

SECTION 3. General issues in management

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Advice seeking network structures and the learning organization

Abstract

Organizational learning can be described as a transfer of individuals' cognitive mental models to shared mental models. Employees, seeking the same colleagues for advice, are structurally equivalent, and the aim of the paper is to study if the concept can act as a conduit for organizational learning. It is argued that the mimicking of colleagues' advice seeking structures will induce structural equivalence and transfer the accuracy of individuals' cognitive mental models to shared mental models. Taking a dyadic level of analysis authors revisit a classical case and present novel data analyses. The empirical results indicate that the mimicking of advice seeking structures can alter cognitive accuracy. It is discussed the findings' implications for organization learning theory and practice, addressed the study's limitations, and suggested avenues for future research.

Keywords: accuracy of cognitive models, advice seeking networks, cognitive congruence, imitation, mediating variable, organizational learning, structural equivalence, QAP-regression.

JEL Classifications: C12, D85, M10.

Introduction

Organizational learning can be described as a transfer of individuals' cognitive mental models to shared mental models (Kim, 1993; March and Olsen, 1975). But what are the carriers of learning in organizations? The question has been addressed by numerous scholars (e.g., Haunschild, 2009; Nagano et al., 2010; Vera and Crossan, 2004), and it has been suggested that social network structures act as important catalysts (e.g., Borgatti and Cross, 2003; Hannah and Lester, 2009).

The focus in this paper is to gain further knowledge about social network structures' role on organizational learning, and in particular we study if structural equivalence in advice seeking patterns can act as a vehicle for the transferring of cognitive models. Structural equivalence indicates similar network positions or structures (Lorrain and White, 1971), which implies that employees seeking the same colleagues for advice are structurally equivalent. Structural equivalence can explain the diffusion of innovations and business practices (Burt, 1987; Galaskiewicz and Burt, 1991). Despite of the concept appears to explain crucial organizational phenomena, its explicit role in the transferring of cognitive models is not well understood. Granted, Kang and Kim (2010) find that structural equivalence is related to knowledge transfer, but they measure knowledge transfer retrospectively as a subjective construct, which can have implications for their study's validity (cf., March and Sutton, 1997).

In this paper we study organizational learning and cognitive mental models as objective and not as a subjective constructs. More specifically, we study the accuracy of cognitive models, which we define as the correspondence between the real advice structure at the workplace (i.e., an objective benchmark) and an employee's perception of the same structure (Krackhardt, 1990). The definition is in line with Senge (1990), who describes a person's mental model as a cognitive or internal image of the workings of the world. Argyris and Schön (1978: 16) argue that "each member of the organization constructs his or her own representation, or image, of the theory-in-use of the whole. That picture is always incomplete." And they continue: "Inquiry into organizational learning must concern itself not with static entities called organizations, but with an active process of organizing which is, at root, a cognitive enterprise". In a similar vein Kim (1993: 39) states that "mental models not only help us make sense of the world we see, they can also restrict our understandings to that which makes sense within the mental model." It thus appears that Kim describes inaccurate mental models of the "real" world as a liability whereas high degree of accuracy is an asset. Studies likewise find that cognitive accuracy is associated with power, effectiveness, status, social knowledge, and social rank (Balkundi and Kilduff, 2005; Choi and Kim, 2007; Johnson and Orbach, 2002; Krackhardt, 1990).

Cognitive accuracy accordingly appears to be an advantage, and in particular we will argue that the mimicking of colleagues' advice seeking patterns can be related to the concept. Aarstad et al. (2010) state that structurally equivalent actors mimic the networking patterns of successful colleagues and

develop a pool of intangible resources. Studying entrepreneurs, they find that similarity in advice structures is related to higher joint performance. Taking a dyadic level of analysis, we elaborate further in this paper how the mimicking of colleagues' advice seeking networks will induce structural equivalence and transfer the accuracy of individuals' cognitive mental models to shared mental models. We develop three hypotheses which we test on a dataset from an entrepreneurial firm. Next, we discuss the findings, assess theoretical and practical implications for organizational learning, address the study's limitations, and suggest avenues for future research.

