NETWORK DYNAMICS AND COOPERATION IN ORGANIZATIONS[1]

A Relational Signaling Perspective

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ABSTRACT
It is argued that network scholars still underexploit signaling theory, and that current theories of the link between network dynamics and cooperation are incomplete when applied to organizations. The paper first reconstructs the key assumptions of general social network theories (GNTs). Drawing on a relational signaling framework, it then sketches the contours of an organizational social network theory (ONT). Longitudinal organizational network research on interpersonal trust, gossip, advice, and punishment is used to assess the empirical validity of contrasting predictions following from both approaches. The results favor a signaling explanation. Implications for a research agenda on signaling in social networks are explored.

INTRODUCTION

On June 1, 2011, the Netherlands' Royal Academy of Sciences announced the publication of the first Dutch National Science Agenda.[i] It contains a collection of forty-nine "pressing questions": issues that, according to the distinguished fellows of the Academy, deserve to be tackled with the highest priority during the coming two decades. There can be not doubt that what the Science Agenda is after are the really BIG questions, like "#1: What happens inside the Earth?" or "#49: How did the Universe emerge?" And in between these existential enquiries, there is question number 41, of interest to many in this room: "Under which conditions do social networks enhance durable cooperation?".

The link between social network dynamics and cooperation constitutes one of the current frontiers in our field. Progress was made, as some recent reviews amply demonstrate (Rivera, Soderstrom and Uzzi, 2010; Borgatti and Foster, 2003; Contractor, Wasserman and Faust, 2006). I want to make to points. First, I argue that network scholars still underexploit a perspective that has demonstrated its explanatory power in other fields, ranging from animal behavior to institutional analysis: signaling theory. Second, our current theories of the link between network dynamics and cooperation are incomplete as soon as they are applied to a specific social context: organizations.

In what follows, I will first reconstruct some core assumptions behind current general social network theories (GNT) of cooperation. Section two first outlines why we need to be careful when applying GNT to organizational settings. It then sketches the contours of what I refer to as organizational social network theory (ONT). Section three presents some empirical illustrations, contrasting predictions from GNT and ONT. Section four concludes with an exploration of implications for a research agenda on signaling in social networks.

GENERAL SOCIAL NETWORK THEORIES

The past decade has witnessed a series of attempts to define the theoretical "hard core" of social network research (Borgatti and Foster, 2001; Kilduff, Tsai and Hanke, 2001; Rivera, Soderstrom and Uzzi, 2010). Widely accepted are the following four overarching "core principles" identified by Kilduff et al. (2010): the primacy of relations between organizational actors, the ubiquity of actors' embeddedness in social fields, the social utility of network connections, and the structural patterning of social life. Overall, general social network theory makes specific assumptions with regard to four domains: nodes, ties, positions, and motives.

Attributes: Assortativity

Attributes play an important role in GNT explanations of social network evolution. Assortative perspectives "emphasize compatibilities and complementarities between actors' attributes" (Rivera et al, 2010). GNT's preferred principle of assortativity is homophily, i.e. the tendency for "birds of a feather to flock together". The praise of homophily has been sung many times (Marsden, 1987, 1988, 1990; Popielarz, 1999). Similarity based on age, race, religion, education, sex, and social distance was found to explain almost all variation in the networks of Americans.

Ties: Connectionism
Common starting point of GNTs is a connectionist assumption (Borgatti and Foster, 2003): the focus is on the resources that flow between ties. Ties are primarily seen as channels for the exchange or transmission of resources, ranging from information to emotional support.

Positions: Structuralism
GNTs have a strong structuralist legacy. They emphasize the importance of configurations of ties. Configurations are conceptualized as structural properties of networks. They have at least two main effects. First, structural positions can define opportunity structures. A central network position can provide superior access to resources for individual actors, since it increases exchange alternatives. Second, due to the social control it generates, network closure can be a source of constraint for the individual, but an asset for collective action, and so forth.

Motives: Theory of Action
GNTs tend to be very eclectic with regard to what drives the behavior of actors in networks. In their programmatic theoretical review of organizational network research, Contractor, Wasserman and Faust (2006) list a selection of no less than twenty-two theories and their respective core mechanisms, ranging from individual value maximization as in social capital theories to social dissonance reduction in cognitive consistency theories (see also Kilduff, Tsai and Hanke (2001) for a discussion of the role of cognitions, emotions, memories and more general perceptual issues). The general impression one gets is that anything goes. A wide variety of psychological mechanisms is used. That some of these principles almost certainly lead to conflicting predictions seems of lesser relevance.

Summary
These reviews of the social network field converge on a number of general assumptions.

1. In their choices of interaction partners, people let themselves influence through the attributes and physical proximity of others (assortativity).
2. Their own position in the social structure, and the position of others influence choices of interaction partners and cooperation through creating opportunity structures (structuralism)
3. Ties are channels for the exchange of material or immaterial resources and services (connectionism).
4. Individuals are subject to a large variety of psychological processes and motives that influence their choice of interaction partners and cooperation (theory of action)

ORGANIZATIONAL SOCIAL NETWORK THEORY
Since quite a while, also organizational scholars investigate network dynamics. To do so, they draw heavily on GNT's four sets of assumptions outlined above. But GNT is developed within and for primary social groups. The psychological

mechanisms it invokes are tailored to small group processes in natural settings, with an emphasis on the exchange of resources between friends, acquaintances, neighbors, relatives or strangers. But organizations are first and foremost settings for joint production. I argue that the social network theories that may hold in natural settings will loose much of their explanatory power in organizational settings. The reason is the ubiquity and salience of formal interdependencies. Membership and embeddedness in organizations triggers a whole set of additional mechanisms, with relational signaling being the most important.

Why Organizations are Different

Organizations are deliberately constructed social orders. They are usually designed to realize some objective. Organizations exist because they are particularly well suited to orchestrate the actions of their incumbents. Organizations are instruments of collective action, which they achieve through coordination and control. Organizations usually have a formal structure consisting of authority relations and workflow relations. Formal structure creates functional interdependencies. These functional interdependencies will permeate the whole organization. Social relations developing in or between organizations cannot be seen detached from these functional interdependencies. Like all other organizational processes, functional interdependencies will permeate all personal contacts and social ties. Social networks will acquire a different flavor because of that.

