et al., 2015; Knoben et al., 2018; Marineau et al., 2018), and 2) studies on inter-organizational networks often tend to focus on large and complex network structures (Schilling and Phelps, 2007). This implies that inaccuracy of observations of network structures in inter-organizational settings is more likely to be the rule than the exception. Hence, the need to understand the antecedents of (in)accurate network observations and the mechanisms through which these observations impact on organizational outcomes follow from our work.

About the latter, the point of departure should be the insight that similar network positions can produce differential organizational outcomes, depending on the accuracy of the observations by the actor. Without accurate observations of one's position in the network, successful focused exploitation of a structural hole is not possible; moreover, the potential for successful "tertius gaudens" activity is lost on the potential broker. The more accurate the observation of one's network position, the more sophisticated network strategies become possible (Rowley and Baum, 2004; Knoben et al., 2019). This notion is very much in-line with recent advancements in network theory that call for bringing the agent back into network research (Gulati & Srivastava, 2014; Ibarra et al., 2005), more specifically, in brokerage theory—with its shift of focus from the network structure to the brokerage behavior of actors (Obstfeld et al., 2014). Our findings complement this development by emphasizing the need to study whether the behavior an organization picks based on its perception of its network structure is in accordance to the objective network position occupied by the organization. Attempting to "tertius gaudens" whenever a brokerage position is not present is likely to backfire on the organization as is illustrated by our findings. Future network research should, therefore, focus on the trinity of structure, observation, *and* behavior in order to more fully account for the performance effects (both positive and negative) of networks. Whereas our research has uncovered the importance of the first two, the fact that we cannot observe actual brokerage behavior could, therefore, be seen as a main limitation of this study.

The literature on brokerage as a process makes an explicit distinction between the network positions that allow for brokerage and the possible strategic orientations that are adopted by the broker. Our paper extends this literature by introducing network perception into this equation: behavioral choices may not be valid when the broker attempts them when operating from an inaccurate perception of his position in the network. For example, acting on the advantages that a "tertius gaudens" orientation can bring a broker in the context of a structural hole can, in fact, harm the broker if he turns out to not span a structural hole. Similarly, a broker may not even consider acting as a conduit if he is unaware of the disconnectedness of two alters. In sum, adding network perception to the brokerage-as-a-process literature can add to the explanation of why and when brokers do (not) engage in particular brokerage orientations and why and when the theorized advantages are likely to be received.

About the former, it has been widely acknowledged that inter-organizational ties are excellent knowledge sharing conduits (Powell et al., 1996). Even though most extant research has focused on the transfer of technological knowledge, this argument could also apply to knowledge about the network structure itself (Borgatti & Cross, 2003; Knoben et al., 2018). In other words, certain network positions might provide the information that is required to benefit from the network leading to a situation where one can 'have their cake and eat it too.' Such a 'network-based theory of network information accuracy' would fit with the path-dependent nature of network structures and positions (Ahuja et al., 2012). However, other drivers of network information accuracy could lurk below the surface as well. Whatever antecedents of network information accuracy are uncovered in the future, the link between network information accuracy and organizational performance found in this study means they will have considerable strategic importance.

Notwithstanding the strength and relevance of the implications of our research described above, two large limitations apply. First, our research (setting) has a specific feature that might impact on the generalizability of our results. Our research setting is non-profit whereas most brokerage studies take place in for-profit settings with significant incentives to get ahead of others. However, the setting of our study might be less specific than it seems at first glance. Specifically, in our research setting organizations in the network collaborate but at the same time compete (for volunteers and subsidies for example). Therefore, the principle of the shadow of the future is highly relevant to those organizations; they are likely to need each other in the future but are at the same time in competition. Hence, engaging in brokerage behavior by playing each other off in the present poses a risk since organizations might need each other in the future. Then again, this balance between competition and collaboration is present in many industries (Schilling & Phelps, 2007) and engaging in brokerage behavior, therefore, is considered risky business is most other settings as well (Rosenkopf & Padula, 2008).

Second, our research is cross-sectional and therefore does not incorporate the role of network dynamics. Network dynamics pose an additional challenge to organizations striving to gather accurate information about their network position as such information would need to be continuously updated. Organizations better able to do so would be better able to sustainably benefit from a structural hole positions whereas organizations not able to do so might see their network benefit evaporate as their network map becomes outdated. Extending our research by incorporating network dynamics therefore seems a logical next step.