1. Theory and hypotheses

In Figure 1 we observe that employee i seeks k , l , and m for advice. If we also assume that j seeks k , l , and m for advice, we can say that i and j are structurally equivalent in advice seeking patterns (Lorrain and White, 1971). Said differently, the information i and j receive through their advice ties comes from similar or equivalent sources.

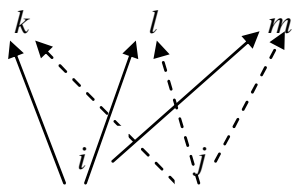


Fig. 1.

It is reasonable to assume that information passing through similar or equivalent network sources induce similarities in cognitive models. Heald et al. (1998) find that similarity in networking patterns is associated with shared cognitions in employees' interpretation of the social structure at the workplace. Studies also find that structural equivalence is related to similarity in behavior, e.g. studying entrepreneurs (Aarstad, Haugland and Greve, 2010; Galaskiewicz and Burt, 1991). Aarstad et al. (2010) report that entrepreneurs, who seek the same actors for advice, are more similar in performance than actors who seek advice from different sources.

Taken together, these studies can indicate that structural equivalence is instrumental for shared cognitions and similarity in behavior. If we relate the findings to cognitive accuracy, it is reasonable to assume that similarity in advice seeking patterns will induce i and j to have a more similar or shared cognitive accuracy of the advice structure than colleagues who are dissimilar in advice seeking patterns. This motivates the following hypothesis:

Hypothesis 1: Structural equivalence in advice seeking patterns is related to similarity in cognitive accuracy for pairs of employees.

So far, we have merely argued that structural equivalence is related to similarity in cognitive accuracy. In the following we elaborate how structural equivalence in advice seeking patterns can transfer the accuracy of cognitive models and act as a vehicle for learning in organizations. A premise for our arguing is that advice seeking patterns are related to imitation or mimetic behavior. Seminal works by organizational scholars state that the effects of mimetic behavior can be advantageous (DiMaggio and Powell, 1983; March and Olsen, 1976). Other scholars likewise argue that imitation is inherently creative, innovative and crucial for organizational learning (see Tsui-Auch, 2003).

Let us now assume that i at the outset seeks k , l , and m for advice, whereas this is *not* the case for j (e.g., j may either seek other colleagues for advice or seek no colleagues for advice at all). We furthermore assume that by seeking k , l , and m for advice, i has developed a high degree of cognitive accuracy (e.g., by seeking these colleagues for advice, i has learned what "really" is going on in the firm beyond any formal organizational chart). On the other hand, j , is at the outset relatively inferior in accuracy of cognitive accuracy. In order to increase her/his cognitive accuracy, j may feel inclined to imitate or mimic i 's advice seeking pattern¹.

By mimicking i 's advice seeking pattern, j may in turn gain access to equivalent or similar network resources. As a consequence, we can expect that j will improve her/his cognitive accuracy. According to our arguing above, this will result in that i and j will be more similar in cognitive accuracy than they were at the outset, but it will also result in that the pair of actors' cumulative or joint cognitive accuracy will be improved. Studying entrepreneurs, Aarstad et al. (2010) report that similarity in network structures is related to higher joint performance for pairs of actors, which is in line with our reasoning.

¹Granted, i 's high degree of cognitive accuracy is not necessarily explicitly visible, but we have referred to studies that relate the concept to power and influence (Balkundi and Kilduff, 2005; Choi and Kim, 2007; Johnson and Orbach, 2002; Krackhardt, 1990). Krackhardt (1990) also shows that employees are very consistent in whom they refer to as powerful. Thus, perhaps without explicitly being aware of i 's cognitive accuracy, j may feel prone to mimic i 's advice seeking pattern, due to i 's possible success at the workplace (e.g., by perceiving i as a powerful or influential colleague).

To generalize our way of thinking beyond *i* and *j*, we argue that employees with relatively low degrees of cognitive accuracy at the outset will have a general tendency to mimic the advice seeking patterns of one or more successful colleagues. This can act as a carrier of individuals' cognitive mental models to shared mental models. To paraphrase Argyris and Schön (1978: 17): "Organizational maps are the shared descriptions of organization which individuals jointly construct and use to guide their own inquiry... Whatever their form, maps have a dual function. They describe actual patterns of activity, and they are guides to future action. As musicians perform their scores, members of an organization perform their maps."