For the study of network dynamics in organizations it is useful to have a clear idea about how to characterize the social relations inside them. Organizational network research usually distinguishes between formal and informal relations. This is a straightforward, intuitive distinction. With the following qualifications it becomes a convenient one also for our purposes. Cross-classifying the two dimensions, four elementary types of relations can be distinguished (see Table 1). I will refer to them as formal, embedded, informal, and membership relations, respectively.

An ideal typical *formal relation* exists if two organizational members are linked through some sort of task or work flow (inter)dependence and/or through an authority relation. The "relation" does not necessarily imply that the two members have frequent contact, talk to each other, or know each other personally. It usually means that the action of one has repercussions on the action opportunities of the other.

In an ideal typical *informal relation*, two organizational members are linked through a personal contact, but are not directly connected through work flow (inter)dependencies or authority relations. The personal contact can take a variety of forms and differ in strength. It can involve communication about personal matters or extend to a strong social bond, involving feelings of friendship and interpersonal trust. Social relations usually come with some obligations, and are subject to norms of weak or strong solidarity.

In an *embedded relation*, two members are linked through a formal relation, but also have an informal relation. In a *membership relation* two employees are neither tied through a direct formal relation, nor through an informal relation. What binds them is that both of them are members of the organization. Remote as the link may be, in most organizations they will be tied

indirectly through falling under the formal jurisdiction of the highest boss. This knowledge defines them as in-group members, and will influence their attitudes or behavior towards each other if they might be required to interact. Even if they do not have a formal or an informal relation, individuals who are part of the same organization will behave differently towards each other than towards complete strangers, or members of other organizations.

What this simple classification shows is the pervasiveness of the formal relation in organizations. There will always be some form of functional interdependence. It may be very weak, as in the case of a membership relation, or very salient as in settings where task interdependence is very strong.

Why Relational Signaling Matters

Signaling theory is used in variety of fields, ranging from evolutionary biology, economics, anthropology, sociology to management studies (Connelly, Certo, Ireland and Reutzel, 2011). Since Spence's (Spence, 1973) seminal work on the role of educational credentials in labor markets, signaling theory has been applied to a variety of issues in the field of organizations, including problems of selection, managerial incentives (Ross, 1977), and corporate governance (e.g. Zhang and Wiersema, 2009). The present study focuses on a a more recent refinement of the general framework, relational signaling theory (Lindenberg).

The key components of signaling theory are a signaler, a signal, a receiver of the signal, and a feedback to the signaler (Connelly et al., 2011). Essentially, signaling is a key mechanism in situations of information asymmetry between two or more parties. Such asymmetries arise where both parties have at least partially conflicting interests, and where reliable and valid information about the quality (e.g. skills, performance) and/or the intentions (e.g. motivation) of one actor is unavailable or difficult to observe for another actor.

A *signal* refers to the "underlying, unobservable ability of the signaler to fulfill the needs or demands of an outsider observing the signal" (Connelly et al. 2011:43). Signals are usually conceived as deliberate communications, in which the signaler seeks to convey positive information about his or her qualities that may be relevant but difficult to observe for the receiver. *Relational signals* are cues about the signaler's intention to initiate or maintain a mutually rewarding relationship with the receiver.

The efficacy of a signal depends on a variety of factors, in particular their *observability* (intensity, strength, clarity, visibility) and cost. Whereas some signals are easy to observe (e.g. a philanthropist's donation to a humanitarian fund) others are more difficult to decipher (e.g. evolutionary accounts of depression have argued that signs of depression reduce aggressiveness of exchange partners). The *cost* of a signal (e.g. the size of a donation in relation to a philanthropist's capital) has long been considered as a major condition for its efficacy, but more recent accounts de-emphasize the importance of costs and suggest that less costly signals may also be relevant (e.g. a prime minister's apology for atrocities of previous governments). Other aspects of signals are (Connelly et al., 2011:52) their *fit* ("the extent to which the signal is correlated with the unobservable quality"), their *frequency* ("the number of times the same signal is transmitted"), and their *consistency* ("agreement between signals from one source").

Relational signaling theory suggests a different look at the four key dimensions of GNT.

Attributes and Signals

GNT uses actor attributes to predict tie formation, with homophily being the major psychological mechanism. The problem with homophily is evident: as long as it does not specify which attribute is relevant, the theory remains an empty container. Attributes are relevant also in signaling theories. For example, evolutionary biology has demonstrated that handicaps – like the peacocks start or a deer's antlers signal reproductive fitness. In human societies, attributes can have general signaling value (e.g. owning an expensive car can be a status signal). Some personal attributes may have a relational signaling value, e.g. because they provide cues about an individual's inclination to cheat, like membership in a specific (ethno-religious) group. But from a relational signaling perspective, attributes are less likely to play a strong and persistent role in organizational networks. The reason is that functional interdependencies are likely to disrupt the fit and consistency of relational signals. As a result, the signaling value of attributes will decline.

Ties and Signals

GNT sees ties as "pipes" (Podolny, 2001), i.e. channels or exchange opportunities through which nodes transmit valued resources. From a relational signaling perspective, any transmission of resources will also be evaluated for its potential relational signaling value. A tie or relation between two parties primarily defines their rights and obligations towards each other. The relation itself needs to be maintained through relational signals. They indicate to which degree each party is still willing to comply to the relational norms.

Take the situation in which A initially proposed to collaborate with B on a new project instead initiates one with C, and cancels the project with B. From a relational signaling perspective, A's investment in C is a positive relational signal to C that might be perceived by B as a negative relational signal towards B.