Acknowledging that there are limitations and specifics to our setting that might hamper the generalizability of our results, we argue that our research has been able to capture generic network processes that are likely to unfold in many other settings as well. Studying the (accuracy of) perceptions of the network structure in other research settings is therefore likely to be a fruitful endeavor especially when future research would be able to link it to actual network behavior.

REFERENCES

Ahuja, G. (2000). Collaboration networks, structural holes, and innovation: A longitudinal study. *Administrative Science Quarterly*, *45*, 425-455.

Bekkers, R., Boonstoppel, E., & De Wit, A. (2017). Giving in The Netherlands Panel Survey-User Manual. Center for Philanthropic Studies, Vrije Universiteit Amsterdam, Amsterdam), Version, 2.

Bondonio, D. (1998) Predictors of accuracy in perceiving informal networks. *Social Networks*, *20*, 301-330.

Borgatti, S. P., & Cross, R. (2003). A relational view of information seeking and learning in social networks. *Management Science, 49*, 432-445.

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

Burt, R.S. (1997). The contingent value of social capital. *Administrative Science Quarterly, 42*, 339- 365.

Burt, R.S. (2000). The networks structure of social capital. *Research in Organizational Behavior, 22*, 345-423.

Burt, R.S. (2001). Bandwidth and echo: Trust, information, and gossip in social networks. A. Casella, J. Rauch, eds. *Networks and Markets: Contributions from Economics and Sociology*. Russell Sage Foundation, New York.

Burt, R.S. (2005). *Brokerage and Closure: An Introduction to Social Capital*. Oxford: Oxford University Press.

Burt, R.S., & Merluzzi, J. (2014). Embedded brokerage: Hubs versus locals. In: *Contemporary Perspectives on Organizational Social Networks* (pp. 161-177). Emerald Group Publishing Limited.

Casciaro, T. (1998). Seeing things clearly: Social structure, personality, and accuracy in social network perception. *Social Networks, 20*, 331-351.

Casciaro, T., Carley, K. M., & Krackhardt, D. (1999). Positive affectivity and accuracy in social network perception. *Motivation and Emotion, 23*, 285-306.

Castellani, B. and F.W. Hafferty, 2009, Sociology and Complexity Science: a New Field of Inquiry. Springer.

Coleman, J.S. (1988). Social capital in the creation of human capital. *American Journal of Sociology, 94*, S95-S120.

Deephouse, D.L., & Carter, S.M. (2005). An examination of differences between organizational legitimacy and organizational reputation. *Journal of Management Studies, 42*, 329-360.

Dekker, J. & P. de Hart (Eds.) (2009). *Vrijwilligers in Meervoud: Civil Society En Vrijwilligerswerk*. The Hague: The Netherlands Institute for Social Research.

Easley, D., & Kleinberg, J. (2010). Networks, crowds, and markets (Vol. 8). Cambridge: Cambridge University Press.

Fehr, E. & U. Fischbacher, (2004). Third-party punishment and social norms. *Evolution and Human Behavior, 25,* 63-87.

Ferraro, G., Iovanella, A., and Pyka A. (2018). Call for Papers: Journal of Business Research, Special Issue on "Complexity: challenges and opportunities". Retrieved from https://www.journals.elsevier.com/journal-of-business-research/call-for-papers/special-issue-on-complexity-challenges-and-opportunities.

Fonti, F., M. Maoret & R. Whitbred (2015). Cognitive Categorization and Network Perception: Cognitive Aggregated Social Structures in Opaque Networks. In: G. Gavetti, & W. Ocasio (Eds.), *Cognition and Strategy*, Vol. 32: 147-179. Bingley: Emerald Group Publishing Ltd.

Fonti, F., M Maoret & R. Whitbred (2017). Free-riding in multi-party alliances: The role of perceived alliance effectiveness and peers' collaboration in a research consortium. *Strategic Management Journal, 38*, 363-383.

Gargiulo, M., & Benassi, M. (2000). Trapped in your own net? Network cohesion, structural holes, and the adaptation of social capital. *Organization Science*, 11(2), 183-196.

Glückler, J. & T. Armbrüster (2003). Bridging uncertainty in management consulting. The mechanisms of trust and networked reputation. *Organization Studies, 24*, 269-207.

Gower, J. C., & Legendre, P. (1986). Metric and euclidean properties of dissimilarity coefficients. *Journal of Classification, 3*, 5-48.

