Network analysis: emergence, criticism and recent trends

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Abstract

Purpose – Network analysis is a well consolidated research area in several disciplines. Within management and organizational studies, network scholars consolidated a set of research practices that allowed ease of data collection, high inter case comparability, establishment of nomological laws and commitment to social capital motivation. This paper aims to elicit the criticism it has received and highlight the unsettled lacunae.

Design/methodology/approach – This paper sheds light on Network Analysis's breakthroughs, while showing how its scholars innovated by responding to critics, and identifying outstanding debates.

Findings – The paper identifies and discusses three streams of criticism that are still outstanding: the role of human agency, the meaning of social ties and the treatment of temporality.

Originality/value – This paper brings to fore current debates within the Network Analysis community, highlighting areas where future studies might contribute.

Keywords Social capital, Network analysis, Economic sociology, Relational sociology

Paper type Conceptual paper

Introduction

Throughout all social sciences, the imagery of "networks" has sparked the imagination of scholars and practitioners (Castells, 2000, 2016; Knox, Savage, & Harvey, 2006). Network Analysis research has gained in the last decades a position of centrality in Management studies (Borgatti & Halgin, 2011). Within the last decade, Network Analysis scholars have consolidated this approach's core premises, while addressing enduring criticism. In contrast to a view that Network Analysis is mainly macro, scholars have shed light on studies that emphasize individual choice and individual personality (Fang *et al.*, 2015; Tasselli, Kilduff, & Menges, 2015). Instead of a conception of networks as static and bearing deterministic effect on individual performance, several reviews have unearthed research efforts that highlight change and dynamics (Borgatti, Brass, & Halgin, 2014; Tasselli *et al.*, 2015). In contrast to a perception that Network Analysis is fully committed to a structural perspective, recent manuscripts attempted to underscore human agency (Borgatti *et al.*, 2014; Gulati & Srivastava, 2014; Kilduff & Brass, 2010). In opposition to views that conceive the patterns of relations as dissociated to culture and meaning, several recent studies have brought back a concern with meaning (Borgatti *et al.*, 2014). These studies have expanded Network Analysis's boundaries and theoretical interfaces.

In spite of this expansion, studies following the Network Analysis approach have reinforced its association to social capital and the idea that social ties bring positive gains (Carpenter, Li, & Jiang, 2012; Hollenbeck & Jamieson, 2015; Kilduff, Tsai, & Hanke, 2006; Kilduff & Brass, 2010). Consequently, Network Analysis have continuously inquired how individual prominence is associated with performance (Kilduff & Brass, 2010). In tandem, Network Analysis has strengthened its concern with operationalizing network centrality measures as a key approach to identify influential individuals (Kilduff *et al.*, 2006). Therefore, it has deemphasized studies that focus on the social system, towards research efforts that emphasize individual agency. Throughout this article, I claim that while several studies have successfully incorporated "human agency", improved the discussion around the meaning of relationships and incorporated the treatment of temporality, these themes still fall short from a with engagement with Network Analysis critics (Emirbayer & Goodwin, 1994; Erikson, 2013). This paper builds upon the existing criticism to Network Analysis and contributes to this debate as it goes deeper on the "human agency", "temporality" and "meaning themes".

The purpose of this paper is threefold. First, it brings evidence of the emergence and prominence of the Social Capital approach over other alternative approaches within the Network Analysis in management studies. Second, it portrays the historical evolution of Network Analysis, with emphasis on the major empirical and methodological breakthroughs that led to the emphasis on Social Capital. Third, recover the major criticism against the Network Analysis mainstream, while highlighting how the Network Analysis mainstream's responses addressed this criticism. Finally, the paper concludes with possible avenues of future developments for Network Analysis, while identifying the major obstacles for a full dialogue with alternative approaches.