Thus, numerous employees may pursue parallel strategies as *j* in mimicking *i* or other successful colleagues' advice seeking patterns, which can have additive effects on the cognitive accuracy. Taken together, we sum up our discussion and advance the following hypothesis:

Hypothesis 2: Structural equivalence in advice seeking patterns is related to higher joint cognitive accuracy for pairs of employees.

We have assumed that *j* can improve her/his cognitive accuracy by mimicking *i*'s advice seeking pattern. A premise for this reasoning is that *j* imprints a cognitive map of the advice structure that is congruent with *i*'s cognitive map. Cognitive congruence deals with to what extent employees are *similar* in cognitive interpretation social network structures, *independent* of whether they have accurate cognitive perceptions or not (Heald, Contractor, Koehly and Wasserman, 1998). Accordingly, *j*, improves her/his cognitive accuracy by being more congruent with *i* in cognitive interpretation of the advice network than she/he was at the outset. Mediation explains why the effect of an independent variable on a dependent variable occurs (Baron and Kenny, 1986). We consequently argue that cognitive congruence mediates the proposed relationships between similarity in advice seeking patterns and joint cognitive accuracy. This motivates the following hypothesis:

Hypothesis 3: Cognitive congruence mediates the proposed relationship between structural equivalence in advice seeking patterns and higher joint cognitive accuracy for pairs of employees.

The concepts of cognitive congruence and cognitive accuracy are closely related, but they nevertheless deviate slightly – but importantly – in connota-

tion¹. We argue that applying cognitive congruence as mediating variable can partake in assessing the internal validity of the findings from this study, and we return to this issue when we discuss the results from the empirical analyses.

2. Method

2.1. Research context and data instrument. In this paper we revisit a classical case and present novel data analyses. The raw data was gathered by David Krackhardt from an entrepreneurial firm. At the time of the data collection, the firm had 36 employees (Krackhardt, 1990). This classical case has been applied in other studies (e.g., Kilduff and Krackhardt, 1994; Krackhardt and Kilduff, 1999), which adds validity to our contribution. The firm's business "involved the sales, installation, and maintenance of the state-of-the-art information systems... and was wholly owned by the three top managers..." (Krackhardt, 1990, p. 347).

A questionnaire was used to gather the data on real and cognitive advice structures. Directions about advice and help for work-related problems "were followed by 36 questions (e.g., "Who would Cindy Stalwart help or advice at work?"), each asking the same question about a different employee. Each of these 36 questions was followed by a list of 35 names, any of which the respondent could check off in response to the question" (Krackhardt, 1990, p. 349). 33 of 36 employees participated in the study.

2.2. Modeling the real advice network. A real or actual advice tie from one employee to another exists if both of them agree on both the relation and its direction. This is analogous with the term *locally aggregated structure* (Krackhardt, 1987), which has been applied in numerous other studies (e.g., Casciaro et al., 1999; Kilduff et al., 2008; Kilduff and Krackhardt, 1994; Krackhardt, 1990, 1992). In Figure 2 we graphically display the advice seeking network (names are reported with pseudonyms). For further details about the modeling of the real advice network, see Krackhardt (1990).

¹ I.e., whereas cognitive accuracy is the correspondence between the real advice structure and an employee's cognitive perception of the same structure, cognitive *congruence* deals with to what extent employees are similar in cognitive interpretation social network structures, *independent* of whether they have accurate cognitive knowledge or not.