A central aspect in this context is 'gift giving' (Akerlof, 1986). Gifts are resources or services that are voluntarily provided by one party and are usually costly for the gift giver. RST argues that gifts can be positive relational signals, which trigger a normative commitment of the agent that will go beyond the contractually specified terms of the employment relation. In an ongoing dyadic relationship, the consistent and repeated provision of gifts will be used as cues that signal the gift giver's continued commitment to the relationship. Hence, relational signals are an important device to express the willingness for a long-term, stable, and cooperative relation, which will be reciprocated with trust from the agent (for empirical evidence, see for instance the efficiency wage literature, e.g. (Fehr, Gachter, and Kirchsteiger, 1996; Goldsmith, Veum, and Darity, Jr., 2000; Maximiano, Sloof, and Sonnemans, 2007).

Note that there is not necessarily a simple and linear correspondence between a "gift" and its positive relational signaling value. Whether a transaction will be interpreted as a positive or negative relational signal will depend on the context. Take the example of giving money to the widow of a deceased during a funeral ceremony. In some cultures, this is seen as a positive relational signal. In others, it would constitute a major offence.

Positions and Signals
GNT conceives of positions as structural exchange opportunities which help to extract benefits from others. Relational signaling theory suggests that an important element of someone's position in a network is its reputational signaling value. Since "who is connected to whom" can convey important information about someone's status, one's pattern of ties to third parties forms a "prism" through which observers can assess our status (Podolny, 2001). For example, employees may be reluctant to ask a low status colleague for advice, because this might lower their own status and therefore reduce their attractiveness as an interaction partner for high status colleagues (Agneessens and Wittek, 2011).

Motives and Signals
Relational signaling theory sees economic exchanges as social relations (Lindenberg, 1988; 2000; 2003; Wittek, 1999; 2003). The material transaction is only one part of a much more complex social relation. It assumes that also in market or organizational settings, individuals strive for improving their psychological and social well-being. To do so, they are looking for status, behavioral confirmation or affection. Their production requires investments that are not constantly rewarded because at least parts of them go unnoticed. That is: an individual complying to a norm without receiving a positive sanction for it will increasingly experience the costs of compliance as salient. Social relations are essential sources of behavioral confirmation and status. More specifically, the relational signals that are produced in social relationships tell an individual that others take notice of his or her compliance or prestige. Humans are therefore constantly profiling their social environment for relational signals that tell them where they stand and to what degree others are still committed to the relationship with them.

Summary
A relational signaling perspective on organizational network dynamics rests on the following general assumptions.[ii]

1. In their choices of interaction partners, individuals will primarily be concerned to manage relations that involve (functional) inter-dependencies (joint production). Attributes will be relevant only to the degree that they have relational signaling value.
2. Any interaction, exchange or transfer of goods and services will also be assessed for its potential underlying relational signaling value (signaling).
3. Positions in social structures influence choice of interaction partners and cooperation through signaling reputations (reputation).
4. Individuals strive for status, behavioral confirmation and affection. Social ties are means to realize these goals. Relational signals are the carriers of social ties (theory of action).

SIGNALING IN ACTION: EMPIRICAL APPLICATIONS
The application of signaling theory to organizational networks is still in its infancy. One of the reasons is a lack of high quality organizational field data,

which contain repeated measurements of sociometric information. The present section presents findings from a series of studies on organizational network dynamics.

Research Design and Data

In order to illustrate how relational signaling mechanisms govern the co-evolution of networks and cooperation in organizations, data from four studies applying a Longitudinal Intra-Organizational Network Study (LIONS) design was used (see Table X). The organizations are a German Paper Factory, a Dutch Housing Corporation, a Dutch Youth Care Organization. The roster method was used to elicit sociometric choices, i.e. per type of relationship, employees were presented a list of colleagues. For each colleague, they had to indicate which of the descriptions comes closest to their relation with the specific colleagues. Likert-Type answer categories were used for most of the sociometric questions.

All settings are characterized by functional interdependence, though it may vary in strength. In the Paper Factory, joint production was strongest during the first wave, when all engineers of the management team under study were involved in a prestigious and intensive production project. In the Youth Care organization, teams of part time pedagogues and behavioral scientists are entrusted to treat several children, which requires frequent communication on progress and treatment. Finally, the Housing Corporation is a service organization delivering apartments to citizens. This required coordination between the clerks of the different departments of the Corporation.

"Cooperation" is a general theoretical construct. It can take a large variety of real life forms. Though different disciplines use different labels (e.g. pro-social behavior, solidarity, extra-role behavior, helping etc.), all of them share the same intuition of what constitutes a cooperative act (Lindenberg, xxxx). For our purposes, it suffices to delineate cooperation as a situation in which one party is willing to forego benefits or to bear costs without expecting an (immediate or direct) return.

A variety of different types of social relations has been connected to the evolution of cooperation, be it as an instantiation of a cooperative act, or as an antecedent, a mediator, a moderator, or a consequence. For the purposes of this review, we focus on interpersonal trust, power attributions, gossip, advice or punishment.

Interpersonal Trust

Interpersonal trust relations are seen as a major glue of social networks in general, and within organizations in particular. In their strongest form, they are friendship relations, in which the involved parties interact with each other also outside work. In their weaker form, they involve sharing of sensitive information that might potentially be damaging to the trustor, like plans to leave the firm (Burt, 1992). Trust relations are characterized by expectations and obligations of mutual solidarity. Individuals in a trust relationship are supposed to help each other if this is necessary, even if this comes at a cost. They are also expected not to inflict harm to the other party. Trusting someone means that one makes oneself vulnerable to exploitation by the other (e.g. if one lends money or equipment to a colleague). An interpersonal trust relation usually reflects

manifold situations in which one of the parties made him- or herself vulnerable to exploitation, and the other party honored rather than abused the trust. Hence, an interpersonal trust relation as it is usually measured in organizational network studies reflects the cumulated cooperative experiences of both parties.

