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## Article

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## Article

# Networks Originate in Minds: An Exploration of Trust Self-Enhancement and Network Centrality in Multiparty Systems

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**Abstract:** Multiparty systems (MPSs) are defined as collaborative task-systems composed of various stakeholders (organizations or their representatives) that deal with complex issues that cannot be addressed by a single group or organization. Our study uses a behavioral simulation in which six stakeholder groups engage in interactions in order to reach a set of agreements with respect to complex educational policies. We use a social network perspective to explore the dynamics of network centrality during intergroup interactions in the simulation and show that trust self-enhancement at the onset of the simulation has a positive impact on the evolution of network centrality throughout the simulation. Our results have important implications for the social networks dynamics in MPSs and point towards the benefit of using social network analytics as exploration and/or facilitating tools in MPSs.

**Keywords:** social networks; multiparty systems; trust; centrality

## 1. Introduction

Multiparty systems (MPSs) are social systems, composed of several organizations or their representatives that interact in order to make decisions or address complex issues with major social impact (Curşeu and Schruijer 2017). Such issues include sustainable urban development, natural resource management (including water use), or dealing with climate change. Therefore, MPSs bring together various stakeholder groups (typically more than three parties) that engage within, as well as between, group interactions in an attempt to find integrative solutions to these complex issues (Curşeu and Schruijer 2018). MPSs often face significant challenges in reaching the desired outcome, as they embed substantial diversity (e.g., interests, backgrounds, and power asymmetries) (Vansina and Taillieu 1997; Fleştea et al. 2017) on the one hand, and a great degree of interdependence on the other hand (e.g., the sustainable and comprehensive solutions can be reached only by building on integrative actions).

In some cases, MPSs can have a formal governance structure (especially in situations in which formal representatives of the state or government are part of the MPS), yet most of the times the governance of MPSs emerges from the interactions, joint practices, and efforts aimed at unraveling and working with the interdependencies among the stakeholders that compose the system (Bouwen and Taillieu 2004). Such an emergent governance is often hindered as the stakeholders that join the system may bring in frictional relational histories, misunderstandings, or false assumptions that lead to stereotyping and negative behaviors and impede the functioning of the whole system (Schruijer 2006). Due to the relational tensions, oftentimes, some of the stakeholders may get marginalized

or even be excluded from the system. In such a case, these stakeholders cannot achieve their aims. Moreover, the system itself may lose its integrity and ultimately fails to achieve its purpose. Therefore, goal achievement motivates stakeholders to be actively engaged in the relational dynamics of the MPS. In social network terms, stakeholders seek to establish and maintain advantageous central positions in the social networks that capture the relational landscape of the MPS. A key question is: what makes a stakeholder central in the collaboration network of an MPS?

Popular business literature acclaims trust as a social lubricant and scholarly research shows that trust fosters collaboration in work teams (Costa et al. 2018), decreases conflict (Curşeu and Schruijer 2010) and facilitates the development of collaborative relations in MPSs (Vansina and Taillieu 1997). Organizational research shows that trust is more likely to emerge in decentralized (organic) rather than hierarchical organizational structures (Costa et al. 2018). Moreover, social network research claims that knowing who trusts whom accurately predicts who will interact with whom and in what way (Kilduff and Brass 2010). Trust however is a multifaceted (e.g., cognitive, affective, relational, etc.) and multilayered (e.g., interpersonal, intra-group, inter-group, etc.) phenomenon and its relationship with actors' structural positions in social networks is complex. Building on social interdependence theories (Deutsch 1949; Holmes 2002), we set out to explore the role of trust expectations as antecedents of network centrality in MPSs. We build on social comparison and self-enhancement arguments (Kwan et al. 2004) to argue that at the onset of social interactions in MPSs, stakeholders engage in social comparison (me versus others) and the emerging trust self-enhancement (trust in myself versus trust in others) ultimately shapes one's centrality in the collaboration network in MPSs. In other words, we claim that one's centrality in social networks originates from trust expectations based on the social comparison processes at the onset of social interactions.

In this paper, we build on the social network approach to argue that an MPS can be conceptualized as a network of groups that interact with each other in order to jointly define and solve the task at hand. We extend the research on MPSs in several ways. First, our exploration is among the first attempts to explore the dynamics of network centrality using sequential evaluations of network perceptions collected at four points during a behavioral simulation. We use a longitudinal data collection approach to test the effect of trust self-enhancement on the emergence and evolution of network centrality. Second, we employ a socio-structural view and a network aggregation procedure in which we combine individual perceptions of network centrality to obtain group level estimates that are representative for each stakeholder group. As such, our paper provides an empirical illustration of how social network procedures can be used to understand the dynamics of MPSs. Third, we explore trust self-enhancement as one of the cognitive antecedents of the structural position in the MPS network. Using this self-enhancement approach to trust, we move beyond the traditional view that trust is the property of an agent and we explore trust as emergent from social comparison processes in a context of social relations.

