Embarked on social processes (the rivers) in dynamic and multilevel networks (the boats)

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Abstract

This paper is the written text underlying the keynote presentation at the Sunbelt XXXVIII in Utrecht, 2018. It presents a neo-structural approach to social processes in the organizational society and the usefulness of the analyses of multilevel networks to understand how we navigate these processes and are made aware of them when we face cooperation dilemmas. Empirical illustrations look at how multilevel networks and relational infrastructures are useful to research a process such as coopetitive learning in science, business and government. A conclusion focuses on the role of multilevel relational infrastructures in institutional entrepreneurship, social change and politics, as well as on our responsibility to develop our knowledge of these social processes and multilevel relational infrastructures as open science.

Keywords

Social processes, Cooperation dilemmas, Multilevel networks, Multilevel relational infrastructures, Coopetitive learning, Institutional entrepreneurship, Politics, Open science, Neo-structural sociology.

Embarked on social processes in the organizational society

The main social processes in which sociology has been interested since the nineteenth century are solidarity and exclusion; deviance, control and conflict resolution; regulation and institutionalization; and learning and socialization. To say that these processes are social is to say that much of their deployment is always problematic and beyond our individual control. Even when we can influence one of their episodes or components, we are embarked in/by them, cannot stop them, and necessarily navigate their tumultuous course with others. Together, these processes can be considered to be social capital of the collective. Navigating our course in these processes with others makes everyone interdependent, and interdependencies are thus too important to be left unorganized. We are thus reminded of this navigation each time we meet cooperation dilemmas. To manage these dilemmas, individuals and societies try to organize these interdependencies with structure and culture; for

example, with relational infrastructures reflecting vertical differentiations (forms of status), horizontal differentiations (forms of division of work) and norms of behavior and exchanges associated with position in the structure created by these differentiations. Structure, culture and agency as analytically distinct operate in conjunction with each other and drive each other's evolution.

Among indicators of these interdependencies, we find impersonal interactions and personalized relationships. Today, the focus is on personalized relationships and relational infrastructures, especially multilevel relational infrastructures. We define relationships as channels for resources and moral commitments with the exchange partners. Specified by culture and agency, relationships combine into relational patterns and these patterns are the relational infrastructures shaping the social processes identified above. Relational infrastructures are the backbones of certain forms of organized collective action and production, which we call collegial (not to be confused with congenial). Since all the social processes

identified above have a relational dimension, studying them from the perspective of this relational dimension adds to their sociological understanding.

The study of the association between position in the social structure and behavior, as revisited by White et al. (1976) and developed in particular by INSNA members, has contributed to understanding this navigation. When personalized relationships are stabilized, they form relational infrastructures (for example, dimensions of status measured by centrality, or division of work approached with blockmodels) that both help members of the collective manage their cooperation dilemmas and constrain them. They represent complex opportunity and constraint structures (White, 1970) nested in social classes that, at some periods in history, facilitate mobilizations, accumulation and opportunity hoarding (Tilly, 1998).

This new structural analysis was bolstered during subsequent decades by specialized statistical models for networks as dependent variables. In these models exogenous effects, i.e. based for example on class, gender, ethnic affiliations, occupation, formal status, etc., bring into the picture the wider social context and its conflicts to understand and explain the formation of networks at different levels of granularity: dyadic (with p2 models, e.g., Van Duijn et al., 2004), triadic or higher order levels (with ERGMs, e.g., Pattison and Wasserman, 1999; Snijders et al., 2006; Wasserman and Robins, 2005), and thus of relational infrastructures. This rigorous methodology has helped to analyze and to contextualize the deployment of the social processes and their navigation. Further sophistication and stabilization of these analyses look at the co-evolution of these networks, behaviors, normative choices and positions (e.g. dynamics in Snijders', 1996, 2005; Snijders and Steglich (forthcoming), analyses of longitudinal network data) where networks are both contexts and contextualized.

This neo-structuralism recognizes that the management of interdependencies and cooperation dilemmas have certainly always been sophisticated and complex. However, as shown by modern sociologists – from Weber (1978) to Presthus (1962), Coleman (1982), Perrow (1991), Lindenberg (1997), Wittek (2017), Wittek and Van de Bunt (2004), Wittek and Van Witteloostuijn (2013) – the organization of interdependencies is today further characterized by the fact that we now live in an "organizational society." In this organizational society, the meso-level of social order (and therefore the construction of the macro level) is dominated by those who control organizations as "tools with a life of their own" (Selznick, 1949, 1957) that tend to "absorb societal functions" (Perrow, 1991). This perspective focuses the attention on the necessity to factor into the analyses – of relational interdependencies and infrastructures, social processes and their navigation – much more than in the recent past, the fact that society is stratified by superposed levels of organized collective action. The study of structure, culture and agency has to take this vertical, multilevel dimension of social phenomena much more into account.

Understanding navigation of social processes with the analyses of multilevel networks

The concept of duality (Breiger, 1974; further developed by Fararo and Doreian, 1984 and many others), in which individuals and groups/organizations co-constitute each other, is central to understand this vertical and multilevel dimension of the organizational society. In particular, it can mean that position in the organizational society is built from at least two levels of collective agency: inter-individual and inter-organizational. To revisit theories of tumultuous and often violent social processes and their collective navigation in the organizational society, we argue that it is useful to look at this navigation at least at two superposed levels of collective agency, simultaneously. A level is defined here as a system of collective agency with the same vertical and horizontal differentiations between members as those considered in the previous section (i.e. multiple dimensions of socioeconomic status and forms of division of work). Actors at each level can be the individuals (affiliated in the organizations) or organizations (companies, government administrations, professions, associations, cooperatives, etc., affiliating individuals). Individuals build relationships within and across organizational boundaries; and organizations build an inter-organizational field or system (industry, policy domain, etc.) in Selznick's (1949) sense of "dynamic configuring fields". At each level, we find all the generic social processes and the relational infrastructures that help navigate them. Each level can be represented as a network that is homogeneous with respect to type of actors, as in Figure 1, and these structures can be analyzed as made up of units of analysis that are pairs of person-organization, in which the person is affiliated in the organization.

