Developing Coalitions:
Computing Organizational Potential

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ABSTRACT
Per Kotter's eight-step model for leading change, there is a need for a guiding coalition, which is a social network of agents for change. The proposed presentation discusses a computational approach to describing the potential of a network's structural position for organizational influence. A simulation of an exemplary index capable of such analysis is presented by the combination of widely accepted social network measures. RStudio was used for the necessary calculations and the social network visualizations [1].

INTRODUCTION
A coalition is combining agency towards a common goal [2]. Building pathways to achieving goals is a process that comprises both formal and informal organizational activity. A formula is proposed to use basic social network measures in both the formal and the informal segments of a social network to compute an index for the potential of a structural position to influence the network. Developing a guiding coalition is based on the change that the informal segment imposes on the formal segment of the network.

According to self-monitoring theory, individuals with a high self-monitoring orientation are flexible socially and try to control their social behavior. This control extends to giving information while socializing. Within an organization's formal activity, members are assigned roles that correspond to certain structural positions. Informal activity reshapes these structural positions. The proposed index exploits such activity in order to develop coalitions. Knowing about the formal and informal segments of an organizational network requires monitoring the network. Nevertheless, an organizational member may have more or less limited knowledge about these segments. Hence, the monitored network is considered inaccurate and labeled as the known network from the perspective of a single organizational member. Each member may have a different perspective. The known organizational network is considered to exclude isolated members (isolates) due to its formal segment, which should not include any isolates by definition. In contrast, the informal segment is monitored to exploit or produce isolates in the context of developing coalitions.

Formal networks (such as organizational charts) describe intended hierarchical connection, but they don't monitor the connectivity realized by people. They describe structural roles, which usually don't take into consideration the plasticity of dynamic social networks. The purpose of the proposed index is to monitor dynamic social networks to project change through the informal segment. For example, the centrality of betweenness in the formal segment can decrease in the known network by adding competitive centrality in the informal segment. Thus, developing the coalition that will bring about change in the network will have to compete against the formal segment. Kadushin argues that the "acceptance of the hierarchical structure occurs through acquiescence of the relationship by those lower in the hierarchy" [3].

Mehra et al. discuss models that describe effects of self-monitoring and structural position in organizations [4,5]. Superimposing the formal and the informal segments of a known network results in a moderated mediation model [6].

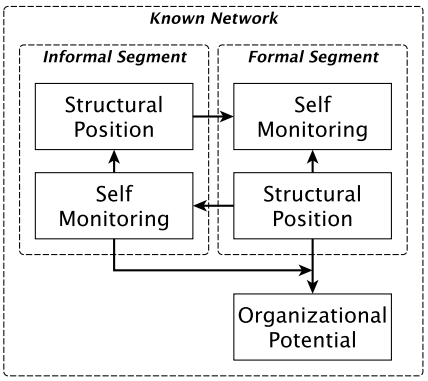

Fig 1. Organizational potential: a moderated mediation model.

Basic social network measures, described in detail by Wasserman and Faust [7], are combined by a formula to compute a single index that computes the *Organizational Potential* (OP) for each actor within a dynamic social network. The formula produces a standardized index with a value from 0 to 1. The following statements describe the relationships among the monitored measures:

Self-Monitoring moderates the ability to be close to other actors in the social network, thus measured by the centrality

of closeness. The measurement takes place in the informal segment.

Structural Position mediates the ability to be aware of interactions between social actors in the known network, thus measured by the centrality of betweenness in the known network.

OP mediated by structural position is measured by the centrality of information in the formal segment that doesn't contain isolated actors (isolates). *OP* moderated by self-monitoring is measured by the centralization of all-degree in the informal segment, which may include isolates. The moderated structural position is weighted by the ratio of informal segment to known network size and by the complementary of the squared ratio of informal to formal segment size.