## 2. Theory and Hypothesis

### 2.1. A Social Network Approach to MPSs

MPSs bring together various stakeholder groups with the goal to address complex issues, oftentimes resulting in decisions with far-reaching implications (i.e., sustainability decisions, designing new laws, etc.) (Curşeu and Schruijer 2017). The decision tasks that such systems face are often vague at the onset of the stakeholders' interactions and the outcome is difficult to predict from the initial expectations and aspirations each stakeholder has. In order to be successful, the stakeholders in the MPS are compelled to engage in collaborative processes and are motivated to establish and maintain a central position in the relational landscape of the MPS. That is, each stakeholder is expected to actively participate and share its interests, views, and concerns regarding the topic at hand. Moreover, as the views and interests expressed during interactions are often diverse, the stakeholders are required to engage in and integrate the task disagreements, in search for the integrative potential of the situation

(Gray 1989; Curşeu and Schruijer 2017). In doing so, the stakeholders also need to handle the differences regarding their identities, status, and power (Schruijer 2006), and work with the various perceptions and behavioral expectations they hold regarding both one's own group and the other groups in the system (Curşeu and Schruijer 2018).

So far, the dynamics of MPSs was explored under a variety of frameworks, ranging from psychodynamics (Schruijer and Vansina 2008), to relational (Gray 1989; Schruijer 2008) and process-based approaches (Gray 1985). In this paper, we take a structural approach to MPSs and argue that MPSs are social networks, in which stakeholder groups are represented by nodes that are interconnected by an evolving web of social ties. In this framework, the MPS dynamics is captured by the structural changes that occur in the nodes and tie characteristics during social interactions (Snijders 2001). In other words, in a structural approach, the evolution of the social network structure in an MPS captures the dynamics of the relational landscape emerging in such a complex system.

Social capital research brought extensive evidence on the value of social ties, linking one's position in the network to various beneficial outcomes such as: power (Brass and Burkhardt 1993; Kilduff and Krackhardt 1994), leadership (Brass and Krackhardt 1999; Pastor et al. 2002), or performance (Hansen 1999; Tsai 2001). Out of the various metrics that describe an actor's structural position in the system, centrality refers to the degree to which a node (a stakeholder group in this case) is connected to all the other nodes in the network (Westbay et al. 2014). Collaboration centrality, in particular, indicates the number of collaborative relations between a stakeholder group and the other groups in the system. We used two indicators of network centrality, namely betweenness and closeness. Betweenness centrality refers to the number of times that a stakeholder in the system connects other stakeholders (pairwise) that are not directly in contact in the network (Freeman 1979). It is a measure of a bridging role in the MPS. On the other hand, closeness centrality refers to how close a node is from all the other nodes in the system (Freeman 1979). A stakeholder with high closeness centrality is situated in the middle of the MPS network and well connected with the rest of the stakeholders.

A stakeholder group that has a central position in an MPS is likely to be more influential and efficient in working at the multiparty and own agenda, as compared to a peripheral actor. It benefits from the multiple exchanges with other groups within the system such that it has greater access to information, support, and other resources received through the social ties (Oh et al. 2004). A stakeholder that is on average closer to the other stakeholders in the system (i.e., it has a high level of closeness centrality) can gather useful information more easily, while it can also more readily communicate its interests throughout the network and work on its agenda. Similarly, a stakeholder with high betweenness centrality plays the role of a broker, facilitating the information flow between other unconnected nodes in the MPS (Burt 1995). As previously discussed, openly discussing vested interests and concerns (i.e., handling task disagreements) among all stakeholders in the system, as well as solving relational conflicts, is a requirement for a successful collaboration (Curşeu and Schruijer 2017). On the other hand such a stakeholder can also act as a gatekeeper, blocking the information flow in the network (Burt 1995). Due to the dependency of others, on the stakeholders with high betweenness centrality, the latter is often considered an indicator of the power and influence these actors have in an MPS (Krackhardt 1996). In other words, given the high degree of interdependence experienced by stakeholders in MPSs, seeking a central position in the collaborative process is an advantageous strategy for maintaining one's status, power, and influence in such systems.

## 2.2. Trust Self-Enhancement and Centrality in MPS Systems

Trust or perceptions of trustworthiness refer to an individual or shared group belief that another stakeholder (individual or group) is honest, reliable (i.e., makes efforts to uphold commitments), and fair i.e., will not take advantage given the opportunity) (Cummings and Bromiley 1996; Zaheer et al. 1998). Whether within-group or between groups, trust is therefore a lubricant for social relations. Abundant research showed that trust increases cooperation (and cooperation further increases trust in a spiral effect (Ferrin et al. 2008), and it does so even in the absence of authority relations (Bradach and

Eccles 1989), it fosters information sharing and reduces the need to monitor others' behaviors (Curall and Judge 1995; Uzzi 1997).

