EMERGENT LEADERSHIP STRUCTURES IN INFORMAL GROUPS: A DYNAMIC, COGNITIVELY INFORMED NETWORK MODEL

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KEYWORDS

Leadership Networks, Cognitive Schemas, Linear-ordering Schema, Network Dynamics, Informal Groups, Network Experiments, Stochastic Actor Oriented Models.

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ABSTRACT

This paper advances novel theory and evidence on the emergence of informal leadership networks in groups that feature no formally designated leaders or authority hierarchies. Integrating insights from relational schema and network theory, we develop and empirically test a 3-step process model. The model's first hypothesis is that people use a "linear-ordering schema" to process information about leadership relations. Taking this hypothesis as a premise, the second hypothesis argues that whenever an individual experiences a particular leadership attribution to be inconsistent with the linear-ordering schema, s/he will tend to reduce the ensuing cognitive inconsistency by modifying that leadership attribution. Finally, the third hypothesis builds on this inconsistency-reduction mechanism to derive implications about a set of network-structural features (asymmetry, a-cyclicity, transitivity, popularity, and inverse-popularity) that are predicted to endogenously emerge as a group's informal leadership network evolves. We find broad support for our proposed theoretical model using a multi-method, multi-study approach combining experimental and empirical data. Our study contributes to the organizational literature by illuminating a socio-cognitive dynamics underpinning the evolution of informal leadership structures in groups where formal authority plays a limited role.

Keywords: Leadership Networks, Cognitive Schemas, Linear-ordering Schema, Network Dynamics, Informal Groups, Network Experiments, Stochastic Actor Oriented Models.

INTRODUCTION

In recent years, both management scholars and practitioners have highlighted the growing importance of informal leadership as a basis for motivating and coordinating work within contemporary organizations (Denis, Langley, & Sergi, 2012). Increasingly, employees are expected to enact a "leader" or "follower" role based on an autonomous assessment of their own and others' behaviors within the workgroup, rather than on exogenously designated authority hierarchies (DeRue & Ashford, 2010). This bottom-up approach to leadership finds support in research suggesting that, when empowered to do so, group members are able to identify informal leaders who have the motivation and capability to help the group achieve its goals (Morgeson, DeRue, & Karam, 2010). Despite widespread recognition of the increasing importance of informal leadership relations within the contemporary workplace, we

know little about how such relations dynamically evolve – form, consolidate or erode – in groups that feature no formally designated leaders or authority hierarchies (DeRue & Ashford 2010).

Existing research on informal leadership posits that people tend to attribute leadership to those who they recognize as contributing most to the group's goals (Morgeson et al., 2010), but it emphasizes that such attribution processes are inherently socially constructed (Morgeson & Hofmann, 1999). For example, group members often come to regard a peer as their leader not owing to his/her superior contribution to the group, but because many other group members regard that individual as their leader (Balkundi & Kilduff, 2006). This "bandwagon" argument provides a well-established socio-cognitive explanation for why, in some groups, a single individual becomes a disproportionately salient target of leadership attributions (Krackhardt & Kilduff, 1999). Whereas some workgroups coalesce around a single leader (Schwartz, 2009), most develop more distributed leadership structures where multiple leaders and multifold leadership hierarchies coexist (Carson, Tesluk, & Marrone, 2007; Kilduff, Anderson, & Willer, 2013; Mehra et al., 2006). This empirical regularity suggests that besides the bandwagon effect, the evolution of leadership structures within informal groups may reflect other, more granular socio-cognitive mechanisms.

To illuminate how informal leadership structures evolve within workgroups, this paper advances a novel socio-cognitive model explaining how individuals' schematic cognitions of leadership dynamically influence whom individuals come (or stop) to regard as a leader, which in its turn shapes the overall evolution of the group's leadership structure. Existing arguments emphasizing the bandwagon effect explain how employees' attributions of leadership change as a function of the group's emerging consensus, that is, of how many others within the group have come to regard somebody as their leader. We extend these arguments by drawing insights from relational schema theory, a line of cognitive theory that examines the schematic cognitive structures – "relational schemas" – people employ to make sense of their and others' positions in a network of interpersonal relations (Baldwin, 1992; Brashears, 2013; Fiske, 1991, 1992; Janicik & Larrick, 2005). By providing theoretical depth into how people cognitively represent and respond to the leadership network emerging around them, relational schema theory makes it possible to link an intra-individual cognitive mechanism to the dynamics – formation and erosion – of informal leadership relations within a group.

Our proposed process model advances three causally related hypotheses. The first is that people hold a "linear-ordering schema" (DeSoto, 1960) for leadership relations. Like all relational schemas, the linear-ordering schema is an internalized knowledge structure, or cognitive representation, which people activate by default when trying to make sense of the relational structures surrounding them. Such cognitive representations provide schematic expectations about how interpersonal relations should be patterned and, thereby, constitute an important form of social knowledge that both enables and shapes people' understandings of interpersonal structures. The linear-ordering schema, in particular, is defined as a default expectation that a given type of relational structure should form a linear order, or ranking. Applied to the context of leadership relations, the linear-ordering schema may be defined as a default expectation that the structure of leader-follower relationships that develops around an individual form a coherent ranking order[2] (Fiske & Rai, 2014; Walker, 1976).

The hypothesis that people hold a linear-ordering schema for leadership relations constitutes the logical premise upon which we build the second hypothesis of our process model. If people's cognition of leadership relations is informed by a linear-ordering schema, then this schema should not only shape their internal representation of the leadership structure; it should also affect how people change – form, consolidate, or revisit – their own leadership attributions in response to the evolving leadership structure around them. Specifically, we posit that a focal group member should be more likely to come to perceive another member as a leader if that particular leadership attribution is schema-consistent, that is, if it meets the expectation of linear ordering when considered within the broader structure of leader-follower relations that is emerging around the focal individual. On the contrary, whenever the pattern of leadership relations around an individual renders a particular leadership

[2] The relational schema literature does not always formally define the liner-ordering schema. However, most if not all prior studies share the underlying intuition that dyads within linear-ordered structures should be partially rank-orderable. For the purpose of the present paper, we adhere to this view and define the linear-ordering schema as the expectation that the set of leader-follower relations that develop in the immediate surrounding of a focal individual should generate a coherent leadership ranking. We follow the formal definition of partial order which stipulates that the relation $\boldsymbol{R}$ on the set $\boldsymbol{X}$ is said to be a strict partial order of the elements in $\boldsymbol{X}$ if $\boldsymbol{R}$ satisfies the following conditions:
$x \prec x$, for all $x \in X$
if $x < y$ then $y \neq x$, for all $x, y \in X$
if $x < y$ and $y < z$ then $x < z$, for all $x, y, z \in X$

attribution incongruent with the expectation of linear ordering, the likelihood that the focal individual will stop seeing that particular group member as a leader should increase.

Lastly, our third hypothesis builds on the second one to derive implications about the network-structural features that are likely to emerge as a group's leadership network evolves. If group members are more likely to form and less likely to drop schema-consistent leadership attributions, then this micro-level mechanism should dynamically affect the overall structure of leader-follower relationships emerging within groups. In particular, we theorize that the leadership networks emerging within informal groups should endogenously develop five structural features – asymmetry, transitivity, a-cyclicity, popularity, and inverse-popularity – as a result of group member's interdependent attempts to dynamically align their own leadership attributions to the linear-ordering schema.