GNT and ONT come to different predictions concerning the evolution of interpersonal trust relations. GNT predicts that in situations of uncertainty, where there is little reliable information about how cooperative others behaved in the past, the formation of interpersonal trust relations will be driven by the psychological mechanisms of homophily ("I become a friend with people who are like me") and balancing ("the friend of my friend will become my friend"). ONT suggests that interpersonal trust relations will primarily be used to manage dependence relations.[iii] They can be important sources for affection, behavioral confirmation and status, and individuals value the relation as such.

In an empirical test of those competing mechanisms with the Paper Factory data (Van de Bunt, Wittek, de Klepper, 2005), the effect of homophily and balance were assessed against the effect of task dependence and structural constraint in the communication network. When tested independently from interdependence and constraint, structural balance has a significant effect. No homophily effects could be found for similarity in age, education, tenure or formal position. When tested simultaneously with structural constraint and task dependence measures, the balance effect disappeared. In this group, the evolution of interpersonal trust relations is driven by two major forces: the tendency to reciprocate a trust relation, and the tendency to build trust relations to those colleagues who constrain our own network.

The previous finding is based on the analysis of the evolution of a single relation. In ongoing work, we tested the co-evolution of trust, communication and advice relations in the Paper Factory. Interpersonal trust indeed turns out to be a function of task interdependence. This finding supports the RST perspective, according to which trust relations develop between functionally interdependent employees.

From a balancing perspective, one would expect triadic closure in those configurations where at t1 both i and j have no contact, but both frequently talk to k or both have an interpersonal trust relation to k. The opposite holds in both cases. First, if i and j have a communication tie to k at t1, there is a significant tendency that they will develop a *distrust* relation at t2. Second, if i an j have a trust relation at t1, there is a significant tendency that the frequency of communication between them *decreases* at t2. These findings make sense from the perspective of strategic brokerage: an individual who has either weak or strong ties to two unrelated others may derive benefits from inhibiting the development of a tie between them (divide et impera).

These findings indicate that triadic closure seems to be far less likely in organizations than one would expect based on GNT. Instead, such configurations seem to exacerbate disconnections and structural holes in the network.

To sum up: interpersonal trust relations have a strong tendency to be reciprocal; they tend to coincide with the web of work related interdependence relations; these functional interdependencies push homophily and balancing concerns into the background; both weak and strong bridging ties decrease rather than increase the likelihood of triadic closure.

Overall, the pattern deviates from the default GNT account of the evolution of trust. It is more in line with principles of ONT, which suggest that in organizational settings social relations will be used for the management of (functional) interdependencies.

Gossip

In current theories of cooperation, structural embeddedness – i.e. the pattern of ties to third parties affecting the exchange between two persons – plays an important role, since third parties can provide information about the trustworthiness of alter. Put differently, ego's decision to trust alter depends on the positive or negative gossip ego receives about alter from a third party. In these reputational models of cooperation, ego and the third party are assumed to have a trust relationship, since this affects the willingness to provide information, as well as its veracity. Put differently, existing trust relations form the channels for the exchange of reputational information, which will then be used to build or not build new ties: interpersonal trust breeds gossip. From a relational signaling perspective, a different mechanism would result, since gossiping itself can be seen as a costly signal. Through gossiping, an individual reveals personal information about his or her social network. To the degree that the gossip is evaluative, revealing it can be risky for the sender. For example, a gossip receiver may strategically exploit his or her knowledge about the sender's social network (as structural hole theory would assume). So it makes sense to gossip only with those we trust. But given this risk, gossiping with a potential trustee may also be a signal for starting a relationship: the gossip sender makes him or herself vulnerable. By revealing potentially sensitive information about (parts of) his or her network, the gossip sender sends a trust signal to the receiver. Depending on how the receiver will subsequently deal with this information, the sender can then decide whether or not to intensify the relationship. Hence, relational signaling theory predicts that gossip breeds interpersonal trust: If A gossips to B at t1, B will reciprocate with an interpersonal trust tie at t2. A multiple SIENA analysis of the co-evolution of gossip and interpersonal trust in the Youth Care data support this argument. Employees do not tend to gossip more or less with colleagues who trust them, whereas gossip tends to be reciprocated by trust.

Informal Power

Relational signaling also plays an important role in the acquisition of informal power and influence. Whereas standard social capital reasoning suggests that a structurally advantageous position conveys power attributions, relational signaling theory would suggest a slightly different picture. First, reasoning from the perspective of the receivers of signals, structure would matter only in so far as it has signaling value. One prediction following from this assumption is that the effect of structural power on power attributions will increase to the degree that it is visible for an observer. E.g. whereas group members may come to a relatively reliable estimate of the number of friends or allies others in their group can count on, their ability to assess structurally more complex positions of other group members (e.g. in terms of the efficiency of their network) will be more limited. Second, relational signaling theory suggests that individuals can acquire power attributions through visible acts of dominance, as they occur

when power strategies are effectuated. The effect of the use of power strategies on power attributions does not require a structural power advantage. Our analyses in the Youth Care organization indeed confirm both hypotheses, and provide some interesting additional insights. The ERGMs distinguish between ego and alter effects. We found three significant alter effects: for in-degree centrality, for power strategy use, and for tenure. That is, an employee is more likely to be seen as influential, the more trust ties he or she has, the more actively he or she engages in the use of power strategies, and the longer he or she is in the organization. No alter effects could be found for the more complex measures of structural power, like aggregate or dyadic constraint (a measure for structural holes), betweenness centrality or closeness, or the interaction between strategy use and structural position. A different picture emerges for ego-effects: here, it is only the more complex structural indicators of power that have an effect. Individuals with high closeness centrality or aggregate constraint tend to allocate more power to others than individuals with low closeness or aggregate constraint. In the Paper Factory data, we further found that power reputation increases the higher the level of trust received from supervisors, but it decreases with the number of ties from peers: getting along does not imply getting one's way.