To summarize, conventional theorizing of trust and social networks suggests that trust in others is a key ingredient for cooperation and communication (Rousseau et al. 1998). In other words, if stakeholders trust other stakeholders, they will be inclined to reach out, establish ties, cooperate, and ultimately increase their collaborative centrality. However, as argued by Edelenbos and van Meerkerk (2015), "the relations between connective capacity, trust and boundary spanning are not unproblematic" (p. 27) as generalized trust in others could also generate lock-in effects and ultimately isolate stakeholders in sparse ego-centric social networks and decrease their network centrality. In an exploration of social networks emerging in a water governance context (in the U.S. National Estuary Program), Berardo (2009) showed that if a particular stakeholder trusted another party, they did not seek to establish ties with additional parties in the system that were trusted by their trustee. However, if the initial level of trust towards a party was low, stakeholders made sure that they were accurately informed by seeking input from all parties in the system. Berardo (2009) suggests that the network behavior of stakeholders with a generalized lack of trust in others could be driven by self-defense and motivate these (non-trusting) stakeholders to acquire a central position in the network, in order to be well informed and establish (or maintain) a strategic advantage. We argue that trust self-enhancement is actually the driving mechanism explaining one's network centrality. Network behavior is driven by social comparison, and if a stakeholder has a substantial amount of self-trust and rather low trust in others (high trust self-enhancement and high group distinctiveness), they will tend to establish and maintain a large number of social ties and become a central actor in the network and acquire more power.

The role of trust self-enhancement in MPSs is grounded in the extension to the intergroup interactions of the expectation states theory (Berger et al. 1974; Berger et al. 1977). In line with this theory, the stakeholder groups form expectations about how much they trust themselves and the other stakeholders, as well as their collaborative intentions. Before the groups have the chance to interact with one another, they build a generalized anticipation related to the trustworthiness and collaborativeness of the other stakeholders in the system (Curşeu and Schrujier 2018). Trust self-enhancement, as we argued before, increases group distinctiveness and the motivation to establish and maintain an advantageous position in the MPS social network. Therefore, trust self-enhancement becomes a basis for expected and real status and prestige differences among stakeholders (Berger et al. 1974; Berger et al. 1977). Given the high interdependence experienced in MPSs, trusting oneself more than others may foster self-interest and motivate stakeholders to seek contact with as many stakeholders as possible in order to maintain a sense of control and a high group distinctiveness. We argue that trust self-enhancement increases stakeholders' expectations to achieve a central network position fosters their collaborative efforts and ultimately influences the real experienced centrality in the MPS (as indicated by betweenness and closeness centrality).

Social identity and social categorization theories (Tajfel and Turner 1979) state that social categorization ("us" versus "them") is associated with in-group valorization (i.e., ascribing positive intentions and qualities to in-group members) and out-group devaluation (i.e., assigning negative qualities and intentions to out-group members). We argue that trust self-enhancement (i.e., a difference in the level of perceived trustworthiness of "our" group versus the other groups operating in the system) is likely to arise and point towards a self-enhancement inter-group strategy (i.e., we perceive "our" group to be more trustworthy compared to the way we perceive the other groups in the system). In other words, trust self-enhancement motivates the groups to seek and maintain a central position in the collaboration network in order to maintain their distinctiveness.

Therefore, our study investigates the role of trust self-enhancement in stakeholders' centrality in the social network that emerges in MPSs as these stakeholders seek agreement in a decision situation. Moreover, one's expectations of collaboration centrality will sequentially predict the centrality of that stakeholder in the social network as intergroup interactions progress. *We therefore hypothesize that:*



**Hypothesis 1 (H1):** *Trust self-enhancement has a positive influence on the perceived stakeholder centrality in the social networks across time.*

### 3. Methods

#### 3.1. Sample and Procedure

This study used a participative learning experience developed based on the principles of a multiparty simulation described in Vansina et al. (1998). The simulation was developed as a learning tool to be used in educational settings in order to teach students about inter-organizational relationships and group dynamics. The data were collected during nine simulations with a total of 239 participants (198 females, average age 23.65 years), nested in 54 groups. The participants were bachelor's and master's degree students, enrolled in a Romanian University, and the simulation was part of their curricular activity. Each simulation included six groups acting as representatives of organizations that have a high stake in the Romanian education system: The Ministry of National Education, The Romanian Agency for Quality Assurance in Higher Education, The National Trade Unions Federation, The National Alliance of Student Organizations in Romania, The Romanian Association of Entrepreneurs, and The Civil Society. Their task was to reach consensus on a decision regarding two critical topics of Education Law. Specifically, the task was to decide (through consensus) whether two articles from the education law (related to university rankings and funding based on academic performance) should be immediately applied, postponed for a limited or unlimited period of time, or suspended. In other words, the simulation creates a multi-party decision context in which several stakeholders collaborate to make a decision in which they have vested interests.