In synthesis, the ambition of our proposed theoretical model is to explain how a micro-level, intra-individual cognitive mechanism – alignment with the linear-ordering schema – contributes to shaping the evolution of informal leadership structures in groups featuring no formally designated leaders or authority hierarchies. To test this model, we develop a multi-method, multi-study research design. Study 1 uses a well-established experimental protocol from relational schema research (Janicik & Larrick, 2005) to examine the hypothesis that people cognitively represent informal leadership networks via a linear-ordering schema. Study 2 develops a novel experimental design to test the hypothesis that people are more likely to form schema-consistent leadership attributions and to drop schema-inconsistent ones. Finally, Study 3 examines the structural evolution of informal leadership networks within three independent, naturally occurring social groups. Using a Stochastic Actor-Oriented Model (Snijders, van de Bunt, & Steglich, 2010), it tests the hypothesis that informal leadership networks spontaneously evolve network-structural features characteristic of linear orderings.

THEORY

People Hold a Linear-Ordering Schema to Process Leadership Relations

The ability to act competently in social interactions requires people to develop a sufficiently accurate understanding of the interpersonal network within which they are embedded (Brands, 2013). However, learning any real-life network is a daunting task that far exceeds people's cognitive abilities (Kilduff & Krackhardt, 1994). Prior research has found that individuals resolve this problem by

activating relational schemas, that is, schematic expectations about how a given kind of interpersonal relation is likely to be patterned. Relational schemas help people process – memorize, interpret and recall – information about otherwise overly intricate interpersonal structures (Baldwin, 1992; Janicik & Larrick, 2005; Ridgeway, 2006). Like all cognitive representations, relational schemas do not yield perfectly accurate pictures of reality, and research has documented various systematic biases stemming from schema activation (Freeman, 1992; Kilduff et al., 2008; Kilduff & Krackhardt, 1999). Despite these biases, relational schemas are indispensable "information compression heuristics" helping people to cognitively map the network of interpersonal relations surrounding them and, as such, they are necessary to interact competently with others (Brashears, 2013; Crockett, 1982b).

A main line of research within the relational schema literature examines people's cognition of hierarchical relationships (De Soto, 1960). An interpersonal relationship is defined as hierarchical when the parties hold unequal and vertically differentiated roles, such that one party affects the views and behaviors of the other more than the other way around (Gould, 2003; Martin, 2009a, 2009b). While scholars studied various kinds of hierarchical relationships, including patronage and dominance, the bulk of relational schema research has focused on influence ties – who influences whom within a social group. A converging finding of this research is that when individuals try to learn their and others' position within an influence network, they activate a linear-ordering schema. This schema carries an implicit expectation that influence relationships must fit together as a coherent linear-ordered structure, or ranking (Walker, 1976). We build on this stream of literature to suggest that people use a linear-ordering schema when cognitively representing leadership relations. Similar to influence relations[3], leadership relations are hierarchical in the sense that they require inherently unequal and vertically differentiated roles (Brandts, Cooper, & Fatas, 2007; Fiske, 1991). On the one hand, regarding somebody as a leader in the group means more than being influenced by that person: it means endorsing his/her views and adopting a deferential attitude towards his/her decisions. Moreover, in return to

[3] Although related, leadership differs from influence relations. We emphasize two differences here. First, a distinguishing feature of leadership relations is that the follower perceives the leader as contributing to the valued goals of the group as a whole. This group-level element, by contrast, is not characteristic of influence relations. For example, *i* may influence *j* but this does not imply that *j* regards *i* as a leader (that is, as somebody who enables the group to achieve its shared goals). Second, a leadership relation exists only insofar as the follower endorses the leader. By contrast, *i* may influence *j* using tactics that require no active endorsement from *j* (DiMaggio & Powell, 1983).

followership, the leader is expected to provide guidance to followers and to take responsibility for decisions that might affect them (Kark & van Dijk, 2007). Research suggests that these unequal role expectations are an integral aspect of informal leadership relations. For example, DeRue and Ashford (2010) argue that for leadership relations to form, both leader and follower must overtly and repeatedly affirm their role inequality through behaviors appropriate to their respective roles. Because leadership relations are hierarchical in the sense just described, our first hypothesis is that people employ a linear-ordering schema when trying to make sense of a group's leadership structure.

Hypothesis 1: People use a Linear-Ordering schema to process information about leadership relations.

People Change their Leadership Attributions to Increase Consistency with the Linear-Ordering Schema

If people use a linear-ordering schema to cognitively represent leadership networks, as per our first hypothesis, then this schema should affect how people adjust their own leadership attributions in response to the leadership structure around them. Extant research shows that people strive to minimize the cognitive inconsistency arising whenever the actual pattern of relations around them strays from the appropriate relational schema (Smith & Collins, 2009). Whereas schema-consistent patterns reduce people's subjective uncertainty and increase their interpersonal effectiveness (Baldwin, 1992; Sanchez-Burks, Nisbett, & Ybarra, 2000), patterns that do not fit the relevant schema are harder to deal with as they require heightened cognitive effort and piecemeal information processing (Festinger & Hutte, 1954; Hebl, Tickle, & Heatherton, 2000). Minimizing the inconsistency between actual and schematic relational patterns is challenging because people have limited or no control over whom other group members regard as their leader. However, evidence shows that people restore cognitive consistency by changing *their own* perception of others so that the ensuing relational pattern may better align with the relevant relational schema (Heider, 1958; Hummon & Doreian, 2003).

This argument enables us to add nuance and precision to the notion that, when forming their own leadership attributions, people are influenced by the leadership attributions of those around them. Specifically, it suggests that people do not mechanically imitate others' leadership attributions. Rather, they use the linear-ordering schema as a cognitive map through which they assess whether their

leadership attributions fit within the leadership structure emerging around them and dynamically adjust those attributions to keep them in alignment with the schema. Building on this argument, our second hypothesis posits that people are more likely to form leadership attributions that are consistent with the linear-ordering schema and to drop those that are schema-inconsistent. That is, the probability that an individual will come to perceive a given group member as a leader should increase if that particular leadership attribution conforms with the schematic expectation of linear ordering when assessed against the pattern of leader-follower relations around the focal individual. On the contrary, whenever a particular leadership attribution violates the schematic expectation of linear ordering, the likelihood that the focal individual will stop seeing that particular group member as a leader should increase.

> *Hypothesis 2: When the pattern of leadership relations around an individual deviates from the linear-ordering schema, that individual will be more likely to modify his/her leadership attributions towards restoring linear ordering.*

Structural Evolution of Informal Leadership Networks

We have argued that, because people hold a linear-ordering schema for leadership relations (Hypothesis 1), they are more likely to come to regard somebody as a leader if that leadership attribution conforms to the schematic expectation of linear ordering, and to stop regarding somebody as a leader if that attribution is schema-inconsistent (Hypothesis 2). The final component of our proposed process model examines how this schema-based leadership attribution mechanism might drive the dynamic evolution of informal leadership structures within groups. Specifically, we identify a set of self-other, triadic, and group-level structural features – asymmetry, transitivity, a-cyclicity, inverse-popularity and popularity – that we hypothesize to emerge in informal leadership structures as a result of group members dynamically adjusting their own leadership attributions based on the linear-ordering schema.