In general terms, looking at the characteristics of such pairs helps to further understand position in the social structure, i.e. individuals dually positioned in superposed levels of collective agency. Duality as co-constitution of one level with the other can be further modelled here using what Snijders (2016) calls "analysis of multilevel networks"
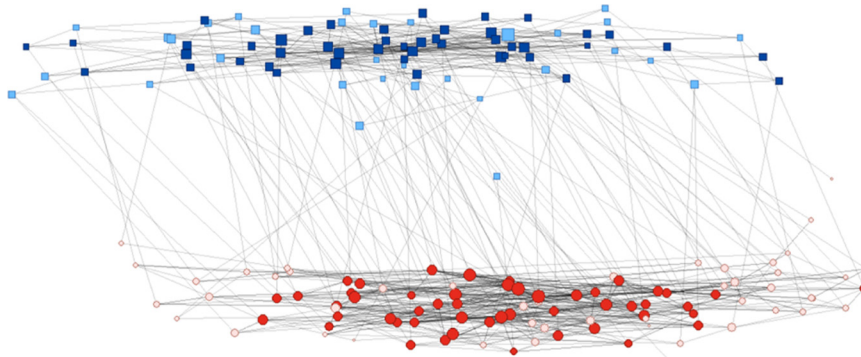
(See 'Catching up with the big fish in the big pond', *Social Networks,* 2008, with Marie Jourda, Lise Mounier & Rafael Stofer)

Figure 1: Superposed levels of collective agency: inter-individual network, inter-organizational network, and affiliation network. In this multilevel, linked-design structure, the two levels are each made up of different types of units. In the analysis of multilevel networks (AMN), as understood here, the unit of analysis is the individual-organization pair.

(AMN), as differentiated from "multilevel network analysis" (MNA). In this approach, each level is context for the other and represents a form of collective agency (Wasserman and Iacobucci, 1991; Parcel et al., 1991; Lazega, 1994; Lazega et al., 2008; Lazega and Snijders, 2016). Such networks overlap and coevolve in complex ways, and these overlaps become indicators of meso-level context for individual relational strategies across boundaries, but also for the construction of macro-level structures (social stratification and inequalities). Each level is context for the other. Statistical models helping explore the emergence and determinants of such structures are provided, for example, by Snijders and Bosker (2012), Koskinen et al. (2017), Wang et al. (2013, 2016), Žiberna (2014), Žiberna and Lazega (2016), Zappa and Lomi (2015), Tranmer et al. (2016). Today I would like to report some of our explorations of how these multilevel dynamics work, based on datasets following this linked design.

Economic sociology offers many example of such forms of coopetition (Brailly et al., 2018, provide an overview), understood as paradoxical cooperative competition. They show how these overlap and their management always matter in understanding markets, more generally contexts where coopetition is vital. In this domain, this multilevel perspective has provided a new network boundary specification technique, as illustrated and developed by Eloire (2010), Eloire et al. (2011), Penalva-Icher (2010), Oubenal (2015), Piña-Stranger and Lazega (2011), Brailly (2016), Favre et al. (2016), who all look at how competitors cooperating in markets navigate social

processes with relational infrastructures. First, they list all organizations active in the field of study, and their interdependencies. Second, they list the main individuals who are affiliated in these organizations and know about the latters' strategies, policies, interdependencies, exchanges, coordination efforts and capacity for resilience. This technique samples individuals, with all the limitations of samples, but is nevertheless useful as an exploratory technique when the researcher knows that the sample represents an organized community with inter-individual and inter-organizational collaborations. Third, they elicit interdependencies between these individuals active in the field with data on their activities, division of work, specialties, productivity and performance. This approach has identified overlooked positions and processes, for example the position of vertical linchpins (actors who are active at two levels, simultaneously), dual alters, extended opportunity structures, multilevel Matthew effects, etc.

If multilevel agency and strategies become so visible in the organizational society, it is preci-sely because they help actors manage both inter-dependencies and conflicts with each other, i.e. coopetition. If the organizational society generalizes coopetition, it is also likely to encourage a form of reflexivity that makes multilevel agency an explicit concern. Coopetition itself as an example of this general statement about social life, i.e. coorientation and coordination among actors who still jockey for positions and compete for resources, is as widespread as soccer games. However, in capitalist economies – where the lower the levels of social stratification, the

more open, direct and systematic the competition forced upon their members – coopetition acquires a different meaning. In many coopetitive fields, for example, individual employees are put in charge of seeking, on a personal basis, information and advice from other employees belonging to different, competing companies, thus figuring out ways for their respective companies to coordinate with one another, i.e. to become relatively friendly competitors instead of engaging in cutthroat competition. Thus, a multilevel approach to collective action dynamics in the organizational and market society can identify ways in which companies compete in public, while their employees cooperate in private.

In theory, one should deal with such broad issues process by process, relational infrastructure by relational infrastructure, each dataset bringing its additional insights. Instead, I will focus here on one single process, coopetitive collective learning, in three different settings. This complexifies even further the tradition of studying learning through advice networks (see for example Agneessens and Wittek, 2012; Barbillon et al., 2016; Glückler et al., 2017; Krackhardt, 1990; and many others). These case studies flesh out this multilevel perspective with the AMN: the first looks at multilevel coopetition in science; the second in business; the third in government. In these cases, we identify the multilevel relational infrastructures that help coopetitors navigate the focal social process that makes collective action among rival peers possible.

Examples: navigating coopetitive learning in science, business and government

The first example is a study of collective learning and coopetitive performance among public scientists, a population of top cancer researchers in France in 1999–2000. This case in point focuses on collective learning among highly competitive actors. All are part of science as a multilevel production system with collective action at each level. Individuals are researchers, all "sublime" in different ways (eight papers per year in internationally visible journals scanned by Cancerlit – later merged into Pubmed – for three years in a row between 1996 and 1998). They work in different research laboratories. The two different levels of collective agency are, first, five different inter-individual level advice networks supporting the work of these scientists; and second the inter-organizational level captured by seven networks of resource interdependencies between laboratories (recruitment of postdocs, shared expensive technology, joint

funding and research projects, etc.) supporting the collective projects of these respective organizations. The dominant specialty is still hematology-immunology that was able to associate more systematically with fundamental research since the 1970s. Indeed, more than a generation earlier, they had collectively won a race to learn and appropriate molecular biology, and to coopetitively share their experience of using its techniques[1].

Multilevel position and relational infrastructures

Multilevel relational infrastructures, especially multilevel status, mainly helped specific researchers navigate the coopetitive learning process. Here we roughly identify high and low multi-level status by taking the median in indegrees between individuals (i.e. central – the big fish) and less central (the little fish, below the median), and the same for organizations, combined with size (the big and the small ponds). We can thus identify four positions in multilevel status: the big fish in the big ponds (BFBP), the BFSP, the LFBP and the LFSP. On average performances of these categories differ. Impact factor (IF) scores are unreliable as measurement of quality of work, but it is nevertheless interesting in our exploratory approach to look at what story they tell. This story is that performances of the BFBP are higher, which is no scoop, but also that over time only the LFBP catch up with the BFBP[2]. This makes sense: only the large and central laboratories have enough resources to help their young postdocs and researchers remain in this highly competitive race.