These findings corroborate both relational signaling hypotheses: the likelihood to be seen as an influential group member increases for the more visible structural power indicators (in-degree), and individuals can boost their power reputation independently from their structural position through the use of power strategies. The visibility argument is further supported by the finding that the more structural constraint a person experiences, the more this person will attribute power to others.[iv]

Knowledge Sharing

The value of a relational signal depends on the context. Changes in the context can transform positive relational signals into ambiguous ones, as the case of the management team of the Paper Factory demonstrated. During a phase of strong functional interdependencies, unsolicited technical advice between engineers was interpreted as a positive relational signal: an attempt of the sender to contribute to joint production by improving the performance of his colleagues and the organization. After an organizational change which disrupted the clear structure of functional dependencies and authority relations, the same behavior – making suggestions for how to solve technical problems – was looked at with extreme suspicion: it was seen as an attempt to increase the sender's position in the prestige hierarchy at the expense of the receiver. The positive relational signal had become an ambiguous one.

Costly Punishment

Relational signaling theory can also enrich the literature on sanctioning or "costly punishment". The economic incentives literature would predict that sanction strength (e.g. against an individual who created trouble for a colleague) would be a function of the severity of the grievance. ONT suggests that the severity of the sanction is a function of the relational signaling character of the infraction. If the damage happens in a functioning social relationship, sanctioning will be less severe, since the affected person will assume that there was no

intention behind it. Punishment will be strong where the affected individual has reason to believe that the person causing the damage acted out of self-interest, or a lack of concern for the other's interests. A vignette-experiment in the Paper Factory provides support for this reasoning (Wittek, 2003): weak grievances resulted in stronger sanctions than strong grievances if they happened for the second time – an indicator that the colleague causing them is not vigilant enough to prevent problems for his colleagues. The damage is seen as a negative relational signal rather than a mishap.

Representative Voice

Relational signaling helps explain inconsistencies in research on voice in organizations, in particular representative voice. These are acts in which one employee speaks up on behalf of a whole group, e.g. by bringing a problem to the attention of the manager. It represents a situation in which a collective good can be produced through a single individual, who however faces a volutneer's dilemma. GNT would predict that the most central individuals would be the ones who have the highest inclination towards representative voice: their centrality provides a good social capital base, which secures social support and potential allies. A recent study of this phenomenon found no effects of social network embeddedness. However, a major predictor was turn-taking: an employee's willingness to incur the costs of representative voice increased with other colleagues' previous visible acts of voice (Pauksztat, 2010). This finding is in line with ONT and relational signaling principles. One's colleague's previous acts of representative voice are interpreted as a potentially costly signal of commitment to the group. This triggers a gift exchange mechanism, pushing colleagues to do the same.

CONCLUSION: TOWARDS A RESEARCH AGENDA

Based on GNT, the evolution of interpersonal trust relations and cooperation is driven by the psychological inclinations towards homophily and balancing. From ONT, interpersonal trust follows from the need to manage interdependencies. Relational signals are the instruments to initiate and maintain social relations. Signals can take different forms. Gossip, the use of power strategies, and power attributions can constitute such relational signals. The initiation and sustainability of cooperative relations will depend on the credibility, clarity and cost of the signal.

Organizational networks follow a different logic than networks in other contexts. Relational signals in joint production settings can have strong effects. In the presented studies, their effect significantly tempers, if not overrules, psychological tendencies towards homophily and balancing, as well as the impact of structural network embeddedness. Network structure as such seems to be far less important in driving the evolution of networks.

The signaling perspective opens new avenues for research. It generates new questions and new hypotheses and may help explain puzzling findings from earlier research in a variety of different domains. For example, from a relational signaling perspective, the exponential growth of CEO salaries would be an unintended consequence of relational signaling. The more excessive payments to

CEOs are publicly scorned, the costlier – in moral terms – it becomes for a Board. Hence the more credible the signal (Van Veen and Wittek, 2011).

These examples illustrate that a signaling approach can also be a powerful tool for the analysis of social network dynamics in general, and of the manifold types of cooperation in organizational settings in particular.

REFERENCES

Akerlof, G.A. (1986). Labor Contracts as Partial Gift Exchange. Pp. 66-92 in *Efficiency wage models of the labor market,* edited by G. Akerlof & J.L. Yellen. Cambridge: Cambridge University Press.

Borgatti, S. and B. Foster (2003). The Network Paradigm in Organizational Research: A Review and Typology. *Journal of Management* 29:991-1013

Burt, R. (1992). *Structural Holes.*

Connelly, B., S. Certo, R. Ireland, and C. Reutzel (2011). Signaling theory: a review and assessment. *Journal of Management,* 37(1): 39-76.

Contractor, N., S. Wasserman and K. Faust (2006). Testing Multitheoretical, Multilevel Hypotheses about Organizational Networks: An Analytic Framework and Empirical Example. *Academy of Management Review* 31 (3), 681-703.

Ellwardt, L. (2011). *Gossip in Organizations. A Social Network Study.* Groningen: ICS Dissertation Series 180.

Fehr, E., S. Gachter, and G. Kirchsteiger, (1996). Reciprocal Fairness and Noncompensating Wage Differentials. *Journal of Institutional and Theoretical Economics,* 152(4): 608-640.

Goldsmith,A.H., Veum, J.R., and Darity, W., Jr. (2000). Working Hard for the Money? Efficiency Wages and Worker Effort. *Journal of Economic Psychology,* 21(4): 351-385.

Kilduff, M., W. Tsai and R. Hanke. (2006). A Paradigm too far? A Dynamic Stability Reconsideration of the Social Network Research Program. *Academy of Management Review* 31 (4): 1031–1048.

Labun, A., Wittek, C. Steglich, R. Wielers (2011a). Pathways to Informal Power: The Interplay between Network Structure and Individual Strategic Behavior Effects on Informal Power. Manuscript under review.

Labun, A., R. Wittek, C. Steglich, R. Wielers (2011b). Power networks: The effects of reputation, social embeddedness and power strategies. Manuscript under review.

Lindenberg, S. (1988). Contractual relations and weak solidarity: the behavioral basis of restraints on gain-maximization. *Journal of Institutional and Theoretical Economics,* 144: 39-58.

Lindenberg, S. (2000). It takes both trust and lack of mistrust: The workings of cooperation and relational signaling in contractual relationships. *Journal of Management and Governance,* 4: 11-33.