Self-other leadership relations. A central part of relational schemas pertains to *self* in relation to *other* (Baldwin, 1992). In the linear-ordering schema, the self-other relation is expected to be asymmetric. In the context of leadership relations, asymmetry implies that if a group member *i* regards *j* as his/her leader, then *i* will expect *j* not to see *i* as his/her leader (in fact, *i* will expect *j* to see *i* as a follower). An implication is that people should be more likely to stop regarding a group member as their leader when the schematic expectation of asymmetry is violated, that is, when that group member

regards *them* as his/her leader. Consider the following illustrative example. Through the course of social interaction, Jane, who regards Mary as her leader, learns that Mary regards Jane as her leader. As long as Jane keeps regarding Mary as her leader, she will expect Mary to behave consistently with her leader role. Mary, however, will fall short of Jane's expectations because she, in her turn, expects Jane to enact a leader role. In addition to increasing Jane's subjective uncertainty, these schema-inconsistent experiences will signal to Jane that Mary may not have the leadership qualities Jane had initially ascribed to her. Consequently, the likelihood that Jane will stop regarding Mary as her leader increases.

In addition to affecting the probability that an existing leadership relation will erode, we propose that the expectation of asymmetry also affects the likelihood that a given leadership relation will come into existence. Consider a group member, Rebecca, who through the course of social interaction learns that Julia regards her as her leader. We contend that this realization reduces the probability that Rebecca will come to see Julia as her leader. Of course, the fact that Julia confers a leader identity to Rebecca does not entail that Rebecca will necessarily accept this identity (DeRue & Ashford, 2010). Nevertheless, it does imply that the probability that Rebecca will come to regard Julia as her leader should decrease: since regarding Julia as a leader would elicit inconsistent cognitions in Rebecca, Rebecca is more likely to avoid this possibility than she would be otherwise.

Hypothesis 3.a: The probability that a group member, i, will come (stop) to regard group member j as her leader decreases (increases) if j regards i as her leader.

Triadic leadership relations. A second component of relational schemas pertains to triadic (*self-other-other*) relations (Crockett, 1982a). Research posits that the linear-ordering schema implies *transitivity* in triadic relations (DeSoto, 1960). Going back to our example, the schematic expectation of transitivity suggests that if Mary regards Jane as her leader, and Jane regards Rebecca as her leader, then the probability that Mary will come to regard Rebecca as her leader increases. We contend that the realization that Jane regards Rebecca as her leader will affect Mary's leadership attributions in two main ways. First, Mary's assessment of Rebecca's leadership qualities will improve because Mary holds Jane's opinions in high consideration and Jane, in her turn, regards Rebecca as her leader. Second, as long as Jane regards Rebecca as her leader while Mary does not, Mary is more likely to face schema-inconsistent situations and to experience heightened subjective uncertainty in her relationship with Jane.

For both these reasons, learning that Jane regards Rebecca as her leader should increase the probability that Mary will come to regard Rebecca as her leader.

Hypothesis 3.b: The probability that group member i, who regards j as her leader, will come (stop) to regard h as her leader increases (decreases) if j regards h as her leader.

A-cyclicity describes the absence of cyclic relationship among members of a triadic which, according to network scholars, is a distinctive property of linear-ordered structures (Martin, 2009). Let us consider one more time a situation in which Mary regards Jane as her leader, who in her turn regards Rebecca as her leader. The schematic expectation of a-cyclicity is a logical extension of the asymmetry principle (Snijders et al., 2010: 51). Asymmetry implies that Jane is less likely to regard Mary as her leader because this would be inconsistent with the linear-ordering schema; *a fortiori*, this should be true for Jane's leader, Rebecca. Similarly, we posit that an existing leadership attribution that violates the a-cyclicity principle is more likely to erode than a schema-consistent one: if Jane's leader, Rebecca, regards Mary as her leader, the likelihood that Mary will stop regarding Jane as her leader increases.

Hypothesis 3.c: The probability that group member i will come (stop) to regard j as her leader decreases (increases) if j regards h as her leader, who in turn regards i as her leader.

Group-level leadership relations. Besides self-other and triadic patterns, we posit that the linear-ordering schema provides schematic expectations about group-level leadership patterns. In particular, the expectation of linear ordering suggests an "inverse-popularity" effect, whereby the number of group members an individual will come to regard as his/her leader should decline with the number of group members who regard him/her as their leader. There are two reasons for this prediction. First, a logical implication of the asymmetry argument is that the subset of group members who are "at risk" of being perceived as a leader by a given individual is inversely proportional to the subset of group members who regard that individual as their leader. Second, insofar people interpret others' leadership attributions through the lens of the linear-ordering schema, realizing that many group members see them as their leader signifies that they are capable of leading the group. In turn, this realization should reduce the probability that they will accept a follower identity by conferring a leader identity to others.

Hypothesis 3.d.: The number of group members that i *will come (stop) to regard as his/her leaders decreases (increases) with the number of group members who regard* i *as their leader.*

Finally, leadership researchers have argued that "an emerging leader who is perceived to be popular may benefit from a bandwagon effect" (Balkundi & Kilduff, 2006: 947). While we are not the first to argue that leadership attributions may reflect a bandwagon effect, we find it important to point out that such effect is consistent with the schema-based explanation advanced here. Insofar as having many followers means being at the top of the group's leadership order, the linear-ordering schema should cue individuals into ascribing greater leadership capabilities to members with many followers, while discounting members with few or no followers. For example, imagine that Sarah, who does not see Jane as a leader, learns through the course of social interaction that many other group members do. We suggest that this realization would lead Sarah to suspect that her assessment of Jane's leadership capabilities might be underrated, increasing the likelihood that Sarah will come to see Jane as her leader, too. By the same logic, Sarah would be more likely to stop seeing Jane as her leader if she would find out that most of the group does not regard Laura as her leader.

Hypothesis 3.e: The probability that group member i will come (stop) to regard j as her leader increases (decreases) with the number of other group members that regard j as their leader.

STUDY 1

Hypothesis 1 posited that people use a linear-ordering schema to process information about leadership relations. To test it, we performed a "network learning experiment" analogous to the one developed by Janicik and Larrick (2005: 351-2 - Study 1), who in their turn followed a long and well-established tradition of experimental research on relational schemas (De Soto, 1960; Henley et al., 1969; Freeman, 1992). This experimental approach leverages the fact that, although people's schemas cannot not be directly observed, they can be inferred by observing how subjects' learning rates change in schema-consistent versus schema-inconsistent conditions. If people hold a linear-ordering schema for leadership relations, as we hypothesized, then they should learn a leadership network with reasonable ease if it features the properties of linear-ordered structures. However, their learning rates should worsen steeply whenever the network deviates from the schematic expectation of liner ordering. If, on the contrary, subjects exhibit no discernible difference in learning rates under the schema-consistent versus schema-inconsistent condition, then it can be inferred that people do not use a linear-ordering schema to process information about leadership relations.

Participants

We recruited participants via a large university's Behavioral Research Lab comprising several thousand contacts, students as well as professionals. Sixty-one individuals signed up (42.6 percent male). Each participant received £10 as compensation. The experiment lasted one hour. Five individuals dropped out during the task and five failed to complete the task within the one-hour limit, leaving us with 51 participants (43 percent male, 63 percent students).