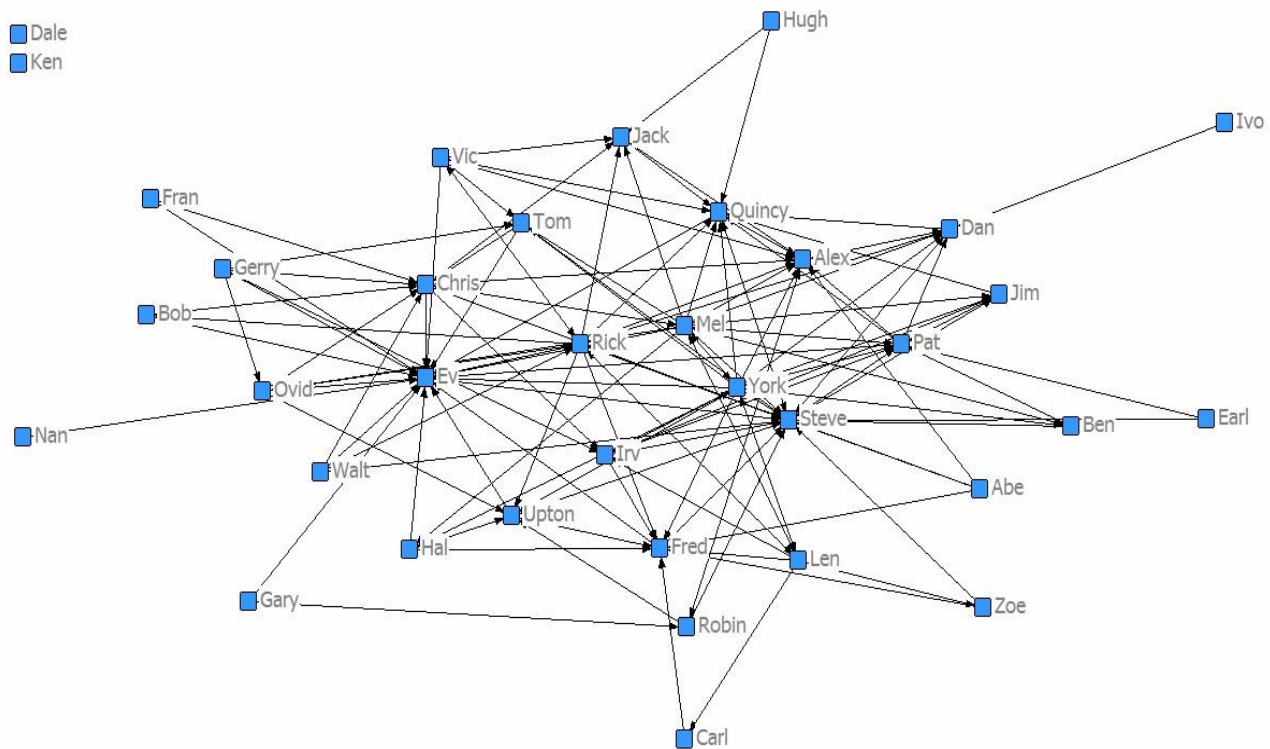


Fig. 2. A graphical display of the advice network

2.3. Structural equivalence in advice seeking patterns as independent variable. Studying the concept of similarity or structural equivalence in advice seeking patterns implies that we take a dyadic level of analysis on pairs of actors. Dyads are rarely perfect in structural equivalence, and a widely used measure to model the concept is to correlate each pair of actors' networking pattern (see Wasserman and Faust, 1994, pp. 368-375). In our context, this implies that we generate a matrix in which we assess the correlation coefficient in advice seeking patterns for each dyad, and the coefficient can theoretically take any value between -1 and +1. As noted, 3 out of 36 employees did not participate in the study. In addition, 2 out of the 33 respondents did not seek advice at all and were consequently deleted from the sample. We therefore remain with a sample size of 31, which implies that we have 465 dyadic observations ($[31^2 - 31] / 2 = 465$).

2.4. Dependent variables. The cognitive advice network for each employee was taken from the responses selected on the questionnaire. Each employee's cognitive map or matrix of the advice network was next correlated with the matrix of the real advice network (i.e., the locally aggregated structure), thus a high correlation coefficient implies a high degree of cognitive accuracy and vice versa. Following Krackhardt's (1990) suggestion, we deleted ego and her/his perceived and real relations from the respective matrices before correlating them.