This suggests that characteristics of organizations count more for IF performance than characteristics of individual members who navigate the coopetitive system. Size and centrality of their laboratory, as well as resources, seem to matter more than their own individual centrality in the advice networks in this segment of the profession. Thus, organizations influence and dominate the coopetitive learning process, especially in favor of the BFBP with high epistemic status, as well as the LFBP. Organizations are that important because they provide resources,

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[1]Retrospectively, we know that this social system was already in decline. Hematologists-immunologists specialized in leukemia still dominated this research field, but the invention of genetic sequencing, then its use by various applied specialties including epidemiological research, was going to extend medical knowledge on solid tumors.

[2]Napoleon used to say that in politics it is better to be first in one's provincial village than second in Paris. In science, it seems to be the opposite.

functional coordination, but also the social discipline needed to navigate the social processes at hand. One indicator of this social discipline was made available to us thanks to measurement of the perceptions by these researchers of who among the others were their direct competitors. Our analyses showed that, under specific conditions, researchers seek advice from, and share experience with, colleagues whom they recognize as direct competitors (Lazega et al., 2017). This was the case almost only among hematologists – immunologists and their laboratories. They were able, more than other specialties, for historical reasons, to turn cutthroat competition into more manageable coopetition, in particular by creating and sustaining this social discipline thanks to multilevel relational infrastructures mentioned above. Figure 2 is based on a stochastic blockmodel of two networks (advice and identification of direct competitors), i.e. a model based on probabilities of advice relations between and within blocks conditioned on presence of direct competitors. In this system, when factoring in the direct competition network jointly analyzed with the advice network among peers, only one social niche was identified as capable of this feat.

This single social niche in this system (Block 2 central in Figure 2) brings together hamatologists-immunologists. They were the only researchers whose relational infrastructure was helpful in terms of taming cutthroat competition and turning it into more or less friendly competition, thus facilitating the achievement of important results collectively and individually. This specialty was able to self-organize as a "social niche" (which is a relational infrastructure as defined above) over two generations, a block of scientist that not only brought together researchers with the same relational profile in this milieu, but also was capable of collective action as a cohesive group (Bernard et al., 2000). Inside the niche, social discipline was strong enough to stop competitors from sharing advice deliberately trying to mislead other members. In addition to resources, only this social niche of big ponds was able to provide this context and social discipline.

Cross-level agency, overlaps, strategies and resilience

But are organizations really thicker than individuals as determinants of such achievements? Our answer is yes if you measure their effect cross-sectionally, at least at one point in time. Only the LFBP with the right relational behavior learn to catch up with the BFBP over time as part of their heavily relational socialization (Lazega, 2014). Indeed variations
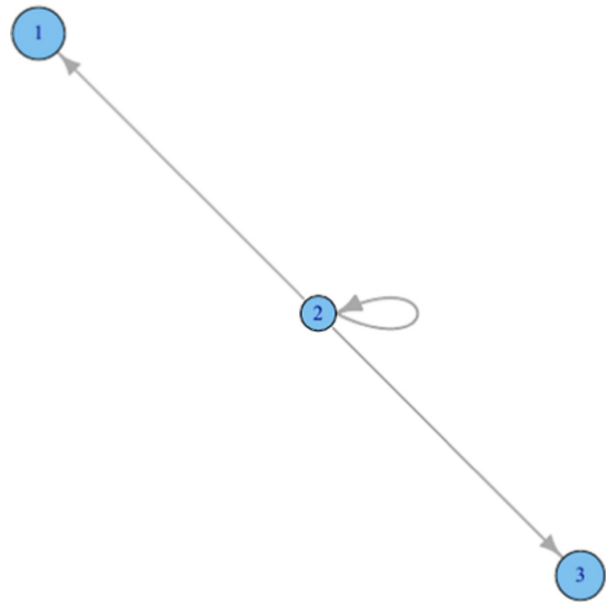
(See 'Effects of competition on collective learning in advice networks', *Social Networks,* 2016, with Avner Bar-Hen, Pierre Barbillon, Sophie Donnet)

Figure 2: Seeking advice and learning from peers identified as direct competitors: managing coopetition with superposed social niches as a collective benefit of multilevel networks. Stochastic blockmodel based on the probabilities of advice relations between and within blocks conditioned on presence of direct competitors. The two kinds of links, seeking advice and identifying as a direct competitors, are dependent. In the second block there is a higher proportion of members seeking advice from each other and calling each other direct competitors than in the two other blocks. Node size proportional to block size, N = 126.

among the LFBP (especially the young researchers looking for freedom and emancipation, as shown by Coromina Soler et al., 2011 and Ziherl et al., 2006) show that, in such multilevel systems, individual learning strategies matter too, not just their multilevel position. We measure these strategies by looking at the ways in which these scientists manage the overlaps between their own individual network and the network of their organization. We identified four types of overlaps as indicators of multilevel relational strategies: independent (no overlap, the researcher has relationships in the interindividual network that

are members of laboratories in which his/her own laboratory does not have relationships at the inter-organizational level); individualist and collectivist have more or less partial overlaps of different sizes; and the fusional strategy means that the researcher, being a good soldier of his/her lab, has relationships in the interindividual network only among members of labs in which his/her own lab has relationships at the inter-organizational level. It is interesting to note that the strategy that characterizes the "winners" in this system (the BFBP and the LFBP) is the individualist strategy. The radical independentist strategy, in particular, seems to be a mistake in this particular context – message for the younger colleagues in the audience. This analysis, as exploratory as it is, strongly suggests that things do not just happen for those in the right place at the right time: individuals in a coopetitive milieu are also strategic in their relational choices.

These individual strategies matter in the interplay between levels, but agency and strategy matter particularly over time. A multilevel approach shows in this case that the resilience of personal relationships, i.e. their deliberate maintenance over long periods, explains in part the effectiveness of these strategies, especially when organizations disappear. In our case in point, for many reasons, almost none of the laboratories in which we interviewed these researchers and directors still exist today as organized entities: technology and methods have changed with genetic sequencing and genomics, turnover of members and directors have created new structures that have replaced to ones we observed. And nevertheless, the density of co-publication ties between members of this population of researchers is almost as strong 17 years later in 2016 as it was in 1999 (year of fieldwork). In this case in point, as shown by the comparison, in Figure 3, between the density of the co-publication networks among these scientists in 1999 and in 2016, the resilience of personal coworkers' relationships is impressive. In total, 17 years after fieldwork, all laboratories had disappeared as organized entities, and researchers were in different laboratories. But they still published together, in part with the same colleagues as in 1999. To put it in a simplified way: combined collective learning and personal ties last long after organizations that brought these scientists together disappear.