Grosser, T. J., Obstfeld, D., Labianca, G., & Borgatti, S. Measuring mediation and separation brokerage orientations: A further step toward studying the social network brokerage process. Academy of Management Discoveries, (in press). agement Journal, 61(3), 896-918.

Gulati, R., & S.B. Srivastava (2014). Bringing Agency Back into Network Research: Constrained Agency and Network Action. In D. Brass, G. Labianca, A. Mehra, D. S. Halgin, & S. P. Borgatti (Eds.), *Research in the Sociology of Organizations*, Vol. 40: 73-93. Bingley, UK: Emerald Group Publishing Ltd.

Hahl, O., Kacperczyk, A. O., & Davis, J. P. (2016). Knowledge asymmetry and brokerage: Linking network perception to position in structural holes. *Strategic Organization, 14*, 118-143.

Halevy, N., Halali, E., & Zlatev, J. J. (2019). Brokerage and Brokering: An Integrative Review and Organizing Framework for Third Party Influence. *Academy of Management Annals*, 13(1), 215-239.

Human, S. E., & K. G. Provan (1997). An emergent theory of structure and outcomes in small-firm strategic manufacturing networks. *Academy of Management Journal, 40*, 368-403.

Ibarra, H., M. Kilduff & W. Tsai (2005). Zooming in and Out: Connecting individuals and collectivities at the frontiers of organizational network research. *Organization Science, 16*, 359-371.

Johnson, L. (2015). A call for complexity: integrated models to solve complex policy problems. *Mind & Society*, 14(2), 259-271.

Kilduff, M., C. Crossland, W. Tsai & D. Krackhardt (2008). Organizational network perceptions versus reality: A small world after all? *Organizational Behavior and Human Decision Processes, 107*, 15-28.

Kirman, A. (2011). Complex Economics, Individual and Collective Rationality, The Graz Schumpeter Lectures.

Knoben, J., Gilsing, V. A., & Krijkamp, A. R. (2019). From homophily through embeddedness to strategy: The role of network accuracy in partner selection choices. *Long Range Planning*, 52(1), 86-102.

Knoben, J., Oerlemans, L. A. G., Krijkamp, A. R., & Provan, K. G. (2018). What Do They Know? The Antecedents of Information Accuracy Differentials in Interorganizational Networks. *Organization Science*, 29(3), 471-488.

Koka, B.R. & J. E. Prescott (2008). Designing alliance networks: The influence of network position, environmental change, and strategy on firm performance. *Strategic Management Journal, 29*, 639-661.

Krackhardt, D (1990). Assessing the political landscape - Structure, cognition, and power in organizations. *Administrative Science Quarterly, 3*5, 342-369.

Lange, D., Lee, P. M., & Dai, Y. (2011). Organizational reputation: A review. *Journal of Management*, 37(1), 153-184.

Lenz, R. T. (1981). 'Determinants' of organizational performance: An interdisciplinary review. *Strategic Management Journal*, 2(2), 131-15

Mariconda, S., & Lurati, F. (2015). Does familiarity breed stability? The role of familiarity in moderating the effects of new information on reputation judgments. *Journal of Business Research*, 68(5), 957-964.

Marineau, J., Labianca, G., P. Borgatti, S., Brass, D., & Vecchi, P. (2018). Individuals' formal power and their social network accuracy: A situated cognition perspective. *Social Networks,* 54, 145-161.

Martinez-Chafer, L., Molina-Morales, F. X., & Peiro-Palomino, J. (2018). The cluster is not flat. Uneven impacts of brokerage roles on the innovative performance of firms. *Business Research Quarterly, 21*, 11-25.

McEvily, B. & A. Zaheer (1999). Bridging ties: a source of firm heterogeneity in competitive capabilities. *Strategic Management Journal, 2*, 1133-1156.

Mischen, P. A., & Jackson, S. K. (2008). Connecting The Dots: Applying Complexity Theory, Knowledge Management And Social Network Analysis To Policy Implementation. *Public Administration Quarterly*, 32(3), 314-338.

Mulder, L.B., E. Van Dijk, D. De Cremer & H.A. Wilke (2006). Undermining trust and cooperation: The paradox of sanctioning systems in social dilemmas. *Journal of Experimental Social Psychology, 42*, 147-162.