Lindenberg, S. (2003). Governance seen from a framing point of view: The employment relationship and relational signaling. Pp. 37-57 in *The Trust Process in Organizations*, edited by Nooteboom, B. and F. Six. Cheltenham: Edward Elgar.

Maximiano, S., Sloof, R., and Sonnemans, J. (2007). Gift Exchange in a Multi-worker Firm. *Economic Journal,* 117(522): 1025-1050.

Pauksztat, B. and R. Wittek (2011). Representative voice in different organizational contexts: a study of 40 departments of a Dutch child-care organization. *International Journal of Human Resource Management* (in press).
Pauksztat, B. (2010). *Speaking Up in Organizations. Four Studies on Employee Voice.* Groningen: ICS Dissertation Series 163.
Podolny, J. (2001). Networks as the Pipes and Prisms of the Market. *American Journal of Sociology* 107 (1), 33-60.
Rivera, M., S. Soderstrom, and B. Uzzi (2010). Dynamics of Dyads in Social Networks: Assortative, Relational, and Proximity Mechanisms. *Annual Review of Sociology* 36, 91-115.
Treadway, D., G. Ferris, A. Duke, G. Adams, and J. Thatcher (2007). The Moderating Role of Subordinate Political Skill on Supervisors' Impressions of Subordinate Ingratiation and Ratings of Subordinate Interpersonal Facilitation. *Journal of Applied Psychology*, 92(3), 848-855.
Van de Bunt, G., R. Wittek, M. de Klepper (2005). "The Evolution of Intra-Organizational Trust Networks. The Case of a German Paper Factory: An Empirical Test of Six Trust Mechanisms". *International Sociology* 20 (3), 339-369
Van Veen, K. and R. Wittek (2011). Understanding the rise in CEO compensation: is it really about the money? Manuscript under review.
Wei, L., J. Liu, Y, Chen & L. Wu, (2010). Political Skill, Supervisor–Subordinate Guanxi and Career Prospects in Chinese Firms. Journal of Management Studies 47 (3), 437–454.
Wittek, R. (1999a). *Interdepedence and Informal Control in Organizations.* Groningen: ICS Dissertation Series 59.
Wittek, R. (1999b). "Closed Structures, Open Structures, Stable Structures. Explaining Structural Form and Temporal Stability of Informal Social Networks in Organizations." *Bulletin de Methodologie Sociologique* 63, 5-28.
Wittek, R. (2003). Norm Violations and Informal Control in Organizations: A Relational Signaling Perspective. Pp. 168-195 in *The Trust Process in Organizations*, edited by Nooteboom, B. and F. Six. Cheltenham: Edward Elgar.
Wittek, R., M. van Duijn, T.A.B. Snijders (2003). "Frame Decay, Informal Power, and the Escalation of Social Control in a Management Team: A Relational Signaling Perspective." *Research in the Sociology of Organizations* 20, 355-380.

TABLES

Table 1: Case Study Organizations

Organization	Population	Country	N	# Waves	Period	References
Paper Factory	Engineers	Germany	22	4	1995-1997	Wittek, 1999; Wittek, Van Duijn, Snijders, 2003; Wittek, 2003; Van de Bunt, Wittek, de Klepper, xxxx
Housing Corporation	Clerks	Netherlands	70	4	1995-1997	Agneessens & Wittek, 2011
Youth Care Organization	Pedagogues	Netherlands	30	5	2007-2010	Pauksztat, 2010; Ellwardt, 2011; Labun, 2012
Furniture Store	Salesmen	Canada	22	3	1954-1955	French (19xx); Wittek, 19xx;

Table 2: Endogenous effects for network co-evolution

Effect	Effective transition in Network	Verbal Description
Out Degree		Preference for ties to arbitrary others
Reciprocity		Preference for reciprocated ties
Mutuality		The extent to which the existence of a mutual tie ij(W) promotes the creation of a tie ij(X).
Agreement		The extent to which agreement between i and j with respect to outgoing W-ties promotes the creation of a tie ij(X)

Table 3: Paper Factory. Parameter estimates from Multiple-SIENA analysis of co-evolution of Interpersonal Trust, Advice, and Communication Networks

a. Communication as dependent network

1	**Communication:** outdegree (density)	**-0.6902 (0.1313)****
2	**Communication:** reciprocity	**0.8702 (0.3361)***
3	**Communication:** Hierarchy (centered)	1.8718 (1.4592)
4	**Communication:** Task Interdependence (centered)	0.0449 (0.0500)
5	**Communication:** Advice	**1.3414 (0.6430)***
6	**Communication:** reciprocity with Advice	-2.0210 (4.1952)
7	**Communication:** mutuality with Advice	2.7428 (7.0103)
8	**Communication:** from Advice agreement	0.1169 (0.2335)
9	**Communication:** Trust	-0.6537 (1.6337)
10	**Communication:** reciprocity with Trust	0.5401 (2.1527)
11	**Communication:** mutuality with Trust	-0.7531 (3.8320)
12	**Communication:** from Trust agreement	**-0.6659 (0.3114)***

*Note: Standard errors are in parentheses. **=p<.01 * = p<.05*

b. Advice as dependent network

13	**Advice:** outdegree (density)	**-2.8689 (0.6555)****
14	**Advice:** reciprocity	-0.1908 (0.4157)
15	**Advice:** Hierarchy (centered)	**0.2324 (0.1053)***
16	**Advice:** Task Interdependence (centered)	**0.0350 (0.0089)***
17	**Advice:** Communication	**0.9729 (0.4598)***
18	**Advice:** reciprocity with Communication	**0.9729 (0.4598)***
19	**Advice:** mutuality with Communication	-0.4416 (1.0919)
20	**Advice:** from Communication agreement	0.0424 (0.0847)
21	**Advice:** Trust	-0.5875 (0.8998)
22	**Advice:** reciprocity with Trust	0.1832 (0.8051)
23	**Advice:** mutuality with Trust	0.5535 (1.7289)
24	**Advice:** from Trust agreement	-0.1531 (0.1812)