This "long" term resilience of personal co-publication ties, combined with strategies of investment in social discipline and relational infrastructures, pay off. This observation limits very much the idea that organizational characteristics have more effect on performance than individual characteristics and

1999   **2016**
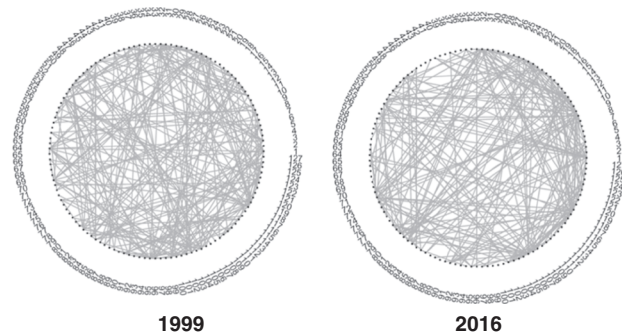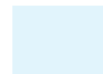
(Bar-Hen & Lazega, forthcoming).

Figure 3: The "long" term resilience of inter-individual collaboration ties over 17 years, long after the different organizations in which they worked have disappeared.

agency in this context. The opportunity structure represented by organizations needs personalized ties within this milieu in order to become an important asset and determinant of performance. But one has to look at this effect over time to realize it.

Position and agency combined in extended opportunity structures: discreet kinds of inequalities
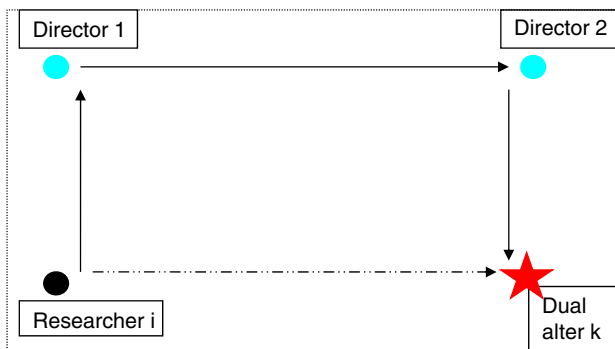
If both position and agency matter separately, how do they matter together as determinants of individual performance in this setting? Another way in which organizations matter, in addition to providing direct access to resources and a form of social discipline, is in their capacity and willingness to extend the opportunity structure of their members. This means rewarding (from the perspective of the director/ manager of the organization) their members who select the "right" multilevel relational strategies and align with the multilevel relational infrastructures. Which of the three strategies that maintain an overlap between the inter-individual and the inter-organizational networks is rewarded by which manager is an underexplored research question.

Indeed, one more reason why organizations are somewhat thicker than individuals when we look at determinants of this kind of performance is that they can extend members' opportunity structures by providing access to what we call dual alters, especially dual alters with complementary resources. We have coined the added value for performance derived from indirect, multilevel, manager-enhanced access to resources accruing from an extended opportunity

structure "network lift from dual alters" (Lazega et al., 2013). We call dual alters actors in the system whom the focal actor does not reach on his/her own, but who can be introduced to the focal actor by his/her director/manager. As shown in Figure 4, network lift from dual alters is equivalent to closing a multilevel 3-path. When directors/managers share relational capital to give access to dual alters, their members' performance increases – especially when the dual alters are rich with resources complementary to that of the focal actor. When this occurs, the LFBP catch up with the BFBP.
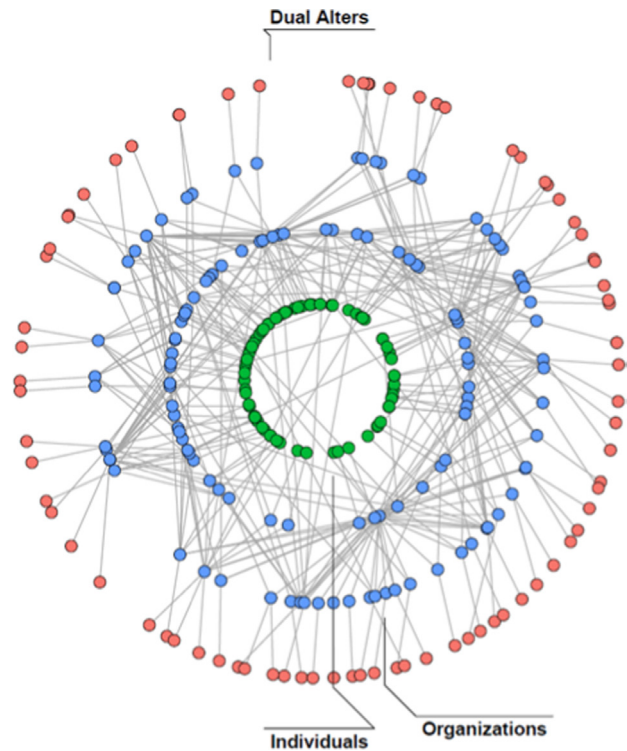
Figure 5 visualizes the potential that dual alters represent. It shows all the dual alters with complementary resources accessible to researchers for coopetitive learning and collaborations through their inter-organizational ties. It is interesting to notice that 50% of the BFSP are both directors and researchers closing multilevel 3-paths for others, while their IF scores still decrease over time. One interpretation of this effect could be that their commitment to their laboratory as a whole comes with this individual cost since they no longer work for themselves but for the collective.

It is worth mentioning that this effect increases when we take into account an additional level, i.e. the

Dual Alters

Individuals   Organizations

(See 'Network lift from dual alters', *European Sociological Review,* 2013, with Marie Jourda and Lise Mounier)

Figure 5: A potential to realize through multilevel 3-paths: picture of all dual alters (in red) accessible to researchers (in green) for coopetitive learning and collaborations through their inter-organizational ties (in blue). Green nodes are actors i. First circle of blue nodes are organizations in which actors i are affiliated. Second circle blue nodes are organizations with which first circle blue nodes are connected. Red nodes are dual alters accessible to members (green nodes i) through inter-organizational networks. For the clarity of the picture, ties among members i (whether as focal actors or as dual alters) are not visualized.

(See 'Network lift from dual alters', *European Sociological Review,* 2013, with Marie Jourda and Lise Mounier)

Figure 4: How can inter-organizational ties be that important to members' multilevel status? Dual alters induced relational capital accessed thanks to closing multilevel 3-paths. By providing an extended opportunity structures: "network lift" from "dual alters" and a 3-level Matthew effect. They provide a social discipline across organizational boundaries, a discipline that makes it possible to seek advice from direct competitors (otherwise risky).

personal collaboration team of the researcher and its characteristics (Lazega and Jourda, 2016). We then have the following different levels: the first level is the focal researcher's personal collaboration team represented as an ego network (as in Burt's (2005), Burt and Merluzzi (2014) "within group" entity); the second level is the complete advice network between

all focal researchers in the field; and the third level is the inter-organizational network of laboratories in which these focal researchers are affiliated. The more dual alters with complementary resources one can reach and exchange with, and the denser the collaboration ego network, the higher the performance because the more likely the focal actor is to benefit from the equivalent of a 3-level Matthew effect. Indeed in multilevel systems, directors/managers can induce access to dual alters by closing such multilevel 3-paths. Thus network lift from dual alters is not only created by closing such complex paths. It is also derived from a specific kind of cumulative advantage. We pictured this 3-level Matthew effect with a paraglider with three levels (Lazega and Jourda, 2016). Incidentally, one of the questions one could ask in business schools is why managers do not create this connection with dual alters for their subordinates more often. The answer might be that this extension of opportunity structures of subordinates requires that managers do not perceive their relationship with their subordinates as cutthroat competitive.