Obstfeld, D. (2005). Social networks, the tertius iungens orientation, and involvement in innovation. *Administrative Science Quarterly, 50*, 100 - 130.

Obstfeld D., S. P. Borgatti & J. Davis (2014). Brokerage as a process: Decoupling third party action from social network structure. In: D.J. Brass, G. Labianca, A. Mehra, D.S. Halgin, S.P. Borgatti (ed.). *Contemporary Perspectives on Organizational Social Networks*, Research in the Sociology of Organizations, Volume 40, Emerald Group Publishing Limited, pp. 135-159.

Phillips, D. J., & Zuckerman, E. W. (2001). Middle-status conformity: Theoretical restatement and empirical demonstration in two markets. *American Journal of Sociology, 107*, 379-429.

Perry-Smith, J. E. (2006). Social yet Creative: The Role of Social Relationships in Facilitating Individual Creativity. *Academy of Management Journal, 49*, 85-101.

Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly,* 116-145.

Provan, K.G., A. Fish & J. Sydow (2007). Interorganizational networks at the network level: A review of the empirical literature on whole networks. *Journal of Management, 33*, 479-516.

Raub, W. & R. Weesie (1990). Reputation and efficiency in social interactions: An example of network effects. *American Journal of Sociology, 96*, 626-654.

Ravasi, D., Rindova, V., Etter, M., & Cornelissen, J. (2018). The formation of organizational reputation. *Academy of Management Annals*, 12(2), 574-599.

Rindova, V. P., Williamson, I. O., Petkova, A. P., & Sever, J. M. (2005). Being good or being known: An empirical examination of the dimensions, antecedents, and consequences of organizational reputation. *Academy of Management Journal*, 48(6), 1033-1049.

Rosenkopf, L. & P. Almeida (2003). Overcoming local search through alliances and mobility. *Management Science, 49*, 751-766.

Rosenkopf, L. & G. Padula (2008). Investigating the microstructure of network evolution: Alliance formation in the mobile communications industry. *Organization Science, 19*, 669-687.

Rowley, T. J., & Baum, J. A. C. (2004). Sophistication of interfirm network strategies in the Canadian investment banking industry. *Scandinavian Journal of Management, 20*, 103-124.

Schilling, M. A., & Phelps, C. C. (2007). Interfirm collaboration networks: The impact of large-scale network structure on firm innovation. *Management Science, 53*, 1113-1126.

Simmel, G. (1950). *The Sociology of Georg Simmel*. Trans. By K. H. Wolff. Glencoe, IL: Free Press.

Soda, G., Tortoriello, M., & Iorio, A. (2018). Harvesting value from brokerage: Individual strategic orientation, structural holes, and performance. Academy of Management Journal, 61(3): 896-918.

Stea, D., & Pedersen, T. (2017). Not all brokers are alike: Creative implications of brokering networks in different work functions. *Human Relations, 70*, 668-693.

Stuart, T.E. & J.M. Podolny (1996). Local search and the evolution of technological capabilities. *Strategic Management Journal, 17*, 21-38.

Tang, C. Y., Zhang, G. Y., & Naumann, S. E. (2017). When do structural holes in employees' networks improve their radical creativity? A moderated mediation Model. *R&D Management, 47*, 755-766.

Uzzi, B. (1996). The sources and consequences of embeddedness for the economic performance of organizations: The network effect. *American Sociological Review, 61*, 674-698.

Vasconcelos, F. C., & Ramirez, R. (2011). Complexity in business environments. *Journal of Business Research*, 64(3), 236-241.

Weigelt, K., & Camerer, C. (1988). Reputation and corporate strategy: A review of recent theory and applications. *Strategic Management Journal*, 9(5), 443-454.

Woolridge, J.M. (2002) Econometric Analysis of Cross Section and Panel Data. Cambridge, Massachusets, The MIT Press,

Zaheer, A. & G. G. Bell (2005). Benefiting from network position: Firm capabilities, structural holes, and performance. *Strategic Management Journal, 26*, 809-825.

Zhelyazkov, P. I., & Gulati, R. (2016). After the break-up: The relational and reputational consequences of withdrawals from venture capital syndicates. *Academy of Management Journal*, 59(1), 277-301.

Zhou, J., Shin, S. J., Brass, D. J., Choi, J., & Zhang, Z. X. (2009). Social networks, personal values, and creativity: Evidence for curvilinear and interaction Effects. *Journal of Applied Psychology, 94*, 1544-1552.