Each simulation started with a briefing on the role that each of the six stakeholders has for the Romanian education system and on the structure of the simulation. The stakeholders interacted in real time and the simulation lasted one day. Therefore, during intergroup interactions, the stakeholders could not avail the passage of time beyond the amount of time allocated for the simulation (e.g., thus, they could not assume that several days/weeks have passed). Groups started with an initial within-group discussion (the first survey took place after this stage, at Time 1), followed by three iterations of 45 min between-group visits (where only a maximum of three stakeholders were allowed in the same room), and plenary sessions with delegates from each stakeholder in the system (subsequent evaluations took place after each plenary session at Times 2, 3, and 4). After the initial briefing, the participants were asked to express their preferences for a maximum of three stakeholders involved in the system or for taking an observer role. Based on their expressed preferences, each participant was assigned to a stakeholder group and instructed to study the booklets containing information about their interests, expertise, and access to resources, as well as general information about each of the remaining stakeholder in the MPS. All simulations ended with a debriefing session focused on reflecting on the within and between group dynamics.

#### 3.2. Measures

Participants were asked to fill in a questionnaire at four time points: after the first in-group meeting (Time 1—planning the strategy, before interacting with the other groups), and after each of the three plenaries (Times 2, 3, and 4)—the round table meetings where delegates attempted to integrate the information they had collected during visiting times and to reach consensus. The questionnaire was based on a round robin procedure (each stakeholder evaluated all the other stakeholders in the system including self-ratings) and included measures of trust and collaborative relations. The questionnaire at Time 1 evaluated the expectations one had regarding the trustworthiness and collaboration of the stakeholders in the system, and at Times 2, 3, and 4, the items referred to perceptions regarding the experienced collaborativeness of each stakeholder.

At Time 1 we used a round robin procedure to evaluate the expected trustworthiness of one's own and the other groups, on a seven-point Likert scale (1 = "not at all" to 7 = "very much"). The

item was worded as follows: *Based on the information you have gathered so far, how trustworthy is the organization “X”?* Trust self-enhancement was evaluated using a procedure described in Kwan et al. (2004) as the difference between self-rated trust and trust ascribed to all the other stakeholders in the system. According to Kwan et al. (2004), this self-enhancement index reflects (favorable) social comparison processes or the extent to which the members of a stakeholder group perceive their own group as more trustworthy than they perceive the other stakeholders in the system.

To compute network centrality, we used a matrix approach, and asked respondents to generate pairwise evaluations of the collaboration between the stakeholders in the system: *Based on the information you have gathered so far, please rate the quality of the relation between all the organizations.* Therefore, we asked participants to fill out a matrix containing all dyadic relations among stakeholders. The evaluations were made on a scale between  $-5$  and  $+5$  (where  $-5$  refers to a very conflictual relation and  $+5$  to a very collaborative relation,  $0$  represents the absence of conflict or the absence of collaboration). Therefore, to estimate the collaborative ties, we have recoded all negative values as zero. We have focused on the ties participants reported for their own group as these are most likely to be the accurate representations of the collaborative relations in MPSs (participants might have had misconceptions about the relations among other groups in the MPS) (Casciaro 1998). As such, the centrality indices were computed by aggregating individual perceptions of own group centrality in the context of the MPS network. Networks were generated for each group, in each session, at four time intervals. As indicators of network centrality, we have used two indices that estimate centrality for each stakeholder in the network relative to the rest of the network, namely closeness and betweenness centrality. Closeness centrality is a measure defined as the sum of geodesic distances from a node to all others in the network. Geodesic distance from a node to another node is the length of the shortest path connecting them (Freeman 1979). In other words, closeness centrality is an estimate of how central a particular stakeholder in the generic MPS network is. A stakeholder with high closeness centrality indicates that the members of the respective stakeholder group perceive it “in the middle” of the MPS network. Betweenness centrality is a measure of how often a given node falls along the shortest path between two other nodes, and is typically interpreted in terms of the potential for controlling flows through the network. The betweenness of a target stakeholder in the MPS network estimates the relative number of stakeholder pairs that can only communicate with each other via the target stakeholder. Therefore, a node with a high betweenness is very likely to have substantial power because it can control the possibility of other nodes reaching each other via efficient paths (Freeman 1979).

#### 4. Results

Means, standard deviations, and correlations are presented in Table 1.