Context

To contextualize the Network Analysis within the management studies scholarship, I chose to identify the articles that were ever published at flagship journals that cite specific core concepts. The journals chosen were ASQ, AMJ, AMR, Org Science, Org Studies, JMS, and SMJ. To represent the evolution of the volume of papers associated to "social capital", I chose the "betweenness" and "structural hole" terms, as they are widespread metrics of individual success within networks. In contrast, I chose the term "blockmodel" to identify the papers associated with a system approach to Network Analysis. These terms and approaches will be further elaborated in the coming sections in this paper. An examination of the evolution of a number of articles that cite these terms at the selected journals shows that this research stream has carved out an important segment (Figure 1).

This picture enacts a scholarly community heralded by a successful research project. Yet, the history of Network Analysis research entails an intense debate, conflict and displacement. Consider for instance the evolution in the citation patterns of the three concepts cited above (betweenness, structural hole, and blockmodel) in Figure 2. While "blockmodel" comprised the majority of citations in the late eighties, early nineties, it vanished to almost oblivion by 2010. This fall is not just explained solely by an expected "obsolesce" of concepts. It also reveals major shifts in the field. The "blockmodel" approach was mainly used to understand a network as a system of social roles, it favored unique case studies, rich in contextual grounding, and combination of several types of relationships at once. In contrast, "betweenness" and "structural hole" are concepts associated with individuals' brokerage capacity, where the whole network or the social context is frequently elided to the background, thereby maximizing the generalizability of findings.

Source: Elaborated by the author

Figure 1.
Evolution of articles
citing selected SNA
concepts at top
management journals
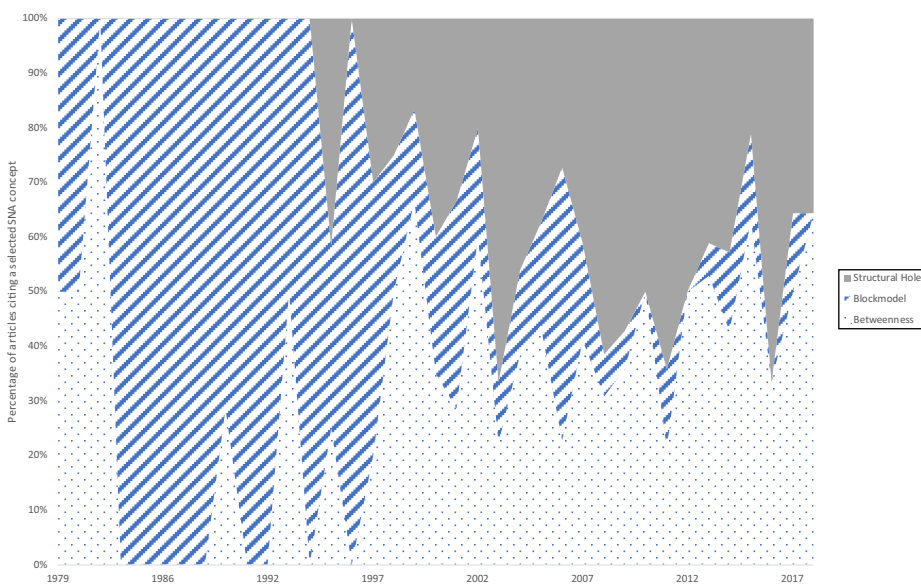
Source: Elaborated by the author

Figure 2.
Percentage of articles
citing selected SNA
concepts at top
management journals

This example illustrates the need of exploring how SNA evolved through time, unearthing its central debates (Borgatti & Halgin, 2011; Emirbayer & Goodwin, 1994; Kilduff *et al.*, 2006; Pachucki & Breiger, 2018). This article follows this extant literature by exploring how the SNA tradition evolved and developed its "hardcore". Further, it inquiries how its defenders answer to critics, and as a consequence, introduce novelties to the discipline.

Early network analysis research program: foundational ideas

The Network Approach, like any other discipline, lays on widely accepted beliefs (Freeman, 2004; Kilduff *et al.*, 2006). At this paper, I suggest that two beliefs are widely shared by several streams of Network Analysis: the primacy of relations and the structural patterning of social life.