The value of creating a standardized index lies in the decision-making process for the development of a coalition by evaluating whom to approach in relation to any known competitive coalitions. Persuading people requires investing time and effort in socializing, maintaining connections, and observing their activity. Additionally, networking leaks information about the coalition and its members. Change is not easy because it requires an effort. The path from leading to achieving change and then to harvesting benefits from instituting it can be a forest of resistance. Ethical and moral considerations are the most valuable topics in the discussion of leading change due to discussing and evaluating its social impact. Nevertheless, this paper will not discuss such considerations due to its abstract context that only serves to exemplify a method to start to develop coalitions within a dynamic social network.

This paper contributes to the literature on group leadership by introducing a method, based on social network analysis, to monitor the organizational potential of people in dynamic networks. It proposes a closed-system computational approach that enables the fast monitoring of network status to facilitate the development of coalitions in high-velocity organizations.

METHOD

The proposed formula calculates a standardized index for each social actor (n_a), who is denoted as n_i in the informal segment and as n_k in the known network (the combination of informal and formal segments). C_c denotes the centrality of closeness, C_i denotes the centrality of information, C_b denotes the centrality of betweenness, and Centr_d denotes the centralization of all-degree.

$$\text{OP}(n_a) = \frac{\left\{\frac{[1 + C_c(n_i)C_i(n_k)] + [1 + C_b(n_k)\text{Centr}_{d(i)}]}{2 - (\frac{g_i - 1}{g_k - 1})^2}\right\} - 1}{3}$$

$$where\ g_i \geq 2 \leq g_k,\ 0 \leq C_c \leq 1,\ 0 \leq C_i \leq 1,\ 0 \leq C_b \leq 1,$$
$$0 \leq \text{Centr}_d \leq 1,\ n_i = n_k = n_a$$

Fig 2. Standardized OP(n_a) index formula.

To calculate the known network, the informal segment is superimposed on the formal segment. When a connection is present in any or both of the segments, then it is present in the known network.

RESULTS

Rstudio was used for the calculations. First a 20 by 20 adjacency matrix of an imaginary (arbitrary) organization, *Alpha Inc,* is created. The organizational structure consists of a management team of 8 actors. There are 5 supervisors and 17 workers. Connections (edges) represent hierarchical interaction, where CEO abbreviates Chief Executive Officer, COO abr. Chief Operations Officer, ATT abr. Attorney, PM abr. Project Manager, PDM abr. Product Manager, SG abr. Secretary General, ACCT abr. Accountant, SPV abr. Supervisor, WRK abr. Worker. (1=CEO; 2=COO; 3=ATT Head; 4=ATT; 5=PM; 6=PDM; 7=SG; 8=ACCT; 9=Head SPV; 10=SPV; 11,12,…,20=WRK). Adjacency tables have not been included due to their size. The network's formal and informal segments are shown in figures 3 and 4 respectively. Their combination is presented in figure 5 as the known network from the perspective of social actor SPV (n_{10}).

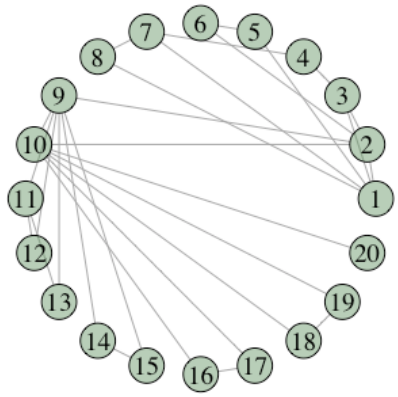

Fig 3. The formal segment of the known network.

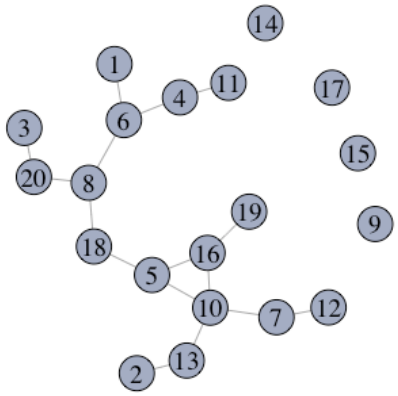

Fig 4. The informal segment of the known network.