*Note: Standard errors are in parentheses. **=p<.01 * = p<.05*

c. Trust as dependent network

25	**Trust:** outdegree (density)	**-1.5711 (0.4004)****
26	**Trust:** reciprocity	**0.7446 (0.3274)***
27	**Trust:** Hierarchy (centered)	**1.0247 (0.5324)***
28	**Trust:** Task Interdependence (centered)	**0.0158 (0.0072)***
29	**Trust:** Communication	-0.8422 (0.9345)
30	**Trust:** reciprocity with Communication	1.5592 (0.9906)
31	**Trust:** mutuality with Communication	**2.4323 (1.2212)***
32	**Trust:** from Communication agreement	**-0.1359 (0.0594)***
33	**Trust:** Advice	0.5985 (1.2078)
34	**Trust:** reciprocity with Advice	-1.1330 (2.1886)
35	**Trust:** mutuality with Advice	0.8824 (2.3699)
36	**Trust:** from Advice agreement	0.1139 (0.1587)

*Note: Standard errors are in parentheses. **=p<.01 * = p<.05*

Preliminary results.

Table 4: Informal Power Attributions: Parameter Estimates and Standard Errors (SE) of Exponential Random Graph Model (Youth Care Organization)

	Informal Power Attributions	
Parameter	*Estimate*	*SE*
Structural variables on individual level		
In-degree ego	.01	.01
In-degree alter	.04	.02*
In-degree similarity (ego-alter)	-1.02	.99
Closeness ego	.15	.05**
Closeness alter	.02	.08
Closeness similarity (ego-alter)	-.99	.70
Betweenness ego	.01	.01
Betweenness alter	-.01	.01
Betweenness similarity (ego-alter)	1.36	.63*
Aggregate constraint ego	9.90	4.81*
Aggregate constraint alter	-.59	5.96
Aggregate constraint similarity (ego-alter)	.22	.55
Dyadic relationships		
Dyadic constraint in the communication network	-.01	.22
Strategic behavior		
Strategic behavior ego	.11	.09
Strategic behavior alter	.37	.14**
Strategic behavior similarity (ego-alter)	-.92	.54
Interactions		
In-degree centrality x strategic behavior alter	-.02	.02
Closeness centrality x strategic behavior alter	.15	.10
Betweenness centrality x strategic behavior alter	.01	.01
Aggregate constraint x strategic behavior alter	8.69	6.71
Dyadic constraint x strategic behavior alter	.01	.23
Controls on individual level		
Tenure ego	-.03	.02
Tenure alter	.04	.02*
Tenure similarity (ego-alter)	.48	.47
Network statistics		
Alternating in-k-stars	-.14	.34
Alternating k-triangles	.65	.14***
Alternating independent 2-paths	-.12	.03***

Note: ***$p < .001$; **$p < .01$; *$p < .05$

Source: Labun,

Table 5. Informal power over time. Parameter estimates and standard errors (SE) for network dynamics - valued ties analyses (Paper Factory)

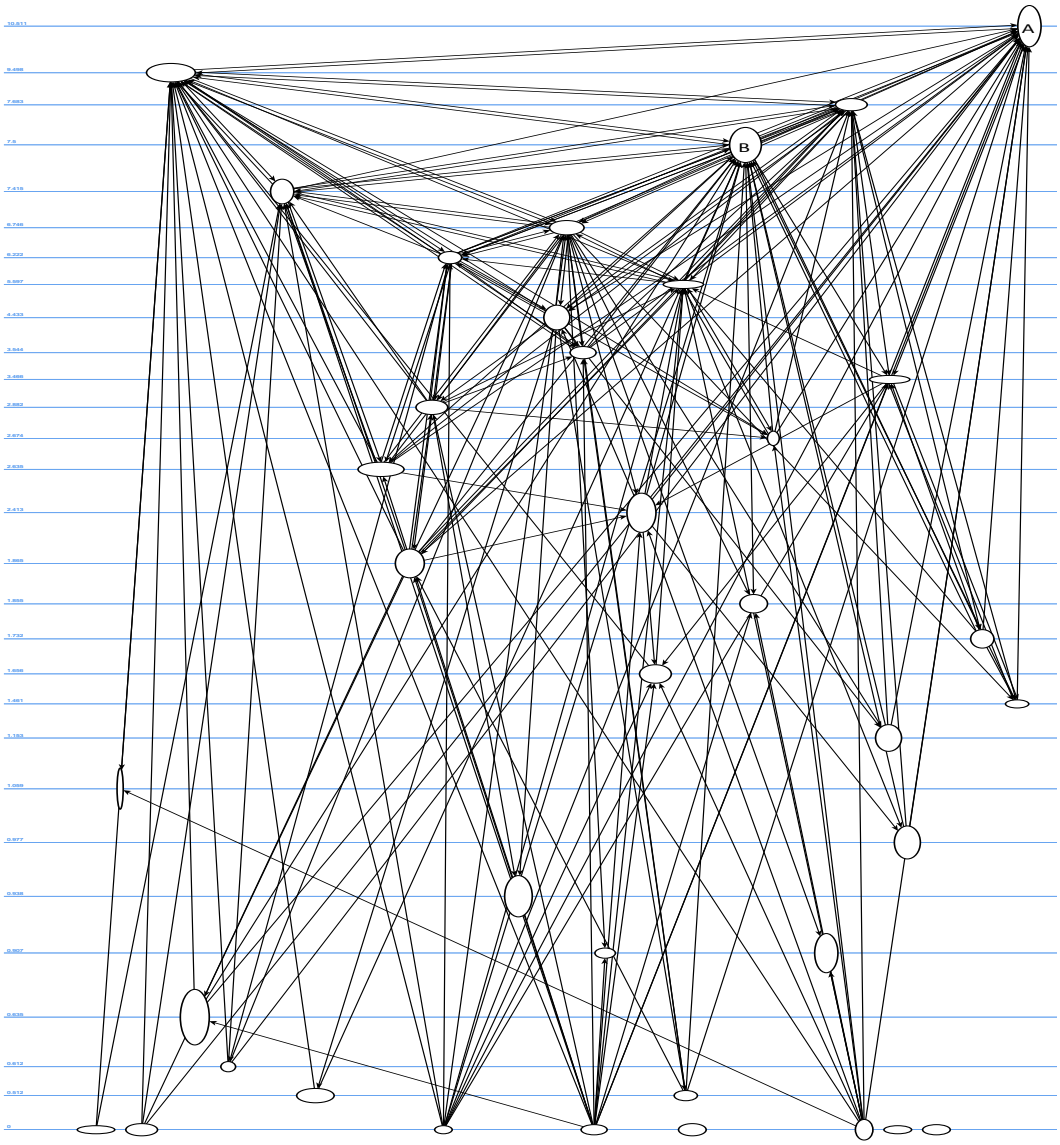
			Model		
Control variables			Estimate	SE	Sig.
1. Network rate parameter (period 1)			24.85	5.74	
2. Network rate parameter (period 2)			34.38	10.09	
3. Network rate parameter (period 3)			22.64	4.72	
4. Shape out-ties (linear)			0.15	0.23	
5. Shape out-ties (squared)			-0.50	0.05	***
6. Dummy period 1			-0.34	0.08	***
7. Dummy period 3			0.04	0.08	
Endogenous network effects					
8. Popularity of alter			0.02	0.01	**
9. Reciprocity			-0.28	0.34	
10. Transitivity			0.13	0.19	
Exogenous network effects					
11. Trust			0.32	0.05	***
12. Formal position (direct superior)			0.14	0.21	
13. Communication			0.07	0.04	+
Actor (alter) attributes - strategy use					
14. Direct		- Bilateral arguing	0.03	0.09	
15.		- Public negotiation	-0.01	0.12	
16. Indirect	(horizontal)	- Asking opinion of others	-0.10	0.07	
17.	(vertical)	- Complain to superiors	-0.17	0.08	*
18. Passive		- Retaliation	-0.96	0.23	***
19.		- Resignation	0.10	0.09	
Other alter characteristics					
20. Average trust received			-0.55	0.22	*
21. Average trust received from superiors			0.31	0.10	***
22. Formal status (number of subordinates)			0.17	0.05	***