Network Analysis is based on "the primacy of relations", which implies a strong ontological program. In comparison to "essentialist" approaches that assume individuals as "self-contained" entities, relational programs and Network Analysis specifically attempt to understand the individual as emergent of its web of relations. Further, Network Analysis places its analyses on sets of individuals linked by edges, which are amenable to the mathematical graph theory analysis (Freeman, 2004). As a result, it shies away from purely "individual variable-centric" models (McFarland, Diehl, & Rawlings, 2011).

Network Analysis scholars attempt to unveil the "structural patterning of social life" through mathematical models. These models might comprise the identification of prominent individuals in a network, of whole networks' characteristics, and the identification of emergent groups and positions in the network, or the underlying mechanisms in tie formation (Freeman, 1979; Kilduff *et al.*, 2006; Snijders, 2011; Wasserman & Faust, 1997). Even when the focus is a qualitative study, SNA research will bring graph-based representations to the fore (Domínguez & Hollstein, 2014).

The early network analysis research tradition: emphasis on meaning, context and social systems

In 2004, Linton Freeman wrote a book called "The Development of Social Network Analysis", where he attempted to reconstruct the genealogies across the Network Analysis community (Freeman, 2004). His identification of Network Analysis's forefathers included Simmel, Moreno, Heider and Lewin as great influences. Before World War II, several initiatives were undertaken at both sides of the Atlantic. This effort included scholars like George Caspar Homans, William Foote Whyte and Elton Mayo. The late thirties "Western Electric Company" studies, a precursor of the Human Relations school in management mapped six types of relations among employees and espoused preliminary social network depictions (sociograms) (Roethlisberger, Dickson, Wright, & Western Electric Company, 1967). Yet, it was at the late fifties and early sixties that the Network Analysis research blossomed, mainly as a response to the "structural functionalist" hegemony. It is worth concentrating on two specific hubs: Harvard University and Manchester communities.

Led by Max Gluckman during the fifties, the social Network Analysis approach at Manchester clashed directly against the structural functionalism's theory and methods (Mitchell, 1969). While the structural functionalism conceived social relations as overdetermined by legitimate social norms, Manchester school anthropologists identified and documented empirical evidence of social relations that did not align with the expected rules. Drawing from kinship studies, these scholars showed that the institutionalized rules governing relationships could conflict with each other. The conflict among rules gave individuals to the opportunity of increasing their discretion in forming relationships

(Nadel, 1957). Consequently, scholars committed to Network Analysis placed social relations in a privileged starting point: social relations could not be reduced to social norms and institutions (Emirbayer, 1997). The Manchester's approach to Network Analysis generated a body of studies that were highly contextualized. The study of relationships was always conducted in tandem with ethnographic fieldwork. Further, field research captured several different types of relationships, collected through interviews as well as direct observation. Scholars associated with the Manchester school also combined interdisciplinary approaches to their field methods, to obtain a wholistic perspective on interviewees. Substantively, these studies were ambivalent *vis-à-vis* the effect of social relations on individuals' outcomes. As several studies attempted to show, one's entrapment into clientelist relations could be harmful.

In the late sixties and seventies, scholars located at the Harvard University developed a set of tools and approaches that paralleled Manchester's. Freeman (2004) calls this period the "Renaissance" of Social Network Analysis at Harvard and crucial for the further development of the discipline. The major propelling force for this emergence was the hiring of Harrison White, a scholar with training in both Physics and Social Science. The efforts of Harrison White and his colleagues were concentrated into using the concept of "structural equivalence" and develop it into the idea of "network positions". "Structural Equivalence" refers to the extent that individuals' patterns of relations are alike. For that matter, structurally similar individuals would be equally connected to alters in a network. White and his colleagues went a step further and suggested that sets of individuals that were structurally similar should be grouped together into "positions" (the "blockmodeling" approach). Further, the relationships between positions ("blocks") could be also analyzed. As a consequence, complex and large networks could be summarized into a collection of interlocked positions (White, Boorman, & Breiger, 1976).