In order to perform the network analyses, data was processed in the open-source statistical programming language R (R Core Team 2013, Vienna, Austria). Networks were generated by aggregating individual perceptions within each group, in each simulation, at four points in time. Networks visualization was run using the qgraph package from R (Epskamp et al. 2012) and the igraph package (Csardi and Nepusz 2006). In order to weight the degree of collaboration for each stakeholder nested in each simulation, we used the scores ranging from  $0$  to  $+5$  where  $0$  represents absence of collaboration and  $+5$  a very collaborative relationship (scores between  $-5$  and  $0$  were excluded as they were illustrative of conflictual relations and not collaboration.). The aggregated networks obtained were in the form of weighted undirected networks with multiple ties. Closeness and betweenness indices (Freeman 1979) were computed with the centrality function from qgraph packages. This function computes and returns betweenness and closeness indices between all pairs of nodes in the graph with a tuning parameter of  $\alpha = 1$ . When  $\alpha = 1$ , the outcome is the same as the one obtained with the classical Dijkstra’s algorithm (Dijkstra 1959; Opsahl et al. 2010).

**Table 1.** Means, standard deviations, and correlations for the variables included in the study.

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1. Group size	4.31	1.29											
2. TR Self T1	4.82	1.12	−0.108										
3. TR To T1	4.85	0.71	0.014	−0.021									
4. TRSE T1	−0.04	1.34	−0.098	0.847 **	−0.549 **								
5. CollBet T1	2.98	5.49	−0.288 *	0.456 **	0.069	0.345 *							
6. CollBet T2	2.22	3.64	−0.120	0.214	0.305 *	0.017	0.425 **						
7. CollBet T3	3.26	4.98	−0.146	0.228	0.318 *	0.022	0.404 **	0.614 **					
8. CollBet T4	1.93	4.74	−0.033	0.296 *	0.251	0.114	0.425 **	0.517 **	0.641 **				
9. CollClo T1	1.01	0.66	0.272 *	0.314 *	−0.010	0.268	0.264	0.196	0.090	−0.092			
10. CollClo T2	0.76	0.50	−0.212	−0.023	−0.024	−0.007	0.011	0.378 **	0.183	−0.028	0.568 **		
11. CollClo T3	0.67	0.49	−0.165	0.028	0.026	0.010	0.278 *	0.360 **	0.296 *	0.139	0.311 *	0.637 **	
12. CollClo T4	1.55	0.79	0.003	0.013	0.064	−0.023	0.230	0.395 **	0.411 **	0.313 *	0.382 **	0.415 **	0.546 **

Note: TR Self—trust self-rated, TR To—trust ascribed to others, TRSE—trust self-enhancement, CollBet = collaboration betweenness, CollClo = collaboration closeness, SD—standard deviation, T1 = Time 1, T2 = Time 2, etc., \*  $p < 0.05$ ; \*\*  $p < 0.01$ .

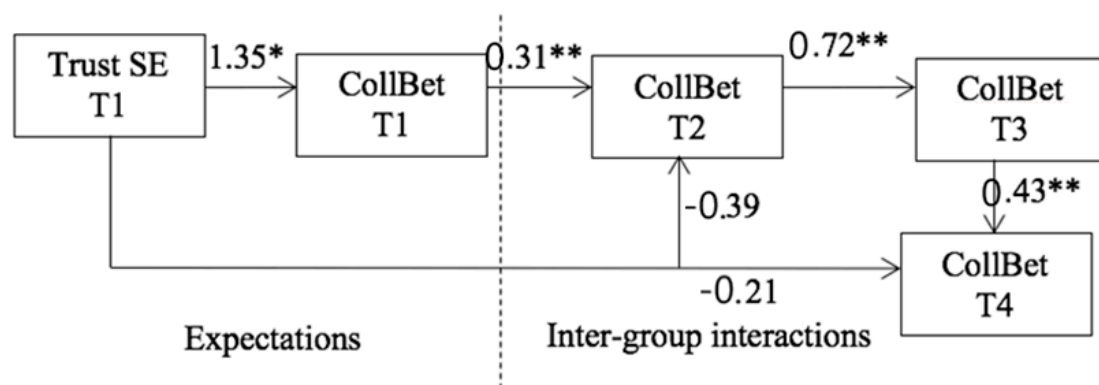


As we collected data in four successive waves during the simulation, we could explore sequential mediation models (model 6) using the Process Macro (Preacher and Hayes 2008, Preacher and Hayes 2008). As network indicators were computed based on aggregated networks at the group level, we entered group size as a covariate in the analyses. We then estimated sequential mediation paths from trust self-enhancement as evaluated at Time 1 (expectations) to subsequent centrality scores in the four time lags. The results of the mediation analysis for betweenness as an indicator of network centrality are presented in Table 2 and summarized in Figure 1.