The combination of specific multilevel relational strategies by individual members and the closing of multilevel 3-paths by the manager can transform a latent, extended opportunity structure, into a social process that is a collective asset shared and useful to navigate the coopetitive learning process. This special dimension of opportunity structures, which we call extended opportunity structures, thus matters for navigating social processes on multilevel, socio-organizational networks.

Multilevel temporalities and synchronizations

Our second example is a study of collective learning and coopetitive survival in business[3], in particular among sales representatives with precarious jobs in a trade fair for regional buyers and global sellers of television programs. Economists of culture show that this global industry is structured as an "oligopoly with fringes." A small number of large multinational firms, the Majors, dominate the global market using scorched-earth tactics. They empty the pockets of the largest clients, for example by selling new and successful series, such as – at the time – "The Borgia," while giving away for free, as an extra, enough hours of

Mickey Mouse to fill the broadcasters' grids for three hours per afternoon for an entire year. Such tactics undermine the official market where thousands of smaller producers with new and creative programs have to fight for leftover crumbs.

Looking at this market as a multilevel structure based on the linked design helps visualize it as in Figure 6. Brailly et al. (2016) and Favre et al. (2016)
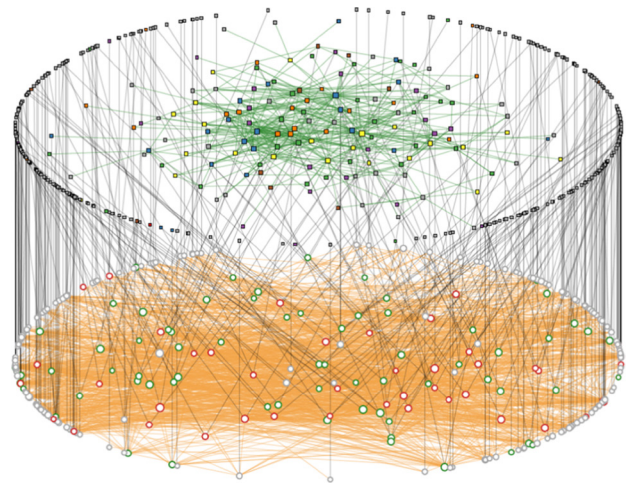
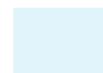(See 'Markets as Multilevel Networks' (2015) with Julien Brailly, Guillaume Favre and Josiane Chatellet)

Figure 6: A trade fair as epistemic and economic space represented with multilevel networks of coopetitive learning among sales representatives for contracting companies. Result of successive visualizations by Julien Brailly, Saint-Clair Chabert-Liddell and David Schoch of a discussion network among sales representatives during year 1 (lower level) and the contract network signed the following year between the companies in which these sales representatives were affiliated (upper level). Many small companies, the units on the outer upper circle, did not sign any contract that year and thus find themselves isolated on this outer upper circle, as if they were watching the economic action driven by the more central companies doing business in the centre. The density of the lower level network represents the "buzz" network of this trade fair. For color codes and for a substantive explanation of this graph, see Brailly (2016; Brailly et al., 2016).

[3]For a neo-structural economic sociology based on the relational work of entrepreneurs using coopetition to navigate social process in markets, see Lazega and Mounier (2003) and Brailly et al. (2018).

show that it is worth network analyzing in detail how deals for the medium- and small-sized companies are initiated and designed by their respective sales representatives at the trade fair, then later transformed into contracts by the companies at the inter-organizational level (Bathelt and Glückler, 2011; Berends et al., 2011). Fieldwork carried out in one such trade fair shows, for example, that the smaller players survive using multilevel, coopetitive strategies that are not entirely dissimilar to the strategies of the scientists cited above. Work at inter-individual level is based on personalized and cooperative advice networks (even between sales representatives working for competing companies), whereas work at inter-organizational level is based on competitive contracting networks. Brailly (2016) has shown how the Little Fish survive through coopetitive relational strategies at their inter-individual level. Survival from collective learning with coopetitors is based on sharing information at inter-individual level (this shows with triadic closure in ties among sellers) morphing into six-order multilevel, multisided, multiplex sub-structures including individuals and organizations, on the buying and selling sides.

In this case of distribution of television programs, the networks reveal different structures and involve different mechanisms of tie formation. But this case also exposes a new dimension of agency in the survival strategies of the little fish, who think multilevel, mobilize multilevel status, and synchronize the different temporalities of the levels in their navigation of the process of coopetitive learning. This specific multilevel management of temporalities is thus another case in point of complementarity between levels. Synchronized schedules and timescales (Brailly, 2016) characterize the superposed temporalities of this multilevel system: A short term "See you next time this year" (at different trade fairs) temporality for individuals shows that the more individuals have recently participated in the same events, the more they exchange information with each other. Longer term "See you same time next year" (at this same trade fair) temporality for organizations shows that the more organizations participate in the long run in the same events, the more they deal with each other. In this multilevel structure, complementarity and synchronization are both necessary for performance, especially for the survival of smaller sellers (after oligopolistic predatory strategies undermined the market).

Thus, creating international socio-organizational ties in the context of a globalized markets requires a complex multilevel process that involves and synchronizes both companies and their employees. The structures of different levels strongly influence

each other and are interdependent. Reframing the embeddedness paradigm with AMN seems to be a fruitful approach to understand the globalization of markets. Organizational and individual levels are both important in different, complementary and synchronized temporalities in this system. The long-term deal network between companies influences cooperation ties between individuals, which in return can bring new business opportunities and constraints to their companies. These dynamics are likely to be recursive, combining short term and long term temporalities and processes (Quintane et al., 2013). Also, although this sharing of leftover crumbs allows smaller players to survive, this is also the story of how big business produces a global cultural order. These coopetitive collective learning processes are at the core of the joint production of global cultural homogenization.