White *et al.* (1976) show that these "positions" are conceptually equivalent to "social roles", since individuals who share the same pattern of relations are probably facing the same social pressures. Yet, in comparison to the functional structuralist approach to social roles, White and associates' approach let roles emerge from the patterns of social relations, rather than biasing the study with ex-ante rule-based relationships. White's insights led to several strides within the organizational theory and the sociology of organizations. For instance, DiMaggio (1986) proposed that "organizational fields" analysis could be complemented with blockmodeling of the field's actors. Bearman (1987) analyzed the English revolution between 1540 and 1640 and suggested that the emergence of network positions preceded the emergence of ideologically cohesive discourses. In a similar vein, Padgett & Ansell (1993) reconstructed the networks among Florentine families (comprising several types of relations) and showed that occupying a network position preceded one's enactment of social identity. These later studies suggested that the individual's actorhood was best conceptualized as an outcome, not antecedent to social relations. Hence, this research stream frequently espoused a "network reductionism", where relations were prior to individuals' interests and identities (Emirbayer & Goodwin, 1994). More balanced approaches attempted to establish individuals and network membership in a dual constitutive relation (Breiger & Melamed, 2014; Kilduff & Krackhardt, 1994).

The emergence of social network analysis social capital approach

In the late seventies, but mostly during the eighties and nineties, Network Analysis would suffer a shift that established the construction of its current mainstream core, mainly due to Mark Granovetter and Ronald Burt translations of the idea of "social capital" into network

constructs. At this paper, I espouse a restricted definition of social capital, offered by Adler and Kwon:

> Social capital is the goodwill available to individuals or groups. Its source lies in the structure and content of the actor's social relations. Its effects flow from the information, influence, and solidarity it makes available to the actor. (Adler & Kwon, 2002, p. 2002).

From this perspective, individuals access important resources through their relationships, thus there is an emphasis on individual and instrumental action. Further, resources and relations are conceived as analytically if not empirically separated. The effort of bringing the idea of social capital to Network Analysis had already been developed by James Coleman and Nan Lin (sociologists strongly influenced by their economist peers at the University of Chicago; see Coleman, 1990; Lin, 2001). Both Granovetter and Burt were influenced by Coleman and Lin and revolutionized Network Analysis and the Economic Sociology. They did that by recovering the taxonomy of triads, developed by social psychologists but seldomly used by sociologists.

Inspired by Fritz Heider (1958), several social psychologists were interested in understanding whether individuals would be able to cope with perceived dissonance within their social contacts (Cartwright & Harary, 1956; Festinger, 1957). These initial investigations led to the insight that individuals would not suffer from "cognitive dissonance" if their perceived surrounding contacts were organized into transitive triads. For instance, if Mario is friends of Rafael, and Rafael is friends of Sandro, we would expect that Mario would be willing to be Sandro's friend. Conversely, those triads that were intransitive were labeled "forbidden triads". This research stream later received further mathematical treatment into a probabilistic model of a finite set of triads (Holland & Leinhardt, 1970).

Under the supervision of Harrison White, Granovetter recovered this taxonomy of triads and suggested that "weak ties" could endure and emerge as bridges in a social system, provided that they were not surrounded by strong ties (Granovetter, 1973). By "tie strength", Granovetter understood the emotional investment but also the resources spent in the relationship. When two individuals (say, MaryJo and Luciana) are close to a third-party (Fabio), Granovetter suggested that MaryJo and Luciana should have at least a weak tie between them. This insight could be unfolded into three implications: first, Granovetter preserved the idea of "forbidden triad", for triads with two strong ties could be at least complemented with a weak tie; second, it offered an important complement to Coleman idea that "social capital" was based on strong and cohesive networks. Instead, to obtain fresh information, one should be able to access opportunities outside her own community, through bridges to other parts of the system (weak ties). Third, Granovetter also introduced an important methodological novelty: while a tie's strength was defined *vis-à-vis* the emotional proximity between ego and alter, it could be operationalized as a sheer share of time that ego spent with alter, simplifying the data collection.

Ronald Burt, a student of Coleman and Lin at Chicago, had also leveraged on the insight of triads and developed upon Granovetter's ideas. Further, Burt also brought to Network Analysis several anchors that helped it to reduce complexity allowing intercase comparability, generate universal laws, and center the analysis on individual action. In the early eighties, Burt was involved in the analysis of a census conducted in the state of California, where the individual relational data was collected. The questionnaire captured a wide range of types of social ties. Burt's analysis of individuals' social ties *vis-à-vis* life attainment (a core principle at the social capital tradition) revealed that "trust" relations were sufficient to capture most variation in explaining individual achievement (Burt, 1984).