Procedure

Task. When entering the lab, participants were told that they would take part in a computer-based "network learning task designed to examine how quickly and accurately people learn patterns of social relations" (Janicik & Larrick, 2005: 351). We explained that the goal of the task was to learn the leadership structure ("who regards whom as his/her leader") among a group of four individuals: Al, Bob, Chris, and Doug. Since the group consisted of four individuals, participants had to assess twelve pairs (hence twelve possible leadership relations). Each relation was presented in a separate screenshot, and the sequence of appearance of the screenshots was random. Each screenshot contained the pictures of all four individuals, in a square layout, with arrows between pictures representing leadership relations. Participants guessed whether the sender of the tie considered the recipient of the tie to be a leader (e.g. "Does Bob regard Doug as a leader?"). Upon responding, participants were notified if their answer was true or false and then moved to the next screenshot. Participants were instructed that they had to identify all relationships correctly twice to complete the task. Such verification task, which was also used by Janicik and Larrick (2005), reduces the possibility that participants identify the correct leadership relations by chance.

Manipulation. We used a between-subject design with two conditions. In the first, participants had to learn a schema-consistent leadership network, that is, a network forming a coherent linear-ordered structure. In the second, participants had to learn a schema-inconsistent network, that is, a network with no coherent linear-ordered patterned. While the networks are similar to those used by Janicik and Larrick (2005), in their case the schema-consistent condition contains one more tie than the schema-inconsistent one. To eliminate this possible confounding factor, we imposed the same number

of ties in both conditions. We present a diagram of the leadership network used in each condition in figure 1. Participants were randomly assigned to conditions.

[Insert Figure 1 about here]

Measure. As in Janicik and Larrick (2005), our dependent variable was the number of trials needed to report all leadership relations correctly twice in a row.

Results and Discussion

We performed a one-way ANOVA to test whether participants in the schema-consistent condition required fewer trials to learn the leadership network than did participants in the schema-inconsistent condition. We found a statistically significant difference between the two conditions $F(1,49) = 6.60$, $p = .013$). In line with our prediction, participants in the schema-consistent condition ($n = 31$, $M = 7.94$, $SD = 3.51$) learned the network significantly faster than participants in the schema-inconsistent condition ($n = 20$, $M = 10.35$, $SD = 2.87$). We interpret these results as providing support for the hypothesis that people employ a linear-ordering schema when processing information about leadership networks, which corroborates the first theoretical claim of our process model.

STUDY 2

Building on the premise that people employ a linear-ordering schema to cognitively map leadership structures (Hypothesis 1), Hypothesis 2 states that people are more likely to form leadership attributions that are consistent with the linear-ordering schema and more likely to drop schema-inconsistent ones. Study 2 develops a novel experimental design to test this hypothesis.

Participants

Participants were recruited via a large university's Behavioral Research Lab. Sixty-nine individuals participated in this study (32 percent male). They received £5 for their participation (30 minutes). None of the participants in Study 1 participated in this experiment.

Procedure

Task. We told participants that they would participate in a computer-based study designed to examine how teams spontaneously organize themselves under conditions of limited information and high time pressure. We informed them that each participant would be randomly allocated to a team of four individuals and their three teammates were present in the lab. In fact, each participant's teammates

were computer-generated by the researchers, which was essential for the experimental manipulation. Participants were asked to engage in a pattern recognition task (developed by Foschi, Sigerson, Lai, & Foschi, 1990 and used in Troyer & Younts, 1997) which required them to assess which of two rectangles had the greatest white surface. Unlike what the subjects believed, the task had no correct answer (50% white surface in all rectangles) and hence there was no objective performance difference among their teammates. Participants were then asked to choose, among their teammates, one or at most two leaders who in their view would be able to help the team win an inter-team competition on the same task. Constraining participants' choice to between one and two leaders was necessary to ensure consistency in the experimental manipulation. Participants could not choose themselves as leaders.

Once participants made their leadership attribution(s), we showed them a network graph summarizing all leadership attributions made within the team: the participant's own leadership attribution(s) as well as those of his/her three teammates. The leadership attributions of the teammates constitute the experimental manipulation (see below). Upon seeing the leadership network, participants were instructed as follows: "Carefully examine who chose whom as a leader within your team. You now have the opportunity to reconsider your leadership choice(s) based on this information." If participants decided to change, they were asked to choose, again, between one and two leaders among their teammates. The experiment ended with a series of questions about participants' subjective experience during the task and about their teammates.

Manipulation. We produced the experimental treatment by manipulating the network of leadership attributions made by a subject's teammates, which, as said above, were in fact computer-generated. We created two conditions in a between-group design. In the first, the leadership choice(s) made by the subject fitted as a coherent linear-ordered pattern within the leadership network of the team as a whole, representing a schema-consistent situation. In the second, the participant's leadership choice(s) deviated from the linear-ordering schema. The schema-consistent and schema-inconsistent networks were identical to those used in Study 1. We randomly assigned 36 participants to the schema-consistent condition and 37 to the schema-inconsistent one.

Measures. We constructed two dependent variables. To capture whether people are more likely to modify their current leadership choices when these are inconsistent with the linear-ordering schema,

we measured the proportion of individuals who changed their leadership attribution(s) after seeing their team's overall leadership network. Additionally, we captured whether such changes were directed towards restoring linear ordering. As our experiment revolved around a small (four nodes only) size network, we calculated an aggregate, network-level index of linear ordering (Krackhardt's (1994: 97) "hierarchy index") before and after the change.

Results and Discussion

We found that 9.4 percent of participants chose to change their leadership attributions in the schema-consistent condition, while 51.4 percent changed them in the schema-inconsistent one (*z-value: 3.7, p* <0.01, based on a two-proportion z-test). This result implies that subjects whose leadership attributions were inconsistent with the linear-ordering schema were significantly more likely to modify those attributions. Furthermore, for those participants who chose to change their leadership nominations (*n*= 19), we tested whether the ensuing leadership network exhibited a more coherent linear-ordered pattern after the change. Corroborating our hypothesis, we found that the degree of linear ordering was higher after the change and the difference was significant at the *p* <0.01 level. This result indicates that when the network of leadership relations around an individual is incongruent with the linear-ordering schema, that individual tends to modify his/her leadership attributions towards restoring linear ordering.

STUDY 3

We have shown that people are more likely to form leadership attributions that are consistent with the linear-ordering schema and more likely to drop schema-inconsistent ones (Hypothesis 2). The third and final component of our proposed process model examines how this schema-based leadership attribution mechanism shapes the structural evolution of informal leadership networks in groups. Specifically, we hypothesized that because group members dynamically adjust their own leadership attributions based on the linear-ordering schema, groups' informal leadership structures tend to evolve towards increasing asymmetry, transitivity, a-cyclicity, inverse-popularity and popularity. To test this hypothesis, we conducted a longitudinal multi-sample field study.

Participants and Data Collection

We collected data on three separate cohorts of US undergraduate students involved in a university exchange program in a non-English speaking European country. There were no interactions

between the cohorts; each cohort participated in the program in 2008, 2010, and 2012. The sample consisted of 125 participants: 40 in the first cohort, 41 in the second, and 44 in the third. Most students did not know each other before the exchange program, allowing us to observe the emergence of a leadership structure from the inception of the group. We collected data at one-month intervals in each group. Demographic and individual-trait data were collected on the first day of the exchange program. The first wave of relational data collection took place one month after the start of the program. We carried out four rounds of data collection in the first cohort, three in the second and third cohort (due to the students' shorter stay in those cohorts). No restrictions or research manipulations were imposed on the group structure (Shelly & Troyer, 2001) and no research interventions were set up to influence the group's spontaneous dynamics. We randomly assigned same-gender students to rooms in the dorm (Hasan & Badge, 2015). All students within each cohort were involved in the same social and task-related activities, most importantly academic courses and study trips. Moreover, the social and task-related activities outside the group were limited because the students did not speak the local language and had few occasions for extended interactions with local residents. The absence of formally designated leaders and authority relations, and the fact that all respondents have homogeneous backgrounds and face the same social and task environments, make for an ideal context to test our theory. All students took part in each round of data collection.