Multilevel agency in institutionalization processes

This multilevel approach to organized collective agency is equivalent to a form of contextualization of networks, behavior and social processes. It has also led back to a basic sociological insight predating network analyses. Just like micro, meso- and macro-levels of society, levels in the decomposition of networks (from dyads to morphology) cannot be linked purely mechanically. Levels of collective agency are linked by the strategic efforts of actors to structure the context of their actions and interactions at all levels, including at the macro level of society. Therefore we have argued that the contextualization of networks cannot be construed without a theory of politics. In fact identification and interpretation of multilevel relational infrastructures is intrinsic to politics. This can be shown, for example, with institutionalization processes, where actors as institutional entrepreneurs participate in normative controversies to structure the contexts of their interactions and thus to manage, for example, their cooperation dilemmas. What we call a neo-structural institutionalism explores how multilevel structure, culture and agency come together as different dimensions of these politics. This multilevel contextualization of networks and behavior has stressed overlooked structural dimensions in the structural study of politics, social change and innovation, for example by stressing the role of status inconsistencies, of collegial oligarchies, of the rhetoric of sacrifice in the management of losers, etc. (Lazega, 2001, 2018). More generally, in a Whitian spirit, further analyses can focus on organized mobility and relational turnover (OMRT) as determinants of the

social processes that can be modeled with multilevel social network analyses. Such phenomena also help contextualize social networks.

Therefore, our third example addresses this issue directly by studying collective learning and coopetition among institutional entrepreneurs. The latter are European judges participating in a form of elitist "social movement" lobbying to create a European transnational court to institutionalize a European-level intellectual property regime, especially for patents. These judges got involved in this political process of institution building because they saw it as their duty as citizens to participate in the construction of a new European-level legal regime for intellectual property, after politicians and governments tried and failed to do so. For other examples of such discreet regulators, especially in finance and the judiciary, (see Huault et al., 2012; Lazega and Mounier, 2012). Indeed, European governments had created a European patent in 1973, but had failed to create the transnational court that would enforce this legal instrument by relying on a common interpretation of this European patent. The judges thought that this failure weakened Europe's capacity to innovate. It allowed large transnational companies and entire industries with patents at the core of their business model (such as the pharmaceutical and biotech industry, the semiconductors' and digital industries, etc.) to instrumentalize the courts, engage in forum shopping (i.e. selecting the national courts and judges most favorable to their preferred outcome, case by case), and use long-lasting "zombie" patents.

Powerful organizations, such as a (non-EU) public/private agency, the European Patent Office (EPO), supported this specialized and elitist social movement. This institution awards patents to business – but is also sole regulator of this system in the absence of the transnational Court. It operates with/under international private law, not EU law. A professional association, the European Patent Lawyers Association as well as a high-level official in the Brussels administration (who later became responsible for the legal department at EPO) were also involved. Judges, lawyers and members of EPO assembled at the so-called Venice Forum (VF) where we collected network data in 2009 – in addition to data on perceptions, opinions and normative choices. We measured several social networks of these judges: discussion, reading decisions made by colleagues across borders, citation of decisions made by colleagues across borders in one's own decisions; and finally recognition of European colleagues considered to be *ex ante* leaders personifying the future European Uniform position on patents. The latter were expected to become members of the Court of Appeals

of this jurisdiction, generating substantive interpretation of patent law and jurisprudence on which European judges would eventually align. Note that this collegial oligarchy of judges, who called themselves a "conclave," did not include representatives of civil society associations challenging patents as the right way to encourage innovation – raising the issue of "democratic deficit" of such institutionalization processes.

This collegial oligarchy of institutional entrepreneurs who were also cross-level actors succeeded in pushing to the creation in 2013 of the European Unified Patent Court (UPC), a new type of judicial institution still waiting for ratifications by key European national parliaments. This VF social movement also informally selected and lifted the collegial oligarchy of super-central judges in inter-individual networks who acquired the high multilevel status that they needed to work convincingly (from the perspective of their peers) on harmonizing the common legal interpretation of the European patent: clarifying anticipations, freezing expectations, obtaining alignments on cross-level linchpins. These supercentral players are identified in Figure 7 mapping the Uniform network among them. They were the most eminent among the judges in this "patent conclave," thus expected to sit on the future Court of Appeal of the UPC once it would become operational. As cross-level linchpins, they had enough multilevel status and the right kind of rhetoric as judicial entrepreneurs to wield influence in this transnational institution building process.

Here we see similar complementarities, but also conflicts, between levels: indeed in the European judicial architecture, the national judge is always the first level European judge, and national judges assembled in Venice were active in their national courts at various levels (from local first level to field-level regulated by Supreme courts). Thus, in this case, the national judges at the VF were also multistatus, vertical linchpins who punch above their weight in collective agency, especially in regulatory, institutionalization processes (Lazega, 2001). These actors with heterogeneous, high and inconsistent forms of status (i.e. in situations of conflicts of interests) were also thinking multilevel, with relationships between levels tense and contradictory, each country having historically developed its own patent law, within its own national innovation system, national legal culture and democratic division of powers.

In particular, this example emphasizes the socializing dimension of coopetitive learning, i.e. the fact that this process generates both epistemic and normative alignments. Drawing on collective learning among themselves, they were getting to know their foreign colleagues and the ways in which they "construe the claims" of litigating parties in their
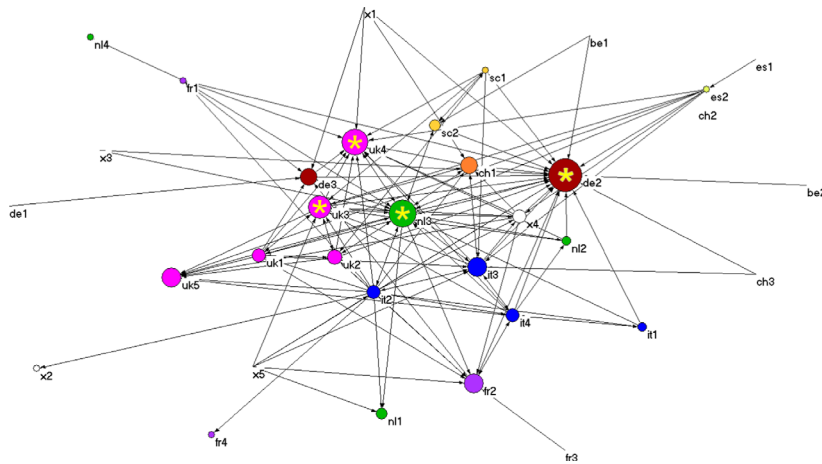
(See "Learning from lobbying", *Utrecht Law Review*, 2013)

Figure 7: The tip of a multilevel institutional iceberg: a collegial oligarchy of institutional entrepreneurs as vertical linchpins involved in coopetitive learning and selection of its *ex ante* leaders. Network map of a EU "patent conclave", the collegial oligarchy crafting the "European Compromise". Mapping the 'Uniform' network: "Who expects whom to represent the future Uniform position, if any?". Clarifying anticipations, freezing expectations, obtaining alignments on cross-level linchpins/collegial oligarchy: Multistatus German, UK and Dutch judges: Judges with * are super-central judges.

respective jurisdictions. Based on this knowledge, these judges tried to hammer out a "harmonized" legal interpretation of the European Patent – although they ended up producing a common, procedural "weak culture" (in Breiger's sense), to start creating alignments and a process of convergence and "harmonization" at the European level (Lazega, 2012a; Lazega et al., 2017).