This finding allowed future studies to forego the examination of multiple types of relations, simplifying both the collection and data analysis, while permitting enhanced comparability between cases.

In contrast to James Coleman, who emphasized cohesion in one's network as a source of social capital, Burt emphasized disconnection between contacts. For Burt, borrowing on Simmel, when one's network encompassed many contacts, and these contacts were disconnected from each other, this allowed the individual to amass a greater wealth of information and eventually promote a broker role among those disconnected contacts (Burt, 1992). Thus, Burt emphasized the "forbidden triads", trespassing a boundary Granovetter avoided to cross. In a sequence of studies, Burt was able to replicate this insight in a number of different contexts, attempting to promote the "structural hole" advantage into a nomological law, and at the same time, displacing his teachers' previous insights on social cohesion to the background (Burt, 2001, 2004).

Following Lin's approach, Burt also focused on "ego networks", rather than "whole networks", allowing the analysis of single respondents to standardized questionnaires. This shift encompassed two moves in relation to the previous paradigm. First, while the previous paradigm was usually based on the whole network data collection, the later paradigm was mainly focused on data based on individuals' direct contacts only (ego network). That allowed researchers to waive the collection of "whole network" relational data. In contrast, it would be possible to collect data from individuals, assuming independence of observations. Second, while the previous paradigm characterized one's centrality in the network as emergent of all paths in a network, the later paradigm was only concerned on how one's direct contacts were related to each other. Burt's strategy to debunk the previous beliefs entailed an empirical comparison between "whole-network based" social capital and "ego-network based" social capital. He concluded that "contacts of contacts" are irrelevant for one's social advantage, allowing future studies to detach individuals from whole relational systems (Burt, 2007).

The social capital turn in Network Analysis scholarship triggered a fast diffusion of this technique into the management community for several reasons: first, it allowed the generation of universal (nomological) laws, easily transposable to new contexts; second, it focused on the positive side of "networking", where connections were usually assumed to be associated to economic gains (Kilduff et al., 2006); third, it brought quick and fast data collection methods based on questionnaires, easily adaptable. In sum, these changes allowed the possibility of translating these insights to management teaching: how to recognize and leverage on their structural social capital advantage (Burt & Ronchi, 2007). Table I summarizes the shift that "social capital" scholars introduced to SNA studies.

	Social system approach	Social capital approach	
Main authors	Mitchell, White, Breiger	Coleman, Lin, Burt, Granovetter	
Individual actorhood	Emphasis on actorhood as emergent from social relations	Prior to action and relationships	
Preferred Unit of Analysis	Whole network	Individual's ego network	Table I.
Generability of knowledge	Case-based	Nomological	Comparison between
Types of Relationships	Emergent and multiple, driven by fieldwork	Ex-ante and parsimonious, based on previous studies	"social systems approach" and
Impact of networks on individuals	Ambivalent	Positive, linked to economic gains	"social Capital approach" to SNA
Source: Author's elaboration			

Criticism to social capital mainstream and responses
In parallel to the emergence and consolidation of the "social capital" paradigm, criticism was offered, internally and outside the Social Network community. In this section, I will present three major themes that were presented as criticism to Network Analysis, as well as the responses developed by Network Analysis mainstream.

Structural determinism and structuralist instrumentalism
One of the most important sources of criticism to Network Analysis approach is its "structural determinism" (Emirbayer & Goodwin, 1994). Critics pointed out that studies usually emphasized only the structural effects on individuals, eliding how individuals attained their advantageous positions by establishing and disrupting ties. This line of criticism remained strong for several decades (Borgatti & Halgin, 2011).