**Table 2.** Overview of the mediation effects estimated in our analyses.

Estimated Mediation Chains	Betweenness Centrality		Closeness Centrality	
	Effect Size (SE)	95% CI	Effect Size (SE)	95% CI
TSE→CT1→CT4	0.25 (0.27)	[−0.07, 1.03]	0.03 (0.03)	[−0.01, 0.11]
TSE→CT1→CT2→CT4	0.09 (0.13)	[−0.03, 0.52]	−0.01 (0.01)	[−0.05, 0.01]
TSE→CT1→CT3→CT4	0.10 (0.17)	[−0.02, 0.78]	−0.01 (0.01)	[−0.04, 0.01]
TSE→CT1→CT2→CT3→CT4	0.13 (0.12)	[0.01, 0.70]	0.02 (0.01)	[0.01, 0.05]
TSE→CT2→CT4	−0.09 (0.13)	[−0.55, 0.04]	0.01 (0.02)	[−0.01, 0.08]
TSE→CT2→CT3→CT4	−0.12 (0.10)	[−0.55, −0.01]	−0.02 (0.02)	[−0.07, 0.01]
TSE→CT3→CT4	−0.09 (0.20)	[−0.67, 0.22]	0.01 (0.04)	[−0.05, 0.09]

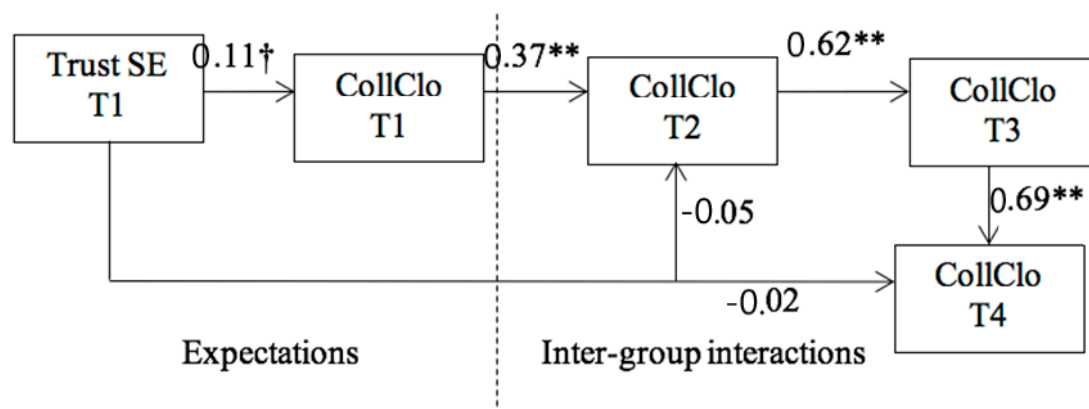
Note: TSE—trust self-enhancement, CT1—centrality at Time 1, CT2—centrality at Time 2, CT3—centrality at Time 3, CT4—centrality at Time 4.



**Figure 1.** Results of the sequential mediation model for collaboration betweenness. Note: SE—self-enhancement, CollBet—collaboration betweenness, T1 = Time 1, T2 = Time 2, etc., \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; path coefficients are non-standardized coefficients reported from the most complete model, i.e., the model in which all previous variables in the mediation chain are included.

The full sequential mediation chain from trust self-enhancement expectations, to collaboration betweenness at Time 1, then at Times 2, 3, and 4 is significant. The indirect effect (trust self-enhancement → collaboration betweenness at T1 → collaboration betweenness at T2 → collaboration betweenness at T3 → collaboration betweenness at T4) was positive and significant, the effect size was 0.13 (SE = 0.12), with a 95% confidence interval (CI) of 0.01–0.70, and because the confidence interval did not contain zero, we can conclude that the indirect effect was positive and significant as hypothesized. In other words, trust self-enhancement had a positive influence on the perceived betweenness at the end of the simulation, by sequentially increasing betweenness at Time 1, then Time 2, then Time 3 and Time 4. However, the results of the sequential mediation revealed an additional significant indirect effect. This indirect effect led from trust self-enhancement expectations at Time 1 to betweenness at Time 2, then Time 3, then Time 4, thus estimating the effect of trust expectations on network centrality as estimated after the inter-group interactions commence. This indirect effect was, however, negative: −0.12 (SE = 0.10), 95% CI [−0.55, −0.01], and as the confidence interval did not include zero, the effect was considered significant. In other words, trust self-enhancement negatively predicted the betweenness at the end of the simulation, by sequentially decreasing betweenness at Times 2 and 3.

We used a similar bootstrapping procedure to estimate the sequential mediation effects from trust expectations to network closeness. The results of the mediation analysis for the closeness centrality indicator are presented in Table 2 and summarized in Figure 2.



**Figure 2.** Results of the sequential mediation model for collaboration closeness. Note: SE—self-enhancement, CollClo—collaboration closeness, T1 = Time 1, T2 = Time 2, etc.; †  $p < 0.10$ , \*\*  $p < 0.01$ ; path coefficients are non-standardized coefficients reported from the most complete model, i.e., the model in which all previous variables in the mediation chain are included.