Table 2: Descriptive statistics and correlation (N=65)

	Variable	Mean	SD.	Min.	Max	VIF1	VIF2	1	2	3	4	5	6	7	8	9	10
1	Reputation	0.11	0.11	0	0.61	-		-									
2	Network (dummy)	0.53	0.06	0	1	1.28	1.23	-0.15	-								
3	Size	305.5	812.6	0	6000	1.06	1.07	0.24	-0.11	-							
4	Department	0.74	0.44	0	1	1.06	1.06	0.11	-0.01	0.00	-						
5	Isolate (dummy)	0.09	0.29	0	1	1.29	1.25	0.01	-0.23	-0.08	0.19	-					
6	Overall network accuracy	0.75	0.13	0.25	0.87	1.84	1.80	-0.01	0.20	0.01	-0.04	0.05	-				
7	Objective degree centrality	5.93	5.22	0	27	7.11	-	0.32	0.18	0.06	0.07	0.07	-0.28	-			
8	Perceived degree centrality	10.68	8.97	0	34	-	2.35	0.24	0.16	0.01	0.05	0.03	-0.21	0.85	-		
9	# “Correct positive”	0.01	0.03	0	0.23	9.14	8.44	0.35	0.05	0.05	0.05	0.28	0.06	0.75	0.58	-	
10	# “False negative”	0.01	0.02	0	0.18	2.95	1.87	0.11	0.07	-0.02	0.02	-0.06	-0.60	0.57	0.42	0.10	-
11	# “False positive”	0.00	0.01	0	0.06	9.76	9.97	0.32	0.07	0.10	0.09	0.25	0.08	0.76	0.64	0.94	0.09

Table 3: Results negative binominal regression analysis for organizational reputation

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
Network (dummy)	-0.236***	-0.231***	-0.236***	-0.237***	-0.224***	-0.197***	-0.209***	-0.215***	-0.207***	-0.221***
	(0.028)	(0.019)	(0.031)	(0.020)	(0.031)	(0.043)	(0.035)	(0.046)	(0.040)	(0.036)
Size	0.038***	0.038***	0.038***	0.039**	0.046***	0.046***	0.042***	0.046***	0.041**	0.050***
	(0.013)	(0.011)	(0.012)	(0.016)	(0.012)	(0.014)	(0.011)	(0.015)	(0.017)	(0.014)
Department	0.193	0.201	0.193	0.192	0.222	0.198	0.218	0.196	0.200	0.245
	(0.181)	(0.199)	(0.181)	(0.188)	(0.205)	(0.203)	(0.208)	(0.200)	(0.189)	(0.210)
Isolate (dummy)	-0.029***	-0.038**	-0.029***	-0.025	-0.036	-0.013	-0.047***	-0.013	-0.034	-0.044***
	(0.009)	(0.019)	(0.008)	(0.032)	(0.026)	(0.036)	(0.016)	(0.038)	(0.032)	(0.016)
Overall network accuracy	0.746***	0.579***	0.751***	0.840**	0.774***	0.438	0.213	0.815***	0.241	0.704***
	(0.173)	(0.071)	(0.255)	(0.349)	(0.043)	(0.411)	(0.306)	(0.274)	(0.243)	(0.048)
Objective degree centrality	0.361***	0.285**	0.360***	0.401**	0.319					
	(0.039)	(0.112)	(0.030)	(0.165)	(0.312)					
Perceived degree centrality						0.305***	0.143	0.277***	0.172	0.170
						(0.005)	(0.092)	(0.001)	(0.138)	(0.108)
# “Correct positive”		0.021			0.110***		0.059*			0.155***
		(0.042)			(0.008)		(0.033)			(0.016)
# “False negative”			0.000		0.005			0.021**		0.024***
			(0.005)		(0.030)			(0.009)		(0.009)
# “False positive”				-0.018	-0.166				-0.072	-0.176**
				(0.092)	(0.120)				(0.074)	(0.085)

N: 65, using clustered standard errors at the network level
* p<0.10, ** p<0.05, *** p<0.010