While multiple conceptualizations of leadership co-exist in the literature (Northouse, 2012), the schema-based explanatory model we put forward should be sufficiently general to apply across such definitional differences. To ensure that our empirical findings are robust across different conceptualizations of leadership, we provided the three groups with slightly different phrasings aimed at capturing such different conceptualizations. Participants in the first group were asked to identify who they regarded as a leader for the group using the following question: "Who did you see as a leader for the group when it comes to class? Please place a check by the names of each person you saw as a leader when it came to class this past month." For this particular group, we followed scholars (e.g., Carson et al., 2007; Mehra et al., 2006) who suggested that in order to capture participants' personal and implicit theories of leadership the researcher should *not* provide an explicit definition of the term "leader." While this approach has the benefit of letting respondents use their implicit leadership theories, other

researchers noticed that it also has a possible drawback: respondents might have different conceptions of leadership, making it difficult for the researcher to compare their leadership choices. For that reason, participants in the second cohort were asked questions about two specific types of leaders (i.e., task and relationship leaders) and were provided with an explicit definition of each leadership type. Definitions were based on Yukl (2009): "Leadership is the act of influencing the activities of an organized group in its efforts toward goal setting and goal achievement. We are interested in who you perceived as two types of leaders during class this past month: 1) task leaders, who provide leadership when it comes to organization and planning and 2) relationship leaders, who provide leadership when it comes to making sure the group worked together as a team. Whom did you see as a task leader for class this past month? Whom did you see as a relationship leader for class this past month?"

By using the qualifications "for class" and "for the group," the questions used in study 1 and 2 emphasized an important aspect of leadership, that is, that leaders influence a group as a whole, not merely its individual members. While this phrasing is consistent with past research, it also introduces a potential ambiguity regarding our theoretical argument. Namely, when asked to indicate whom they regard as a leader for the group, respondents may think about whom they think *the group* regards as a leader. To eliminate this possible ambiguity, in the third cohort we removed the qualifications "for class" and "for the group," thereby focusing respondents' attention on whom they regarded as *their* leader. All the questions used were pre-tested to ensure they were interpreted as intended. In all groups, respondents were free to nominate as many leaders as they deemed appropriate. This included the possibility of nominating no leaders at all.

For each cohort and each round of data collection, answers were coded into a binary, directed adjacency matrix following a standard practice in social network analysis (Wasserman & Faust, 1994). A one in cell (i,j) indicates that actor *i* regards actor *j* as a leader; a zero in cell (i,j) indicates that actor *i* does not regard actor *j* as a leader. We mapped respondents' leadership attributions onto an evolving network where nodes represent individuals and arrows represent leadership choices (Carson et al., 2007; Emery, 2012; Mehra et al., 2006). The direction of the tie distinguishes between leaders, who receive the tie, and followers, who send the tie.

Modeling the Evolution of Informal Leadership Structures

To analyze how leadership structures evolved in the three cohorts, we adopted statistical methods designed to model longitudinal network data, also known as Stochastic Actor Oriented Models (SOAMs). Extensive explanations of these models are in Snijders et al., 2010. Our operationalization follows Emery (2012) and Emery and colleagues (2013), who used SOAMs to estimate the dynamics of informal leadership networks. SOAMs assume networks to evolve in continuous time, implying that changes in interpersonal ties are a discrete outcome of a continuous-time Markov chain. This assumption fits with our theoretical argument, where individuals' choices to (stop to) regard somebody as a leader is a discrete, state-changing outcome ensuing from a continuous-time process of social interaction. Further, a key characteristic of these models is that they are actor-oriented, i.e., they assume tie formation and dissolution to reflect the "choice" of individuals to either regard or stop regarding specific group members as their leader(s). The model is formally expressed through an objective function that each individual actor attempts to maximize within a stochastic framework. In the specific context of our analysis, the objective function can be interpreted as an attempt to reduce the cognitive inconsistency faced when the pattern of leadership relations around an individual is incongruent with the linear ordering schema. In line with our theoretical argument, individuals cannot directly affect the leadership choices of other group members, but will attempt to reduce the cognitive inconsistency by adjusting their own leadership choices. Technically, individuals' leadership choices are expressed as a linear combination of three classes of effects – individual, dyadic, and structural (Snijders et al., 2010), allowing us to test our hypotheses while controlling for alternative causal mechanisms and explanations.

Individual variables. We control for gender because prior studies found that men are more likely emerge as leaders than women (Karakowsky & Siegel, 1999). As cognitive intelligence and leadership emergence are positively related (Taggar, Hackett, & Saha, 1999), we used participants' Grade Point Average (GPA on a 4.0 scale) as a proxy for cognitive ability. Since research also found that people with higher self-esteem are more likely to be regarded as leaders (Atwater et al., 1999), we used the Rosenberg (1989) self-esteem scale to control for this effect. Finally, we controlled for the effect of self-monitoring, i.e., the ability to adjust one's behavior to better fit different social situations, as prior studies found that high self-monitors are more likely to emerge as leaders (Mehra, Kilduff, & Brass, 2001). We assessed self-monitoring by using Snyder's 25-item self-monitoring scale (1974).

For the third cohort only, we collected two additional control variables: network accuracy and Leadership Structure Schemas. Network accuracy is defined as "the degree of similarity between an individual's perception of the structure of […] relationships […] and the actual structure of those relationships" (Casciaro, Carley, & Krackhardt, 1999: 286) and is argued to be a source of advantage (Brands, 2013). To measure network accuracy, we first collected leadership Cognitive Social Structures (CSS), that is, participants' cognitive representation of the leadership relations existing among other group members. To do so, we extended Flynn and colleagues' approach (Flynn, Reagans, Amanatullah, & Ames 2006; Flynn & Wiltermuth, 2010) as follows. Each participant was presented with five randomly selected group members and asked to assess the outgoing leadership ties (who does X regard as a leader?) and incoming leadership ties (who does X regard as a leader?) of each of those group members. We repeated this procedure at each point of data collection. Each leadership CSS was then compared with its corresponding "actual" leadership network to obtain a measure of network accuracy (Simpson, Markovsky, & Steketee, 2011). We counted any deviation from the actual leadership network: both actual ties that were not reported by the respondent but existed in reality, as well as reported ties that did not actually exist. Our measure of network accuracy ranges from zero to one: zero represents a perfect match between the leadership CSS and the actual network, one indicates that the respondent's CSS is entirely inaccurate. DeRue and Ashford (2010) argue that individuals have implicit theories about how leadership should be structured in groups: while some individuals conceptualize leadership as concentrated in one unique individual, others envision leadership as shared among multiple teammates. As people's Leadership Structure Schemas (LSS) may affect people's leadership choices, we controlled for LSS using Wellman, Ashford, DeRue, & Sanchez-Burks' (2011) scale.

Dyadic variables. Past research suggests that the probability of a leadership relation to form depends on the frequency with which individuals interact as well as on the existence of friendship ties between them (Fernandez, 1991). We include two dyadic parameters to explicitly control for the impact of prior friendship (assessed at the beginning of each exchange program) and frequency of interaction between any pair of individuals within our groups (assessed at each round of data collection).