Note: *** p<0.001; ** p<0.01; * p<0.05; + p<0.10.

Source: Labun, Wittek, Steglich, Wielers (2011). Power networks: The effects of reputation, social embeddedness and power strategies. Manuscript.

FIGURES

Figure 1. The Power Reputation Network



Note: A power attribution from ego to alter is present if ego perceives alter to be rather influential or very influential. The height and the width of the nodes differ based on one's tenure and strategy use, respectively. A node labeled "A" is the manager; node "B" is the behavioral scientist – the second most important person in terms of the position in the formal hierarchy of the current organizational setting.

Source: Labun

[i] http://www.knaw.nl/Content/Internet_KNAW/publicaties/pdf/20111001.pdf

[iii] In the Furniture Store data (Wittek, 1999b), half of the Salesmen were Jews. Though Jews are more likely to direct interpersonal trust choices to other Jews at the beginning of the study, this homophily effect disappears at later stages. Also the results for balancing point towards the need for refining standard SNT arguments. The analysis is based on a careful decomposition of the seven different types of configurations defining balance in a triad. The tie between i and j can be absent, asymmetric or mutual, and either i or j or both can direct a tie to k (Wittek, 1999:24). Of the seven effects, four corroborate the balancing assumption, two are not significant, and one contradicts the balancing assumption. Some balancing processes could be detected: there is a significant tendency for salesmen who trust each other to also trust the same third parties. But the revealed pattern could not find support for the balancing hypotheses in one important respect: there is a significant tendency for two salesmen who trust the same third person to *not* trust each other. This implies that balancing processes are inhibited if a salesman has encountered a cooperation problem with a specific third party.

[iv] Another issue arising from the foregoing is: how do individuals build interpersonal trust relations to influential others? Standard SNT has little to add here, it just assumes that individuals will prefer to make contact to influential others, since having these people in your network of course has a higher payoff than ties to people who are not influential. While this reasoning makes sense from the perspective of ego, it forgets the other side of the coin: why would an influential person want to invest time in a relation with someone who has little influence, i.e. whose "social capital value" is low? In order to become an interesting interaction partner for an influential other person, one needs to be influential oneself, i.e. have much "social capital". Put differently: informal influence and power comes from existing social relations, ties that the individual has built up in the past, preferably to influential others.

RST offers an alternative explanation. RST would suggest that relational signaling is an instrument to build relations. Occupying a structurally advantageous network position is not a necessary condition in it. Also influential people are subject to relational signaling and the "power of the gift". The key is ingratiation. "Political skill" has been shown to affect an individual's effectiveness in generating interpersonal trust (Kolodinsky, Treadway & Ferris, 2007; Wei, Liu, Chen & Wu, 2010). A fundamental requirement for such ingratiation techniques to be effective is that they are not recognized as such (Treadway et al., 2008). This shows another important aspect of signaling: as soon as the signal is perceived to be strategic rather than genuine, it is likely to backfire. The reason is that it signals to the receiver that the sender is not genuinely interested in the relation, but instrumentalizes it for his or her purposes. Self-serving intentions should not be visible.

Hence, we would expect (a) If A attributes power to B at t1, B will reciprocate with an interpersonal trust tie at t2, (b) the more an employee engages in the use of power strategies at t1, the more likely it is that he or she will develop an interpersonal trust relation with informal leaders at t2. These hypotheses were tested with a multiple SIENA model in the Youth Care organization. The empirical test allows disentangling the social capital mechanism (according to which it power attributions are a function of strong ties) and the relational signaling mechanism (which predicts that strong ties are the result of power attributions). The analyses provide support for the signaling view, but also call for a closer investigation of the signaling processes underlying the use of power strategies.