As indicated by the path coefficients presented in Figure 2, the full sequential indirect effect (trust self-enhancement → collaboration closeness at T1 → collaboration closeness at T2 → collaboration closeness at T3 → collaboration closeness at T4) was positive. The indirect effect was 0.02 (SE = 0.01), 95% CI [0.01, 0.05], and as the confidence interval did not include zero, we can conclude that the effect was significant. The sequential mediation analysis for closeness did not reveal any other significant indirect effects; therefore, we can conclude that the indirect effect for closeness was aligned with our hypothesis. A full summary of all mediation effects estimated with model 6 in the Process Macro (Preacher and Hayes 2008) is presented in Table 2.

## 5. Discussion

This study explores the implications of trust self-enhancement (i.e., a group assigns more trust to oneself as compared to the trust assigned to the other stakeholder groups) for the evolution of perceived centrality (expected before the intergroup interactions and experienced during the intergroup interactions) in the MPSs. More exactly, we analyzed the impact of trust self-enhancement expectations on betweenness and closeness centrality indices as they evolved during the intergroup interactions in an MPS composed of six stakeholders dealing with a complex decision task.

As the results show, trust self-enhancement was a precursor of network centrality in the sense that trust self-enhancement at Time 1 (one's own group is perceived as more trustworthy as compared to the other stakeholders in the MPS) led to increased expectations regarding one's own betweenness and closeness centrality at Time 1 (prior to the interactions with other stakeholders). Then, these expectations sequentially increased the perceptions of experienced betweenness and closeness centrality at Times 2, 3, and 4.

Stakeholders that perceived themselves as being more trustworthy (i.e., more honest, reliable, and less likely to exploit the others), than the other stakeholders in the MPS, were motivated to seek and maintain a central position in the MPS network in order to maintain a high group distinctiveness and ultimately acquire more power. Central stakeholders could make useful contributions to the task at hand by sharing relevant information and by trying to integrate the differences stemming from the other stakeholder groups in the system that might not be otherwise connected through betweenness centrality (ultimately central actors may become more powerful this way). Moreover, expectations regarding one's own betweenness centrality in the collaboration network were further positively

associated with perceptions regarding one's betweenness centrality observed in real inter-group interactions throughout the simulation. As previously argued, enacting such a bridging role within the MPS was an indicator of the stakeholder's power and influence within the system. Such a privileged position may have a beneficial impact for the success of the collaboration process, since, in order to achieve a comprehensive decision, the system is required to integrate the needs and concerns of all actors involved in the process (Schruijer 2006; Gray 2007; Curşeu and Schruijer 2017) and a stakeholder with high betweenness centrality can facilitate this process. However, such a stakeholder may also act as a gatekeeper, blocking the information flow and thus impeding the collaboration process (Burt 1995). In MPSs involved in decision-making tasks, as was the case in our study, such central stakeholders acting as gatekeepers may have prevented consensus to emerge.

Similarly, trust self-enhancement was positively associated with closeness centrality in the collaboration network throughout the simulation. Viewing one's own group as more trustworthy led first to an anticipation of having a more central position in the system, which, in turn, materialized in experienced closeness. The emergence of closeness centrality was relevant for the collaboration process, as the stakeholder groups that relationally are on average closer to the other stakeholders in the system (i.e., they have a high level of closeness centrality) could more easily gather useful information, communicate interests throughout the network, and help with integrating the diverse points of view. On the other hand, high levels of closeness centrality may also impede the potential for fruitful collaboration, as such central stakeholders may push forward their (hidden) agenda, by suppressing diversity and prevent participation, especially from less powerful stakeholders in the system (Curşeu and Schruijer 2017).

These results extend the expectations state theory (Berger et al. 1974; Berger et al. 1977) by showing that prior to engaging in intergroup interactions, self-enhanced perceptions of trust lead to expectations about a high centrality in the MPS network. These expectations are probably rooted in two mechanisms: self-esteem and self-defense. On the one hand, high self-trust mobilizes the stakeholder to actively engage in intergroup interactions, and on the other hand, rather low trust of others may stimulate the stakeholder to reach out to others in order to establish and maintain control over their actions in an MPS. Seeking and maintaining a high centrality in the MPS network is likely to be a mechanism that allows stakeholders to maintain their high distinctiveness as a group related to trust self-enhancement.

An important claim based on these results is that collaboration starts in the minds of those involved and it is later on shaped by the contextual dynamics and social complexities emerging in MPSs. This adds value to practice as well. The onset of interactions in MPSs seems to be crucial. Prior to any kind of interactions between the stakeholders, consultants and managers can guide the stakeholders to work with themselves and engage in reflective processes about the positive impact of their role in the system and empower them to create expectations about the contribution they can bring to the system.