Structural effects. We include six structural effects. The first, *Density*, captures the tendency within a group to nominate many versus few leaders; including this control is important to retrieve

unbiased estimates for our parameters of interest (Snijders et al., 2010: 50). The remaining five structural parameters test hypotheses 3a through 3e, as summarized in Table 1. Hypothesis 3 predicts the *Symmetry* parameter to be negative: the probability that at time t_{+1} individual *i* will come (stop) to regard individual *j* as hi/her leader should decrease (increase) if *j* regards *i* as his/her leader at time *t*. Hypothesis 3b predicts that the *Transitivity* parameter be positive: if at time *t* individual *i* regards *j* as his/her leader, and *j* regards *h* as his/her leader, then the probability that *i* will come (stop) to regard *h* as his/her leader at time t_{+1} increases (decreases). Hypothesis 3c predicts that the *Cyclicity* parameter be negative: if at time *t* individual *j* regards *h* as his/her leader, and *h* regards *i* as his/her leader, then the probability that *i* will come (stop) to regard *j* as his/her leader at time t_{+1} decreases (increases). Hypothesis 3d predicts a negative *inverse-popularity* parameter: the probability that at time t_{+1} individual *i* will come (stop) to regard other group members as his/her leaders decreases (increases) with the number of group members who regard *i* as their leader at time *t*. Lastly, Hypothesis 3e predicts a positive *popularity* parameter: the probability that at time t_{+1} individual *i* will come to regard *j* as his/her leader increases with the number of other group members that regard *j* as their leader at time *t*.

[Insert Table 1 about here]

Results

Table 2 reports descriptive statistics and correlation matrices for each of the leadership networks examined. Providing *prima facie* support to our hypothesis 3a, the proportion of reciprocated leadership nominations decreased over time and this pattern was observed for all leadership networks (e.g., going from 5.6% to 3.5% for task-leadership and from 8.1% to 4.6% for relationship-leadership). Groups vary somewhat in terms of network centralization, that is, in the extent to which group members converge on a single leader. While the relationship-leader network remained relatively distributed, all other leadership networks tended to converge towards a small number of leaders, with network centralization scores ranging from 57% to 73.3%.

[Insert Table 2 and Table 3 about here]

In table 3, models 1 through 4 report the results of SOAMs estimating the evolution of the leadership network in each cohort. Consistent with previous research (Fernandez, 1991), we find that friendship relations do influence the emergence of leadership structures, as indicated by the positive

and significant parameters $\beta_{\text{Friendship}}$ in all networks. While we note a positive effect of social interaction on the proclivity to regard somebody as a leader in the generic and relationship-leadership domains, we also find that people are *less* likely to regard as task leaders people they frequently interact with (negative significant parameter $\beta_{\text{Social interactions}}$). While we did not have any strong theoretical prior for this result, it seems plausible that having frequent social interactions with a given group member might at the same time increase students' perception of a close match between that person and the prototype associated to "relationship" and "generic" leadership, while concurrently accentuating the mismatch with the task leadership prototype. We find no significant effect for gender, meaning that men were as likely to emerge as leaders as women, perhaps because our sample is composed of a majority of women. As one would expect, individuals are more likely to regard somebody as a task leader if s/he has a higher GPA, a finding consistent with previous research (Taggar et al., 1999). Interestingly, an individual's GPA does not significantly affect the probability that one will come to be regarded as a *relationship* leader. This finding aligns with the view that relationship leaders are not judged based on their task-related capabilities but, rather, on their interpersonal skills such as self-monitoring (Mehra et al., 2001). We find that higher self-monitors tend to be regarded as relationship leaders. When it comes to generic- and task-leadership, though, self-monitoring has no effect. Finally, consistent with previous studies (Atwater et al., 1999), individuals with greater self-esteem are more likely to emerge as leaders.

Density has a negative and significant coefficient across all models. This implies that over time group members become increasingly selective in choosing whom they regard as a leader, as one would expect. The parameters capturing our hypotheses 3a-3e are reported in the bottom rows of models 1 to 4. Importantly, the results are consistent across all observed leadership networks. This suggests that, even though each leadership domain (e.g., task- versus relationship-leadership) depends on distinct value criteria and identifies different individuals as leaders and followers, the mechanisms governing the evolution of informal leadership networks is similar in all cases. Specifically, the *Symmetry* parameter is non-significant and close to zero across all models. As we elaborate in more detail later, this finding does not provide support to Hypothesis 3a, which predicted a negative effect for *Symmetry*. Consistent with Hypothesis 3b, we find a positive and significant effect for *Transitivity* on all three types of leadership networks (models 1 to 4). Hypothesis 3c posited leadership attributions to be driven

by a-cyclicity. Our analyses provide partial support to this hypothesis. Individuals' leadership attributions are driven by a-cyclicity in the generic-leadership network (models 1 and 4). For the task- and relationship-leadership networks, the *Cyclicity* parameter is negative as hypothesized, but the effect is not statistically significant (models 2 and 3). Furthermore, we find partial support for Hypothesis 3d. For relationship and task leadership (models 2 and 3), the *Inverse-popularity* parameter has negative and significant effect, as hypothesized, which indicates that individuals who are regarded as leaders by a large (small) number of group members tend to regard fewer (more) others as their own leaders. However, this effect is non-significant in models 1 and 4. Finally, corroborating hypothesis 3e, we find a positive effect of the *Popularity* parameter across all models. This implies that the larger the number of group members who regard a given individual as a leader, the greater (smaller) the chances that other group members will come (stop) to see that individual as a leader.

DISCUSSION

As DeRue and Ashford noticed, a central but thus far unanswered question in leadership research is, how do informal leadership relations develop when there is no institutionalized authority hierarchy within a group (2010: 627)? To address this question, we developed and empirically tested a 3-step process model explaining how people' schematic cognition of leadership relations influences the evolution of informal leadership structures in contexts where formal authority plays no role. Integrating insights from relational schema research and social network theory, our proposed model links an intra-individual, cognitive mechanism to the dynamics of tie formation and dissolution that govern that evolution of informal leadership structures. We argued that group members employ a linear-ordering schema when they cognitively represent information about leadership relations; consequently, whenever the leadership network around them is inconsistent with the schema, they tend to adjust their own leadership attributions to reduce such inconsistencies. We derived from this argument a set of structural features – asymmetry, transitivity, a-cyclicity, inverse-popularity and popularity – that we hypothesized to emerge in informal leadership structures as a result of group members dynamically adjusting their own leadership attributions based on the linear-ordering schema. Using a multi-method, multi-study approach, we found broad (albeit incomplete) support for our argument.

Limitations

While the experimental results we presented provide support for all key theoretical claims postulated by our proposed process model, not all our hypotheses were fully corroborated in the empirical analyses of the naturally occurring groups. In particular, one result runs counter to our theoretical prediction in all empirical networks analyzed: we hypothesized asymmetry to drive people's leadership attributions, but the asymmetry parameter was non-significant across all SAOMs. Both methodological and theoretical reasons can account for this unexpected finding. Since we found experimental support for our argument in both study 1 and study 2, we speculate that the empirical models estimated using data on the naturally occurring groups may not perfectly control for factors counterweighing our asymmetry hypothesis. Specifically, while we do have information on friendship relations and frequency of social interactions, we suspect that controlling for these dimensions of a person's social network is not sufficient to isolate leadership dynamics as neatly as one can do in controlled experiments. The lack of support for our asymmetry hypothesis might also have theoretical justifications. Most notably, Gould (2003) argued that the emergence of social hierarchies generally reflects two conflicting motivations. On the one hand, people prefer to confer status to those who are higher status than they themselves are, which generates linear-ordered hierarchies. On the other, they want their "status-conferring gestures" to be reciprocated, which leads similar-status actors to exchange deferential gestures among each other. Insofar as regarding somebody as a leader entails conferring status to that person, Gould's model would suggest that similar-status actors might be motivated to reciprocate each other's leadership choices, something that would counteract the tendency towards asymmetry we hypothesized. We regard the prospect of incorporating Gould's status argument in our process model as an exciting opportunity for future research.