Note that high multilevel status of super-central judges in collective learning is not transformed into political capital purely mechanically. Table 1 shows an ERG model of this Uniform network, in which

Table 1. Winners and losers from heterogeneous types of capitalism in the *Europe des Juges* institutionalization process.

Effects	Parameter estimate	Standard error
Variables of interest		
Judges apply the same rule	**−0.579**	**0.272**
Judges belong to same capitalism block	0.797	0.452
Judges apply the same rule AND belong to continental Europe capitalism block	**1.242**	**0.346**
Judges apply the same rule AND belong to UK capitalism block	0.673	0.335
Judges apply the same rule AND belong to Scandinavia capitalism block	**0.951**	**0.402**
Judges apply the same rule AND belong to southern Europe capitalism block	**0.945**	**0.351**
Endogenous network controls		
Density	**−4.537**	**1.039**
Reciprocity	**1.261**	**0.394**
Indegree control 1(Markov)	**0.012**	**0.001**
Outdegree control 1(Markov)	**0.012**	**0.001**
Twopath	**−0.087**	**0.025**
Indegree control 2	−0.061	0.331
Outdegree control 2	−0.340	0.350
Transitive closure	**1.167**	**0.211**
Cyclic closure	0.029	0.120
Transitive connectivity	−0.058	0.032

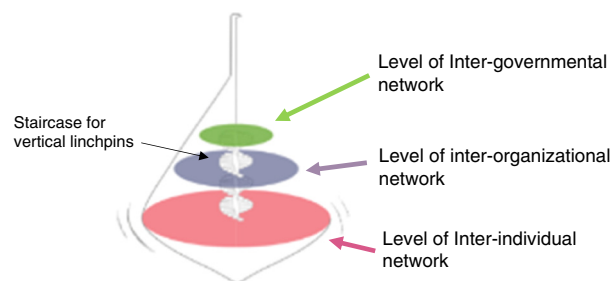Level 1: Judges
Level 2: Capitalism block

(See 'Collegial Oligarchies in Transnational Institution Building', with Eric Quintane and Sandrine Casenaz, *Social Networks* , 2016)

these "activist" judges who get involved in politics, who share the same rules, and who produce a new private/public transnational institution, do not necessarily look up to the same normative *ex ante* leaders. Belonging to countries characterized by the same kind of capitalism and broadly defined legal culture have no direct effect, on their own, on selecting these normative *ex ante* leaders. However, the interaction effects of both variables help understand the construction of this collegial oligarchy and the need for observing and testing cross-level dependencies over time. These judges as vertical linchpin institutional entrepreneurs discreetly involved in politics were trying to promote a new private/public transnational institution (the European UPC) and to put the issue on the political agenda of the European Commission. Understanding their agency requires thinking in terms of dynamics of multilevel networks. Whether this political process produces a new *Europe des Juges* (Dehousse, 1999) remains to be seen.

Staircase for vertical linchpins

Level of Inter-governmental network

Level of inter-organizational network

Level of Inter-individual network

(See 'Organized Mobility and Relational Turnover as Context for Social Mechanisms , in J.Glückler, E.Lazega & I.Hammer (Eds), *Knowledge and Networks*, 2017)

Figure 8: Context as multispin providing stability from movement in multilevel relational infrastructures. Multispin (multilevel spinning top) as direct context of multilevel networks, driving the organized mobility and relational turnover of their members (individuals, organizations, governments).

Multispin: contextualizing social processes and dynamics of multilevel networks

As suggested by Table 1, the macro level and the meso level contexts jointly matter for coopetitive learning and for the selection of rules to make judicial decisions. The socio-economic and political context needed to catalyze such multilevel network dynamics is no less complex than these dynamics themselves. For example, it provides and sorts personnel (Tilly, 2003), helps select leaders and facilitate their circulation, excludes dissenters, mixes members of different social niches, creates moments of synchronization between the dynamics of several levels influencing each other. In Figure 8, we represent this context as a multilevel spinning top, or "multispin," a rough metaphor of stability from movement (Lazega et al., 2011; Lazega, 2016b, 2017) and of synchronization in these multilevel network dynamics. In this system judges are becoming increasingly central over time as they move across hierarchical levels. They rotate and move across jobs, which creates intense relational turnover. This combined OMRT can create upward mobility for vertical linchpins (but also downward mobility for others). In turn, mobility helps create the specific multipositionaly-with-status-inconsistency that is associated with institutionalization of new norms, i.e. participation in institutional change.

In this multispin as a (rather rigid) metaphor of the context facilitating the institutionalization of

new norms at the transnational level, the network dynamics of selection of *ex ante* leaders in this collegial oligarchy indicate processes at superposed levels that co-evolve, influence each other and lead to, or undermine, synchronization. This gives us insights into the production of cross-level linchpins but also of the dynamics that push and pull them across levels. Notice the stairs in the shaft of the multilevel spinning top, representing upward mobility of vertical linchpins associated with institutionalization of new norms, but also the fact that there are losers in these dynamics of multilevel networks of institutionalization. For the latter, multilevel networks lead to nowhere. The dynamics of bottom up collegiality promoting cross-level vertical linchpins can also demote them. Relative structural stability regardless of membership turnover was identified in judges' advice networks and coopetitive learning using stochastic blockmodeling and Siena models (Lazega et al., 2011; Lazega et al., 2006), exposing a cyclical centralization–decentralization–recentralization of advice networks as stabilization provided by this multispin. This was confirmed at the inter-organizational level by Brailly et al. (2016) in the study of the global trade fair in which clusters of sales representatives participating in the market were unstable over time while clusters of the companies and organizations in which these persons were affiliated were more stable. Indeed high turnover at the interindividual level and the stability of the structure at the interorganizational level could

be hypothesized to co-generate each other, often by dumping synchronization costs on individuals (Lazega, 2016a).