Table 4: Robustness Tests

	Poisson estimation		OLS with logged DV		Excluding isolates		Excluding central nodes (Degree Centrality > 25)		Network 1 only (N=31)		Network 2 only (N=34)		Alternative Accuracy Measure	
	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20	Model 21	Model 22	Model 23	Model 24
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
Network (dummy)	-0.227***	-0.226***	-0.177*	-0.155	-0.177**	-0.170***	-0.159**	-0.162***					-0.227***	-0.226***
	(0.029)	(0.028)	(0.018)	(0.034)	(0.087)	(0.046)	(0.075)	(0.035)					(0.029)	(0.028)
Size	0.045***	0.048***	0.000	0.000	0.052***	0.054***	0.045***	0.045**	0.055	0.067	0.047	0.025	0.045***	0.048***
	(0.011)	(0.013)	(0.000)	(0.000)	(0.008)	(0.018)	(0.014)	(0.023)	(0.254)	(0.255)	(0.158)	(0.167)	(0.011)	(0.013)
Department	0.204	0.223	0.283	0.304	0.243	0.255	0.296	0.292	-0.050	-0.039	0.652	0.467	0.204	0.223
	(0.207)	(0.206)	(0.177)	(0.194)	(0.277)	(0.222)	(0.355)	(0.253)	(1.002)	(1.014)	(1.115)	(1.066)	(0.207)	(0.206)
Isolate (dummy)	-0.036	-0.041**	-0.154	-0.229			-0.024	-0.024***	0.422	0.131	-0.078	-0.058	-0.036	-0.041**
	(0.026)	(0.017)	(0.218)	(0.117)			(0.016)	(0.005)	(1.123)	(0.614)	(0.270)	(0.267)	(0.026)	(0.017)
Alternative overall network accuracy	0.791***	0.803***	0.071	-0.031	0.543	0.499*	0.874***	0.875***	0.168	-0.005	0.539	0.669		
	(0.061)	(0.142)	(0.156)	(0.046)	(0.530)	(0.274)	(0.128)	(0.072)	(7.579)	(7.525)	(4.126)	(4.112)		
Objective degree centrality	0.249		0.071		0.129		-0.029		1 585		0.643		0.249	
	(0.309)		(0.058)		(0.715)		(0.734)		(2.678)		(1.606)		(0.309)	
Perceived degree centrality		0.139		0.022		0.058		0.001		0.407		0.454		0.139
		(0.122)		(0.007)		(0.309)		(0.316)		(0.946)		(1.275)		(0.122)
# "Correct positive"	0.100***	0.135***	0.005**	0.009***	0.139	0.156***	0.109	0.106***	0.820	0.103	0.206	0.175	0.100***	0.135***
	(0.014)	(0.012)	(0.001)	(0.001)	(0.114)	(0.024	(0.076)	(0.005)	(2.420)	(1.404)	(0.477)	(0.933)	(0.014)	(0.012)
# "False negative"	0.012	0.027***	-0.003	0.001	0.013	0.021***	0.080	0.075*	0.076	0.021	0.188	0.150	0.012	0.027***
	(0.029)	(0.006)	(0.005)	(0.001)	(0.050)	(0.006)	(0.106)	(0.040)	(0.308)	(0.249)	(0.516)	(0.487)	(0.029)	(0.006)
# "False positive"	-0.126	-0.136*	-0.022	-0.021	-0.139	-0.141	-0.072	-0.077	-0.262	-0.200	0.069	0.082	-0.126	-0.136*
	(0.109)	(0.082)	(0.029)	(0.015)	(0.116)	(0.118)	(0.153)	(0.134)	(0.917)	(1.006)	(0.736)	(0.473)	(0.109)	(0.082)
Alternative overall network accuracy													0.791***	0.803***
													(0.061)	(0.142)

* p<0.10, ** p<0.05, *** p<0.010

Figure 1a: Objective network structure network A (N = 35)

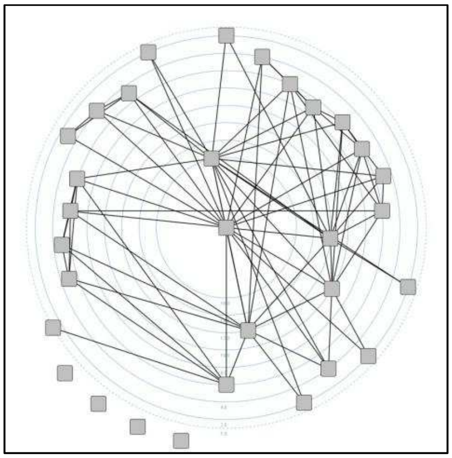

Figure 1b: Objective network structure network B (N = 31)