2.4.1. Similarity in cognitive accuracy. To model similarity in cognitive accuracy between pairs of actors, we created a matrix in which we applied the absolute value in difference for each dyad. If i 's cognitive accuracy is .50 and j 's is .20, the i - j dyad's similarity in cognitive accuracy is .30 ($|.50 - .20|$).

2.4.2. Joint cognitive accuracy. Joint cognitive accuracy was modeled by creating a matrix in which we summarized each pair of actors' cognitive accuracy. E.g., if i 's accuracy is .50 and j 's is .20, the i - j dyad's joint accuracy is .70 ($.20 + .50$).

2.5. Cognitive congruence as mediating variable. To model cognitive congruence between pairs of actors, we correlated i 's cognitive network matrix of advice ties on j 's, repeating this procedure on all dyads in the sample. Next, we aggregated these correlates into a new data matrix. As with the concept of structural equivalence, the concept of cognitive congruence can theoretically take any value between -1 and +1.

Burt (1982) argues that structural equivalence can have a strong explanatory effect on organizational phenomena. We argue in this paper that structural equivalence is also a major carrier for the dependent variables, but due to limited space we do not elaborate in detail why we do not include other control variables than cognitive congruence (as a mediating variable) for this study. Upon request, however, the first author can provide a detailed note about this issue.

3. Results

Table 1 reports dyadic QAP (quadratic assignment procedure) correlations for 31 employees (i.e., 465 dyads). All the analyses are calculated in Ucinet 6.135 (Borgatti et al., 2002). The significance level is calculated by randomly permuting rows and columns for one matrix (by default) 5000 times (Borgatti, Everett and Freeman, 2002). Below we present the results of the hypothesized effects (due to limited space we do not discuss the descriptive statistics here, but upon request the first author can provide a detailed discussion).

Table 1. QAP correlations

	Min	Max	Mean	SD	SCA	JCA	CC
Similarity in cognitive accuracy (SCA)	0	.302	.071	.056			
Joint cognitive accuracy (JCA)	.513	1.01	.810	.088	-.346*		
Cognitive congruence (CC)	.151	.715	.433	.101	-.345**	.716***	
Structural equivalence in advice seeking	-.169	1.00	.196	.266	-.204*	.174*	.178*

Notes: Number of dyads = 465; * $p < .05$; ** $p < .01$; *** $p < .001$ (two tailed tests).

We hypothesized that structural equivalence in advice seeking patterns is related to similarity in cognitive accuracy (SCA) for pairs of employees, and we observe in Table 1 that the correlation between the concepts is negative and significant. This finding gives empirical support to hypothesis 1.

Next we hypothesized that structural equivalence in advice seeking patterns is related to higher joint cognitive accuracy (JCA) for pairs of employees, and Table 1 shows a positive and significant relationship between the concepts. Thus, also hypothesis 2 gains empirical support.

We furthermore hypothesized that cognitive congruence would mediate the relationships between structural equivalence in advice seeking patterns and higher joint accuracy of cognitive knowledge (hypothesis 3). To test this hypothesis we applied a multi regression technique developed by Dekker et al. (2007). By default, we applied 2000 random permutations, and the results are reported in Table 2. We observe that when controlling for cognitive congruence, the relationship between structural equivalence in advice seeking and joint cognitive accuracy is practically zero. Thus, hypothesis 3 gains empirical support in that cognitive congruence in practical terms fully mediates the relationship between structural equivalence in advice seeking patterns and joint cognitive accuracy (from a significant standardized coefficient of .174 to an insignificant coefficient of .048).

Table 2. QAP regression

Dependent variable	Joint cognitive accuracy
Cognitive congruence	.708***
Structural equivalence in advice seeking	.048
R-square	.515***
Adjusted R-square	.515

Notes: Number of dyads = 465. Standardized coefficients. * $p < .05$; ** $p < .01$; *** $p < .001$ (two tailed tests).

Discussion and conclusions

Organizational learning can be described as a transfer of individuals' cognitive mental models to shared mental models (Kim, 1993; March and Olsen, 1975). In this paper we have argued that employees with relatively inaccurate cognitive mental models may tend to mimic the advice seeking patterns of more successful colleagues. This can act as a transferring mechanism of learning and improve cognitive accuracy by the sharing of mental models. Thus, if an employee improves her/his cognitive accuracy by mimicking the advice seeking pattern of a colleague, this will increase the joint cognitive accuracy for the dyad members.