This criticism was frequently collapsed into the remark that network studies lacked a theory of change, for longitudinal analyses could try to explore how social actors established and disrupted ties. To be sure, these two criticisms should not be confused. A theory of change might be restricted to show how individual action (micro) aggregates into network evolution (micro-macro link). Yet, the individual predisposition for action might be overdetermined by her network position. What Emirbayer and Goodwin (1994) referred as "Structural instrumentalism" is the favorite approach adopted by proponents of longitudinal networks, as I will explore further above (Snijders, 2011).

In contrast to the "structural determinism" and "structural instrumentalism" approaches, Emirbayer and Goodwin (1994) suggest the adoption of the "structuralist constructionism". This approach takes in full account the individual's possibility of exercising agency, and conceives actors as dialogical, while avoiding assuming individuals as "self-sufficient entities" (Emirbayer & Mische, 1998). Emirbayer and Mische (1998) define human agency as:

> [. . .] the temporally constructed engagement by actors of different structural environments – the temporal relational contexts of action-which, through the interplay of habit, imagination, and judgment, both reproduces and transforms those structures in interactive response to the problems posed by changing historical situation. (p. 970)

In contrast to the "structural determinism", under this approach individuals exert choice (although under constraints). In contrast with the "structural instrumentalism", individuals are not conceived as maximizing utility out of fixed maximization rules. Interpretative understanding of concrete situations might lead actors to reframe situations and rechannel their efforts (Gross, 2009; Padgett & Ansell, 1993).

Introducing agency to mainstream network analysis. Current attempts to reintroduce human agency into Network Analysis have usually conflated agency to individual action. At this section, I present how psychologists, rational action sociologists, and economists have conceived agency within networks.

Psychologists associated with the current Network Analysis scholarship have usually attempted to correct the overtly structuralism by reintroducing individual attributes into the analyses (Kilduff & Krackhardt, 1994). One approach was to introduce individuals' personality attributes into the models, to explore how personality traits explain tie formation and position attainment (Mehra, Kilduff, & Brass, 2001). A similar strategy was to explore the individuals' social cognition skills, and attempt to establish the extent that one's position in the network is explained by her cognitive skills (Kilduff & Tsai, 2003; Krackhardt, 1987). While these approaches have helped to improve the "micro-macro"

linkages in the Network Analysis research, they have scarcely helped to explain why individuals make their choices, thus eliding the agentic dimension of social action.

Another Network Analysis mainstream family of responses to the lack of agency in Network Analysis studies has been largely associated to an attempt of modeling longitudinal behavior, thus, conflating "agency" to "change" (reinforcing the 'Structuralist instrumentalism' approach). For instance, the SIENA project has proposed an actor-based simulation that attempts to infer what social actors value in a social network when they form and disrupt ties. This approach is based on approximating the observed network waves to the simulated networks, assuming that actors want to maximize utility (Snijders, 2011).

Agency has been introduced to Network Analysis by scholars following alternative streams, but often with a "utility maximization" approach (Gulati & Srivastava, 2014). For instance, computational social scientists attempt to create ex-nihilo networks solely based on simulations. A remarkable example of a contribution based on computational simulation is Buskens & Van de Rijt's (2008) model of a network as if everyone strove to control structural holes. Their simulations show that if all individuals in a network strove for structural holes, their relative gains would be completely depleted.

Economists have also attempted to give a contribution to the problem of agency in SNA (Jackson, 2008). Economists usually espouse Nash equilibrium modeling, frequently combined with experiments that might confirm the equilibria deduced by theory. For instance, Galeotti & Goyal (2010) show that under circumstances of minimum asymmetries of expertise among individuals, participants of a network will organize themselves around a "star-shape" (centralized) network. Finally, physicists have developed sophisticated modeling and simulation approaches to explain the emergence of complex structures (Barabási, 2003).

Meaning of ties and forms

Critics of Network Analysis have pointed out that this scholarly community used to take as granted a dichotomy between "form" and "content" of ties (Emirbayer & Goodwin, 1994). As a result, relations appear to be "tubes" throughout which "stuff" (values, norms, beliefs, information about jobs opportunities, ideas) flow. As we have seen before, the analytical separation between structure and culture (or, the pattern of ties and the meanings that circulate) was a central assumption for social capital proponents.