Our findings also revealed an additional effect regarding the implications of trust self-enhancement for collaborative betweenness network centrality in interactions (not mediated by betweenness centrality expectations evaluated at Time 1). The indirect effect of trust self-enhancement via experienced collaboration betweenness at Time 2, and the sequentially at Time 3 and Time 4, was negative and significant (effect size  $-0.12$ ,  $SE = 0.10$ , 95% CI  $[-0.55, -0.01]$ ). Through this mediation path that excluded expectations of betweenness, trust self-enhancement actually decreased betweenness after the onset of intergroup interactions (although this effect was not significant). It was therefore likely that this negative significant indirect effect was explained by the sequential positive association between collaboration betweenness at Times 2, 3, and 4. A potential explanation is that initial trust self-enhancement may lead to overconfidence concerning one's centrality position in the MPS network. When the interactions begin, the stakeholders with high trust self-enhancement may discover that the other stakeholders do not perceive them as being so central in the system. Overconfidence could therefore be an alternative mechanism that explains the workings of trust self-enhancement in MPS.

This emergent result points towards a dual mechanism that connects trust self-enhancement with betweenness centrality. On the one hand, trust self-enhancement influences the expected network position and enhances one's centrality in the collaboration network. On the other hand, trust self-enhancement may generate overconfidence in one's position, that leads to a decrease in collaboration centrality after real between-group interactions start. We could fully explore the first mechanism through the sequential mediation analyses reported in Figures 1 and 2. However, we did not collect data on overconfidence that could elucidate the second mechanism likely to be involved here. Future research could further explore the co-existence of these two mechanisms linking trust self-enhancement expectations to centrality in the collaborative network.

To conclude, the main contribution of this study is the result concerning the sequential development of betweenness and closeness centrality, in line with the view of multiparty systems as dynamic entities (Curşeu and Schruijer 2017). In such a system, stakeholders with sometimes very different concerns and agendas interact in the hope of reaching a common goal that cannot be envisioned from the start of the interaction. In order to do so, the stakeholders are expected to share their interests and concerns and use their expertise to work through disagreements. Often, however, they start their interactions based on initial assumptions about each other, which they subsequently test and (re)shape according to the information gathered during intergroup interactions. In turn, the emerging cognitive structures (social networks in minds) will further influence the network centrality of the stakeholders. The structure of the collaboration network is thus subject to constant change, in line with the within and between group dynamics.

Our paper also points towards the relevance of using a social network analysis in the exploration of MPSs dynamics. Modern analytical approaches allow the integration of various network perceptions in aggregated social networks that capture the relational landscape of MPSs. Next to the benefit of using these approaches in research, one could envisage dynamic social network visualization tools used by facilitators of MPSs. MPS stakeholders are often trapped in the social dynamics of these systems and process interventions that may rely on social network visualization tools, which are needed in order to help the system overcome the hurdles of conflict and relational tensions and optimize the collaborative efforts.

Next to the contributions, our study has limitations as well. We have used a behavioral simulation, with a specific decision task and our results may not generalize to other tasks, inter-organizational settings, or MPSs. In order to ensure generalizability, our results need to be replicated in other settings and using other evaluation methods as well. Each of the simulations contained six stakeholder groups; therefore, the size of the social network was rather small, a fact that could have restricted the variance in our centrality measures. Moreover, our network analytic approach aggregated individual relational perceptions (or expectations at Time 1) within groups, and in doing so, we obtained a more accurate image of network centrality. However, we cannot claim that our measure of network centrality was based on objective, measurement-error free data. Rather we claim that due to the aggregation method used, we rely on intersubjective aggregation as an indicator of collaboration. Future research could extend these network approaches in MPSs and use more objective network indicators. Finally, our results focused on collaboration network centrality and no definite claims can be derived about the success of such collaborative relations. High betweenness and closeness may eventually be detrimental for the relational dynamics in multiparty collaboration. Stakeholders with high betweenness may act strategically and display dysfunctional inter-group behavior by filtering and distorting the information shared among the other stakeholders. Moreover, MPSs in which closeness is very high may eventually display collusive dynamics with negative implications for the outcomes of such MPSs (Gray and Schruijer 2010). Future research could investigate more directly the association between the two centrality indicators and collaborative goal achievement in MPSs.

## 6. Conclusions

Our study contributes to the literature on the dynamics of multiparty systems by using a relational, social-network approach to investigate how trust self-enhancement at the onset of inter-organizational relations impacts the evolution of collaboration centrality. Although the pivotal role of trust in collaboration was extensively explored so far, we show that collaboration network centrality displays a certain sequential development as it is only possible to predict centrality indicators from the ones evaluated in the previous time frame. This element is common to the social complex-adaptive systems that display such a sequential dynamic (Curşeu 2006). In other words, we show that a particular state of a multiparty system (e.g., collaboration centrality) can be predicted by using the previous state alone and not the more distant states. In order to understand the collaboration outcomes in such systems, one must understand the sequence of events in a comprehensive manner. It is therefore difficult to predict the outcomes of a multiparty system from compositional features or from its initial state alone. One needs to follow and comprehend the sequences of actions and interactions in such systems in order to grasp the complex nature of inter-organizational interactions.

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