The mimicking of advice seeking patterns will furthermore induce structural equivalence or similarity in network structures, and we find that similarity (or structural equivalence) in advice seeking patterns is associated with higher joint cognitive accuracy (Table 1). Our result is in line with Aarstad et al. (2010), who report that similarity in advice structures is related to higher joint performance. They also argue that structurally equivalent actors mimic the networking patterns of successful colleagues and develop a pool of intangible resource. We also find that structural equivalence in advice seeking patterns is related to similarity in cognitive accuracy (Table 1). Having argued that *j* improves her/his accuracy by mimicking *i*'s advice seeking pattern, this in fact cannot be possible unless the dyad members also become more similar in accuracy.

To generalize our findings, we can infer from the empirical analyses that numerous employees pursue parallel strategies in mimicking other successful colleagues' advice seeking patterns, which leverages learning by the sharing of mental models. In a similar vein Argyris and Schön (1978: 19) argue that "in order for organizational learning to occur, learning agents' discoveries, inventions, and evaluations must be embedded in organizational memory. They must be encoded in the individual images and the shared maps..."

Our analyses, moreover, show that cognitive congruence mediates the relationship between structural

equivalence in advice seeking patterns and joint cognitive accuracy (Table 2). Assuming that *i* and *j*'s joint cognitive accuracy is a function of *j* mimicking *i*'s advice seeking pattern (which in turn improves *j*'s accuracy and induces her/him to be more similar with *i*), this process cannot take place unless *j* imprints *i*'s cognitive map of the advice structure. In our opinion, the mediating effect of cognitive congruence indicates that such a process takes place, and adds validity to our line of reasoning[§].

The explained variance of the empirical findings does not seem to be particularly strong. For instance, a correlation coefficient of .174 in Table 1 tells that similarity in advice seeking patterns explains a little more than 3% of the variance in joint cognitive accuracy ($.174^2 = .0303$). We must bear in mind, however, that the coefficient explains the variance in joint cognitive accuracy for each dyad in the sample. This implies that imitating the advice seeking pattern of not only one, but perhaps numerous colleagues can have an additive effect on joint cognitive accuracy. If we in addition assume that numerous colleagues pursue parallel mimicking strategies, the total impact on the sharing cognitive mental model can be substantial.

Implications for theory and practice

We have referred to studies that relate individuals' cognitive accuracy to power and influence at the workplace (Balkundi and Kilduff, 2005; Choi and Kim, 2007; Johnson and Orbach, 2002; Krackhardt, 1990). Thus, having accurate cognitive mental models appears to be beneficial for each individual, and in this paper we have assessed how structural equivalence in advice seeking patterns can leverage this ability. Research nevertheless indicates that cognitive accuracy can be beneficial beyond an individual level of analysis (e.g., at group level, organization level, or even at an inter-organizational level), and below we elaborate this issue.

Kim (1993: 43) states that organizational learning increases "an organization's capacity to take effective action", and Krackhardt (1992) argues that cognitive misinterpretations of strong informal friendship ties prevented an attempt to unionize the firm he was currently studying. It thus seems that cognitive inaccuracy in the labor union constrained effective action on their part. Said differently, cognitive

accuracy seems to be beneficial beyond an individual level of analysis in that it appears to leverage an organizational capacity to take effective action.

Close-knit network structures can increase performance (Lazer and Friedman, 2007), but Killworth et al. (2006) find that cognitive mistakes in predicting the shortest path length between actors are prevalent. In other words, despite that close-knit network ties can be beneficial; many employees appear to miss out the benefits of such structures due to cognitive misinterpretations. In another study, Greve (2009: 1) argues that "valuable innovations [in the shipping industry] remain rare because they are not adopted by distant firms in geographical and network space." A plausible hypothesis related to this statement is that valuable innovations would be more frequent if relevant actors had more accurate perceptions of the "actual" path-length between themselves and other network members. This paper has assessed how the sharing of mental models can facilitate cognitive accuracy of "actual" social network structures, which, as a consequence, also increases the awareness of the de facto path-length between network members.