According to the dual-process paradigm, people activate either an automatic (e.g., System 1 which is fast and unconscious) or a conscious information-processing system (e.g., System 2 which is effortful, serial, logical, and controlled) when processing information. Leadership information is also treated by the dual-process model (Brown, 2012). Relational schemas fall squarely within System 1 (Baldwin, 1992). For instance, Schubert (2005) assessed that schemas are activated in a fraction of second and extensive research discussed how leadership perceptions result from an automatic unconscious recognition process (Epitropaki & Martin, 2004). However, people also make conscious

and deliberate decisions when it comes to endorsing others as leaders (or to gain others' endorsement). For instance, one might consciously adjust their behavior or use impression management to gain greater endorsement from others (Brown, 2012) or might consciously endorse a group member with high self-esteem as leader (Atwater et al., 1999). By focusing on relational schemas, our proposed explanatory model complements existing research on the role of deliberate thinking in leadership emergence.

Our theory and arguments build on the assumption that individuals are aware of the leadership relations evolving around them. This leaves open the question, is it realistic to assume that individuals have an understanding of whom their contacts regard as leaders? We begin by noticing that this assumption is consistent with most theories of social cognition, which assert that to be eligible for participation in any social interaction, individuals must be able to infer the relational pattern in which other group members are involved (Fiske, 1991, 1992; Jannick & Larrick, 2005; Ridgeway, 2006). According to this literature, people strive to form accurate cognitive maps of the social relations around them based on the social information they gather through situated action and interaction within the group (Horowitz, 1988; Howard, 1994; Ridgeway, 2006). Because such maps are an essential prerequisite for any individuals to gain legitimacy, effectiveness, and membership within a group, the simplifying assumption that people are able to sense the leadership relations around them seems a plausible building block on which micro-macro explanations can be founded (Martin, 2009). Nevertheless, research has shown that individuals vary in their ability to form accurate cognitive representations of relational patterns, and that rarely such representations are fully accurate (Janicik & Larrick, 2005; Krackhardt, 1990; Krackhardt & Kilduff, 1999). Given our research goal, our main preoccupation has been to ensure that our findings are robust to these individual-level differences. For that reason, we incorporated a control variable capturing differences in people's cognitive accuracy in one of our models (study 3, model 4). Rather than treating cognitive accuracy as merely a control variable, though, we believe it would be theoretically interesting to examine its impact on the evolution of leadership structures. Answering this question, which the present study left unaddressed, might further illuminate how relational schemas affect leadership emergence processes.

Contributions

This paper makes several contributions to the literature. First, despite increasing evidence that informal leadership networks have a profound effect on important individual and collective outcomes (Carson et al., 2007; Kilduff et al., 2013; Mehra et al, 2006), our study is one of the first to examine how such networks form and change over time. In order to go beyond the predominantly static view of leadership networks (Balkundi & Kilduff, 2006; DeRue et al., 2015), we developed and tested a novel process model explaining how informal leadership networks evolve within informal groups. Our proposed model responds to Carter, DeChurch, Braun, and Contractor (2015: 614)'s call for research that "identifies the *endogenous rules* or *principles* governing leadership emergence." We argued that because group members align their leadership attributions to the linear-ordering schema, informal leadership networks tend to spontaneously evolve towards increasing asymmetry, transitivity, a-cyclicity, popularity, and inverse-popularity.

Second, by illuminating how a micro-level cognitive mechanism affects the formation and dissolution of leadership relations, the study also responds to calls for research on the micro-foundations of interpersonal networks (Ibarra et al., 2005; Moliterno & Mahoney, 2011). Over the past few years, scholars have demonstrated that cognitively informed network theories can significantly deepen our comprehension of both the effects and processes occurring through interpersonal networks. Prior studies found that individual cognition affects people's mental representation of the network (Simpson et al., 2011), which parts of the network they activate (Smith, Menon & Thompson, 2012), and which contacts they turn to (Elliott, Haney & Sams-Abiodun, 2010). Our results complement the work by DeRue, Nahrgang, and Ashford (2015) in elucidating the socio-cognitive underpinnings of emergent leadership structures in informal groups. In an effort to derive group-level implications from individual-level mechanisms, De Rue and colleagues examined how group identification and role prototypicality influence emergent leadership structures in self-managed groups, whereas we explore how the linear-ordering schema shapes the dynamic evolution of informal leadership structures.

Third, DeRue and Ashford noticed that we still have an insufficient understanding of how leadership relations develop in the absence of formal hierarchies (2010). The present study addressed this question through a multi-study, multi-method research design that enabled us to isolate the emergence of informal leadership from the confounding effects of formal authority. Our experimental

evidence demonstrates that the schema-based mechanism we proposed operates even when there are no differences across group members' formal position, quality or contribution to the valued goals of the group. This finding is particularly important in light of the emphasis that management scholarship and practice have placed on the merits of an informal, emergent approach to leadership, as a way to ensure that greater leadership scope is conferred to those who have the highest potential to help the group achieve its goals (Ancona, & Bresman, 2013). While our results do not contradict the view that emergent leadership approaches may be better than top-down ones at identifying effective leaders, they do draw attention to the fact that such approaches hinge on group members' socially constructed – and hence possibly distorted – perceptions. This finding suggests caution in assuming that emergent leadership dynamics will necessarily reflect members' differential quality or contribution to the group.

Fourth, a distinctive feature of our process model is that it assumes individuals to focus on the subset of leadership relations emerging around them, as opposed to the overall leadership network. This perspective differentiates our argument from conformity-based explanations, such as Asch (1956) or studies on the bandwagon effect (Balkundi & Kilduff, 2006), which emphasize that group members' leadership attributions adjust to the emerging group-level consensus. It also differentiates our argument from Fiske's view of the "authority ranking" schema (1991, 1992), in which everyone is expected to be in either a superior or a subordinate relation with everybody else. Both conformity-based and Fiske's arguments may explain the emergence of a single leadership hierarchy, but they collide with the well-documented empirical observation that many social groups have multiple leaders (Carson et al., 2007; Mehra et al., 2006). Our proposed model, on the other hand, acknowledges that group members are unlikely to have a complete overview of the overall leadership network and, therefore, they will adjust their leadership attributions to the local linear ordering emerging around them. Accordingly, the schema-alignment mechanism theorized in our model does not imply a group-level convergence around a single leader or the formation of a single group-level ranking. On the contrary, insofar as a group features a differentiated network structure, our explanatory model would predict that multiple leadership rankings (and hence multiple local leaders) emerge and coexist within the same group.