Erikson (2013) traces back this approach to Simmel's early studies, whose sociological project entailed bringing to sociology an analogue of Kantian pre-experience categories of "time" and "space". For Simmel, argues Erikson, the shape of relationships (e.g. transitive triads) is prior to experience. Thus, these universal shapes work as pre-content cognitive schemata that shape the individual perception of situations. For instance, Simmel compares two men wooing a woman to two firms competing for the same customer as similarly conducing to conflict, regardless of the content that is expressed throughout these interactions.

Scholars have deployed several strategies to challenge this dichotomy. One strategy is to show that ties are endogenous to what flows throughout them. In other words: what goes through a relationship changes it. For instance, Zelizer (2005) shows that the exchange of money between two persons might change their relationship. For instance, if a girlfriend gives money to her boyfriend after sex, this could offend the later and ruin the relationship.

Several critics have pointed that ties should not be taken as "things" that an actor possesses and is able to act upon this. In contrast, McLean (1998, 2007) shows how social actors deploy rhetorical resources to attempt framing how interactants and third parties will

interpret the content of a relationship. In opposition to the dichotomy between "form" and "content", several critics suggest that ties are constituted by meaning, and without a prior framework of reference, social actors are unable to recognize a relationship with alters (White, 2008).

(Re) introducing "meaning" to the mainstream. Network Analysis has slowly encompassed multiple types of relations. For instance, Ibarra's (1992) distinction between "instrumental" and "expressive" ties has been a dominant approach to differentiate ties within Network Analysis scholarship. Recent reviews have acknowledged the paucity of types of relations applied in Network Analysis (Borgatti *et al.*, 2014). One recent answer to this criticism is the return to ethnography as a starting point for any research project (Borgatti, Everett, & Johnson, 2013). Borgatti and his associates suggest that any research design should include an "ethnographic sandwich", where the identification of the most important types of relations is conducted before the relational data collection.

Further, several new approaches have been developed to extend the simultaneous analysis of several types of relations. The analysis of "multiplex" (several types of relations) networks has gained traction in the last years, exploring the groups of actors more likely to develop reciprocity and other configurations based on different types of relations (Agneessens & Skvoretz, 2011). The same idea is extended to strategic management and organizational studies, by studying strategic alliances and merger and acquisition ties (Shipilov, 2012; Shipilov & Li, 2009).

Further, recent studies have attempted to reincorporate negative ties. Negative (or conflictive) ties were mostly emphasized by Heider's balance theory, and lost room, as the social capital and the positive organizational relations approaches led to an emphasis on positive relations (Kilduff *et al.*, 2006). In contrast, recent scholarship has stressed the role of negative ties to individual outcomes (Labianca, 2014). These studies are complementary to the social capital approach, as they attempt to clarify how negative relations undermine social capital predictions.

Temporality

The attempts of modeling network change with sophisticated longitudinal models have spurred the debate on how temporality is conceived within Network Analysis studies. Critics have pointed at least three problems associated with Network Analysis mainstream treatment of time.

First, the models assume that individuals experience time as a homogeneous and linear flow (Abbott, 2001). While at some circumstances and contexts events occur at a faster pace, in other situations, events are experienced as fewer and longer.

A related problem is what Granovetter dubbed "presentism" in SNA (Granovetter, 1992). The "presentism" is the assumption that social actors think their relations in an ahistorical fashion as if they don't have a history, and there are no expectations on their future existence. This problem became more salient as critics to questionnaire as reliable devices for relational data collection came to scrutiny. It became apparent that respondents confused "existing relationships" with relationships that they wanted to preserve in the future (Martin, 2017).

Finally, critics have pointed out that users of longitudinal models were frequently forced to create a collection of "snapshots" before modeling network change. As a result, intermediary data has been lost in the process. Moreover, by flattening relational data into a single point in time, the resulting structures might be misleading (Butts, 2009). As Big Data is incorporated into the toolbox of social scientists, the temporal resolution problem becomes

even more acute, requiring better models that are appropriate to frequent changes in small temporal units (Pachucki & Breiger, 2018).