Research has shown that the concept of structural equivalence can have crucial explanatory effect on organizational phenomena, such as innovation, the spreading of business practices and performance (Aarstad, Haugland and Greve, 2010; Burt, 1987; Galaskiewicz and Burt, 1991). In this paper we have emphasized that structural equivalence can transfer the accuracy of individuals' cognitive mental models to shared mental models. We argue that managers should be aware of how they can apply this insight. For instance, a first practical step (which is often done) can be identified and classified skilled employees along several dimensions (including cognitive accuracy, but also practical knowledge, intellectual knowledge, tacit knowledge, etc.). Subsequently, managers should aim to identify from which sources these skills have been acquired (e.g., advice seeking patterns, but also other sources such as coursework, certain experience, use of manuals, etc.) and make this information explicitly available for relevant employees, who are in need of similar knowledge. The mimicking successful colleagues' sources will induce structural equivalence, and the major implication from our study is that this may act as a carrier for the transfer of learning between employees.

Nevertheless, it might be intuitive to assume that learning is also transferred through cohesive direct ties between employees, and the research literature gives some support to this argument (Reagans and McEvily, 2003). Other studies point to that both structural equivalence and cohesion play complemen-

[§] Theoretically, we can also assume that *i* instead imprints *j*'s cognitive map. But since the similarity in advice seeking patterns is positively associated with joint cognitive accuracy, this is a likely result of *j* improving his/her cognitive accuracy, and not *i* deteriorating his/her cognitive accuracy (by imprinting *j*'s cognitive map of the advice structure). In the latter case, similarity in advice seeking patterns for *i* and *j* would have resulted in lower joint accuracy, which is contrary to what we find.

tary roles in explaining the diffusion of innovation, learning, and performance (Aarstad, Haugland and Greve, 2010; Harkola and Greve, 1995; Kang and Kim, 2010). A practical insight from these scholarly works accordingly is the complementary roles which cohesive ties might play *along* with structural equivalence as carriers of learning in organizations, and managers should be aware of these issues.

Argyris and Schön (1978) make a distinction between what they label as single-loop learning and double-loop learning in organizations. In brief, single-loop learning involves the detection and correction of error without further substantial changes in organizational practices or policies. Double-loop learning, on the other hand, "occurs when error is detected and corrected in ways that [also] involve the modification of an organization's underlying norms, policies, and objectives" (Argyris and Schön, 1978, p. 3). In this paper we have implicitly studied knowledge transfer as single-loop learning in that we have merely examined how structural equivalence can induce the detection and correction of employees' inaccurate cognitive maps of the advice seeking structure. We nevertheless emphasize that our contribution can have implications for the fostering of double-loop learning. A prerequisite for a successful and smooth modification of an organization's underlying norms, policies, and objectives, is that the employees share an accurate cognitive interpretation of the challenges at hand. In this paper we have illustrated that the concept of structural

equivalence can act as an important carrier for the sharing of accurate cognitive mental models.

Limitations and future research

Applying the concept of cognitive congruence as a mediating variable has indicated causal direction between structural equivalence in advice seeking patterns and joint cognitive accuracy, but the study's cross sectional design nevertheless limits a robust assessment of the internal validity. Future research should therefore deal with this issue, either by the use of instrumental variables, a longitudinal design or an experimental design.

We have argued that cognitive accuracy can be beneficial beyond an individual level of analysis, but it is a matter of fact that some employees have more accurate cognitive perceptions of social network structures than others. Future research should accordingly study in what ways the concept of cognitive accuracy is related to individual or collective benefits at the workplace. Questions may be: Is homogeneity in cognitive accuracy more beneficial for a collective of organizational members, whereas heterogeneity in accuracy will benefit a minority of members at the cost of a collective group? It is also likely to assume that contextual issues in terms of stable and simple versus unstable and complex environments can moderate the relationships between employees' cognitive accuracy and individual or collective benefits, and future studies should examine these issues.

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