The dynamics of cross-level linchpins becoming increasingly central over time and moving across hierarchical levels to institutionalize new norms across borders, these dynamics show how such multistatus and cross-level actors steer the multilevel structures that help communities navigate obstacles in key social processes. Note that multispin as a metaphor also reminds us that there are many examples of such promotion and navigation processes that exclude political opponents by just making the cost of synchronization between levels too high for them. OMRT as determinants of social processes can help filter, close, solidarize, lift and ratchet up a collegial oligarchy at the top. Again, the more open at the bottom, the more closed at the top. These promotions can often squander the social capital of the collective. The norms and institutions that they promote may not be considered legitimate if their assumed followers do not participate in their formulation, selection and promotion.

Dynamic multilevel networks to explore politics in the organizational society

In conclusion, the reason social processes can be navigated by relational infrastructures is that these relational infrastructures impose a form of social discipline that shapes the course on these social processes as capital of the collective. Acknowledging superposed levels of collective agency and analyzing them separately and jointly focuses the attention on multilevel relational infrastructures that help revisit vertical and horizontal differentiations in society. For example, individuals active at two levels simultaneously, i.e. vertical linchpins with multilevel and inconsistent dimensions of status who punch above their weight in the political process. Or multilevel social niches, i.e. combinations of roles played by members of a block of individuals at one level and the roles of a block of organizations at the other level, given affiliation ties. As seen with coopetition, processes at each level influence each other across levels, coevolve and can synchronize – although this synchronization cannot be taken for granted or assumed to be equally costly for all actors across levels. Dynamics of multilevel networks is a mindbogglingly complex set of phenomena with many components moving at the same time: different kinds of actors, behaviors, interactions, relationships, attributes such as positions and affiliations, relational

infrastructures, social processes, encompassing global contexts creating mobility and inequalities.

The three case studies of coopetition in science (multilevel networks of researchers), in business (multilevel networks of sales representatives), and in government (multilevel networks of transnational judges as institutional entrepreneurs) help us explore aspects of this temporal multilevel social order and the implications of this approach for social network analysts today. Analyses of relational infrastructures of coopetitive learning in science show that individuals and organizations are equally, but differently, important for creating and sharing new knowledge with key multilevel players. Observation of multilevel relational infrastructures of coopetitive learning in business shows that synchronized temporalities of individuals and organizations are key to the building of a new global cultural order using markets. Tracking multilevel relational infrastructures in lobbying shows that the construction of institutions also requires what we called "stability from movement," this time in coopetitive learning, i.e. intense OMRT as context for these multilevel relational infrastructures and, with this mobility and turnover, diverse levels of access to law – indeed in many cases too much access to law. Witnessing success in the deployment of such social processes, we can be led to believe that organizations are more important than individuals. This is only true when our measurements are static; over time, individuals and their personalized relationships matter just as much, with increasing intensity of conflicts and power plays being managed with new cohorts relying on complementarity and synchronization of levels.

We are just beginning to explore these dynamics of multilevel relational infrastructures in collective agency, a field of research for the future. As suggested by our last illustration, a better knowledge of navigation of social processes with the dynamics of multilevel networks in the organizational society helps to better understand politics and contemporary transitions, especially institutional change in the face of depleted common pool ecological resources (Bodin, 2017) and increasing social inequalities.

For example, multilevel relational infrastructures and multilevel network models of navigation of social processes can measure the extent to which democracies have become elitist and unequal, and focus on how powerful elites will behave in the coming transitions. In the context of an organizational and class society, relational data is not data like any other. It can increasingly help Big Relational Tech (BRT), i.e. relational data hegemons, identify, coopt or undermine the vertical linchpins and collegial oligarchies that dominate collective learning and

institutionalization processes in society. Social networks touch deep and we are becoming increasingly transparent to such organizations. The concentration of power that big relational data represents because of its increasing value as indicator of social processes and their multilevel navigation has yet to be understood and to sink in. Then, if power must check power, who will check these hegemons (Al-Amoudi and Lazega, 2019)? At least three implications follow from such questions for our academic research.

First, the social construction of multilevel extensions of opportunity structures through dual alters is not just decisive for individual destinies; it is also important in the collective, political construction of the micro–meso–macro links. There are no mechanical transitions from the individual, to the dyad, to the triad, etc. until one reaches the collective with its morphological, horizontal and vertical differentiations and structures, such as multidimensional status and division of work. There is no such a mechanical transition without levels in a stratigraphy, and without multilevel strategies, including these selective extensions, in fact without millions of such extensions. These extensions and their consequences are not studied yet in spite of their obvious political importance, for example, in regulatory processes. It will be up to neo-structural sociology to show how they are created, and a special attention could be paid, for example, to how dual alters participate in anyone's engagement in citizenship and political institutionalization of any new normal.

Second, evolution of multilevel relational infrastructures and social change drive each other in the organizational society, which is a class society where organizations are "tools with a life of their own" evolving in "dynamic constitutive fields" (Selznick, 1949). In the navigation of social processes, multilevel relational infrastructures can create collegial oligarchies and democratic deficits. From "big fish in the big pond" to "cross-level linchpins" to "institutional entrepreneurs," this often leads to rebuilding institutions and societies through very discreet, technocratic, social and institutional engineering (such as finding/recommending/assigning the "right" alters and dual alters for any task). It is therefore part of our responsibility as social scientists to keep identifying these multilevel relational infrastructures and the elites' ways of managing/navigating the social processes that our societies are made of: solidarities, controls, regulations and learning. For any controversial issue, in all domains, small private collegial oligarchies pop up, selected privately through sifting and lifting by multispins in every field. One of the latest was by a BRT company to decide what is fake news, what is angry mood manipulation,

and how to deal with them. The more we know about dynamics of multilevel networks as public scientists, the more we will be able to contribute to managing the roller coasters of these social processes in which we are embarked. Therefore we need new richer data structures, more powerful network statistics to tests hypotheses on dynamic, multilevel networks.

Third, one implication of neo-structural research is that we need to keep collecting and criticizing our own social network datasets combining structure, culture and agency (Archer, 1982; Reynaud, 1989; Breiger, 1990, 2010; Favereau and Lazega, 2002; Grossetti, 2011; Lazega, 2012b), and to develop network literacy along with thorough organizational, ethnographical and qualitative analyses. We should not give up designing our own research on the ground, collecting our own small and multilevel datasets, listening to how people themselves make sense of their actions, relationships, contexts, controversies, etc. If we do not measure and model these processes ourselves, only BRT will, and we will no longer be able to understand these processes in the original language. We can keep learning with our small datasets, especially when big relational data is not accessible to scientists in decent conditions. This is the only way to keep the knowledge of social processes public and democratic.

A hidden competition is under way between public social sciences and private social sciences to track these realities. Following two generations of "governance," collegial oligarchies of top-down collegiality emerge in many social niches making political decisions without saying so, privately designing changes in public institutions, not just in governments and government-related committees. Public social scientists and social network analysts should not let this disappear from the sight of the wider public. Much remains to be done to be useful in that respect.

Acknowledgments

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