Introducing more developed approaches to temporality. A major recent breakthrough in the Network Analysis mainstream was to establish a clearer distinction between "relational events" and "relational states" and its implications for research (Borgatti *et al.*, 2013). "Relational events" are observable interactions, recorded by the interactants themselves or third-party observers. For instance, a hand-shake is a relational event. In contrast, "relational states" are usually perceptions of a relationship between individuals or enacted by third parties. For instance, when two individuals get married, they are objectively bound in a relationship state. Further, when one recognizes a classroom peer as a "friend", this is also a disclosure of "relational state", although subjective.

This distinction led Network Analysis scholars to develop the models through two different directions. One possibility is the modeling of relational states as the outcome of relational events. For instance, Gibson (2005) applies Conversational Analysis to infer relational states from interactions (relational events) occurred in a series of meetings. Another possibility has been to model the dynamics of "relational events", circumventing the arbitrary establishment relational states. For instance, the "Relational Event Modeling" approach (Butts, 2008) infers the relational mechanisms from a stream of interactions (Quintane, Conaldi, Tonellato, & Lomi, 2014 for an example in the organizational literature).

Discussion and conclusion

Throughout this paper, the main goal was to present the emergence of Network Analysis studies, subsequently the development of its mainstream core associated with social capital, and how the mainstream research responded to related criticism. At this section, I take in stock the debate above and discuss the extent that the mainstream has been able to respond to its critics, and the likely limits to its expansion.

The first theme discussed was the "Structural determinism" and "Structuralist instrumentalism" associated with Network Analysis studies. A related debate was the lack of attention to agency (Borgatti & Halgin, 2011; Emirbayer & Goodwin, 1994). The mainstream response to critics has been to take agency to be strongly grounded on "rational choice" assumptions, thus, reinforcing what Emirbayer & Goodwin (1994) called "structuralist instrumentalism". A full account of agency might encompass the idea of reflexivity and internal dialogue, as well as the interpretation of the concrete situation as fundamental (as seen above Emirbayer & Mische's (1998), conception of human agency). An example of full engagement with the "structuralist constructionism" may be observed at McLean's (2007) analysis of how enacted situations led to the deployment of rhetoric resources by Florentine families to reframe relationships.

The second theme debated was associated with the paucity or lack of meaning related to ties. A related debate was the dichotomy between forms and content. Mainstream scholars have made remarkable efforts in closing the gap established at the late eighties, where attention to ties' content was shifted to the background (i.e. reintroduction of ethnography, development of multiplex models, etc.). The expansion of the possibilities of types of ties has also brought the reintroduction of negative ties that were present in earlier Network Analysis studies (Labianca, 2014). As a byproduct, the belief that "connections are related to economic gains" has been revisited – social ties might also bring several types of "pains" (Krackhardt, 1999). In contrast, recent qualitative studies, outside the social capital mainstream, have shown how standard questionnaires freeze the meaning attached to relationships, while these relationships' would be better understood as outcomes of an ongoing process (Small, 2017). Small's (2017) research brings a direct implication for field

researchers: to understand the meanings implied within one's social network, it is not sufficient to apply questionnaires. Researchers must also deploy qualitative and unstructured methods to capture the process of formation and evolution of social ties.

Finally, the theme of temporality has risen as a source of criticism, and we have seen how mainstream has responded to it by distinguishing "relational events" from "relational states", and then modeling the former without imposing "temporal granularity" assumptions to obtain the later. Also, researchers have improved their approach to modeling non-linear sequences of events. Yet, there is a standing challenge on how to grasp individual expectations of tie duration. In contrast, several scholars associated with "relational sociology" approaches have advocated thinking of ties as narratives. As such, ties should go beyond simple "existence" or "non-existence" at the present snapshot, to incorporate a full narrative description (White, 2008). A narrative approach to networks would allow the qualitative collection of social ties without forcing the projection towards a single point in time.

This research bears the limitation of mainly focusing on mainstream management literature. As a consequence, there is a bias towards associating "social capital" to individual attainment. In contrast, future studies might expand the scope of investigation to cover empirical studies that focus on "collective social capital" (Lazega, 2015).

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