Fifth, our work contributes to a stream of management theory that began to unveil the role of cognitive schemas in shaping people's leadership attributions (Brands, 2013; Epitropaki & Martin,

2004; Gawronskyi, Walther, & Blank, 2005). Recent work looked at how interpersonal perceptions (DeRue et al., 2015), beliefs that groups are best led by a single or by multiple leaders (Leadership Structure Schemas, DeRue & Ashford, 2010), and person-in-situation schemas (e.g., Leader-in-Social-Network schema, Brands, Menges, & Kilduff, 2015) affect emergent leadership structures. We examine the impact of relational schemas on the evolution of leadership structures. By demonstrating that people dynamically adjust their leadership attributions to the changing pattern of leadership relations emerging around them, but do so through the interpretive lens of relational schemas, our study responds to recent calls to elucidate the "dynamic interplay" between individual cognition and interpersonal networks (Balkundi & Kilduff, 2006; Brands, 2013; Ibarra, Kilduff, & Tsai, 2005).

Sixth, while our proposed model focuses specifically on the evolution of leadership networks, the analytical strategy on which it builds suggests a useful approach to study other facets of interpersonal networks. An obvious extension of our research would be to examine the dynamic evolution of other hierarchical relationships, such as influence or status, to test if they spontaneously develop similar network-structural features as the ones we documented here. But our proposed explanatory logic might also be extended to theorize about the dynamics of non-hierarchical relationships, such as friendship, where relational schemas other than linear ordering would constitute the micro-level mechanism driving the structural evolution of the network.

Finally, the process model evaluated in this paper integrates two theoretical perspectives that many regard as unrelated or even incompatible (Bandura, 2001). On the one hand, cognitive explanations have tended to assume that social structures exist only in the minds of individuals, manifesting themselves through the cognitive schemas individuals employ to navigate and act upon the ambiguities of the social world (Baldwin, 1992). On the opposite end, structuralist explanations have largely neglected the role of individual cognition and have conceptualized "a reified social structure disembodied from people and personal agency" (Bandura, 2001: 14). The argument offered in the present paper identifies an important theoretical link between cognitive and structural explanations. Consistent with cognitivist arguments, we have assumed that cognitive schemas play a key role in guiding people's attempts to fit within the broader (leadership) structure (Horowitz, 1988; Ridgeway, 2006). Consistent with the structuralist perspective, we have posited that the social structure around an

individual triggers causal processes that are at least partly exogenous to the individual's cognition. As a result, the causal engine postulated by our argument lies in the dynamic interplay of individual cognition and interpersonal structure. A distinctive contribution of our proposed explanatory framework, we believe, is that it explicates this dynamic interplay in a theoretically parsimonious and empirically testable fashion.

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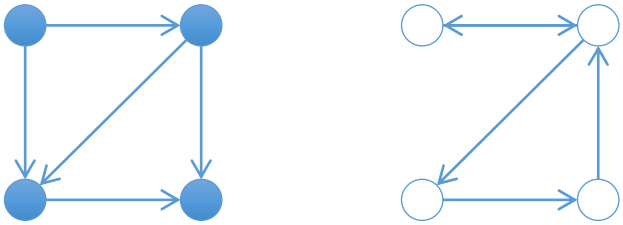
FIGURE

Figure 1: Pattern of leadership relations in the two network conditions used in Studies 1 and 2



Schema-consistent network Schema-inconsistent network

TABLES

Table 1. Study 3: Summary of structural parameters, with corresponding network representations and hypothesized effects

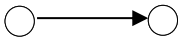
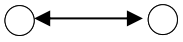
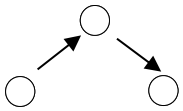
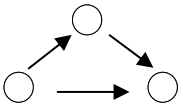
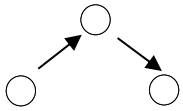
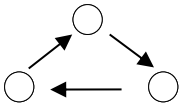
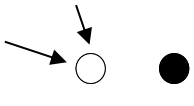
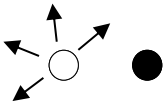
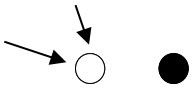
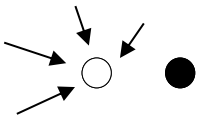
Structural Effect	Time t	Time t+1	Description	Expected
Density			Basic tendency to have ties at all	Required for model convergence
Symmetry			Tendency towards reciprocation	H3. Negative
Transitivity			Tendency towards transitivity	H4. Positive
Cyclicity			Tendency towards cyclic formations	H5. Negative
Inversed-Popularity			Nodes with higher indegree will have an extra propensity to send ties	H6. Negative
Popularity			Nodes with higher indegree will have an extra propensity to receive ties	H7. Positive

Table 2. Study 3: Descriptive Statistics & Correlation Matrix across Cohorts

Cohort 1	*Mean*	*S.D.*	*1.*	*2.*	*3.*			
1. Gender (0 = male)	.96	.27						
2. GPA	3.43	.26	-.10					
3. Self-Esteem	34.52	3.52	.07	.18				
4. Self-Monitoring	13.15	3.24	-.11	-.3†	.19			
Cohort 2	*Mean*	*S.D.*	*1.*	*2.*	*3.*			
1. Gender (0 = male)	.66	.48						
2. GPA	3.27	.57	.07					
3. Self-Esteem	33.86	3.55	-.15	.01				
4. Self-Monitoring	14.00	3.81	-.42**	.01	.31*			
Cohort 3	*Mean*	*S.D.*	*1.*	*2.*	*3.*	*4.*	*5.*	*6.*
1. Gender (0 = male)	.77	.42						
2. GPA	3.38	.34	-.13					
3. Self-Esteem	44.07	4.03	-.13	.06				
4. Network Accuracy T1	.11	.07	.05	.03	-.04			
5. Network Accuracy T2	.11	.05	.18	-.06	-.02	.27†		
6. Network Accuracy T3	.09	.06	.23	-.01	-.13	.14	.55**	
7. Leadership Structure Schema	25.09	4.96	-.17	-.15	-.09	.01	-.13	-.15

† p<.1; * p<.05, ** p<.01

Table 3. Study 3: Longitudinal Analysis of Leadership Networks

	Model 1 Generic Leaders (Cohort 1)		**Model 2** Relationship Leaders (Cohort 2)		**Model 3** Task Leaders (Cohort 2)		**Model 4** Generic Leaders (Cohort 3)	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Dyadic Effects								
Initial Friendships	.257 *	.104	.169†	.98	.243 *	.107	.071	.149
Social Interactions	.219 *	.109	.234 *	.108	-.261 *	.119	.598 *	.107
Individual Effects								
Gender	.012	.112	-.116	.102	-.159	.127	-.140	.117
GPA	.298 *	.143	.064	.089	.149 **	.085	.320 *	.135
Self-Esteem	.023 *	.010	.015	.008	.038 **	.015	-.006	.013
Self-Monitoring	.005	.011	.011 **	.003	.012	.017		
Network Accuracy							-.545	.934
Leadership Structure Schema							.017†	.010
Structural Effects								
Density	-1.939 **	.073	-1.576 **	.153	-1.965 **	.146	-2.303 **	.137
Symmetry (H3)	.275	.137	.318	.202	.305	.223	.144	.208
Transitivity (H4)	.075 **	.026	.392 **	.071	.273 **	.051	.135 *	.046
Cyclicity (H5)	-.123 *	.055	-.017	.159	-.052	.127	-.170 *	.084
Inversed Popularity (H6)	.019	.013	-.099 *	.045	-.087 *	.034	.021†	.012
Popularity (H7)	.068 **	.006	.054 *	.020	.078 **	.009	.071 **	.006

† p<.1; * p<.05; ** p<.01

Note: Cohort 1: generic-leadership network was observed monthly for four months; Cohort 2: task- and relationship-leadership networks were observed monthly for three months; Cohort 3: generic-leadership network was observed monthly for three months