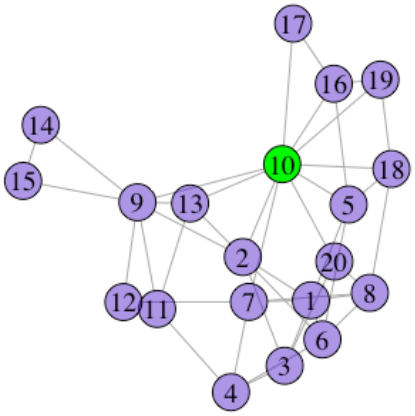

Fig 5. The known network on time t=1.

Known network t=1

To compute the proposed OP index, it is needed to compute the betweenness and closeness centralities, the degree centralization, and the informal (g_i) to the known network (g_k) size ratio on time t=1.

Known Network	Informal Segment
C_i = .0707	C_c = .0081
C_b = .3830	$Centr_d$ = .1404
$g_{i,k}$ = .8000	
$OP(n_{10},t_1)$ = .1641	

Table 1. OP for SPV (n_{10}) on time t=1.

Head SPV (n_9) is an isolate in the informal network. Table 2 calculates the OP for SPV had they been isolate in the informal network too.

Known Network	Informal Segment
C_i = .0634	C_c = .0026
C_b = .2868	$Centr_d$ = .1053
$g_{i,k}$ = .7500	
$OP'(n_{10},t_1)$ = .1312	

Table 2. OP(n_{10}) on time t=1 if SPV was isolated in the informal segment.

Known network t=2

In a later time t=2, SPV used the observed known network of time t=1 to make a new connection in the informal segment. SPV identified two possible candidates: n=4 (ATT) and n=8 (ACCT). Time constrains for creating and maintaining a new informal contact suggest a choice between the two. Who to chose from the two? Calculating the resulting $OP(n_{10})$ for each case suggests an answer.

Known Network	Informal Segment
C_i = .0725	C_c = .0081
C_b = .4129	$Centr_d$ = .1404
$g_{i,k}$ = .8000	
$OP(n_{10},t_2)$ = .1651	

Table 3. OP(n_{10}) on time t=2 if SPV (n_{10}) was connected to ATT (n_3).

Known Network	Informal Segment
C_i = .0721	C_c = .0081
C_b = .4079	$Centr_d$ = .1404
$g_{i,k}$ = .8000	
$OP'(n_{10},t_2)$ = .1649	

Table 4. OP(n_{10}) on time t=2 if SPV (n_{10}) was connected to ACCT (n_8).

Tables 3 and 4 suggest that connecting with ATT (n_4) will increase OP for SPV more than connecting to ACCT (n_8). Nonetheless, the difference may not be substantial enough to impose a choice.

Known network t=3

In a later time t=3, ATT (n_4) has left the organization and a new employee joined the formal segment under the same role. Table 5 describes the updated OP for SPV.

Known Network	Informal Segment
C_i = .0723	C_c = .0065
C_b = .4020	$Centr_d$ = .1521
$g_{i,k}$ = .7000	
$OP(n_{10},t_3)$ = .1153	

Table 5. In a later time t=3.

SPV's OP in the known network suffered a decrease. WRK 11 was isolated since the new ATT was their connection in the informal segment. Monitoring a dynamic social network allows the planning of reactions to possible problems. The value of the proposed OP index manifests in identifying possible solutions to develop weakly connected coalitions.

DISCUSSIONS

Conclusion

Monitoring a known social network based on formal and informal activity can capture more accurately the dynamic character of a high-velocity social network. The proposed index was constructed to monitor organizational networks with multiple levels of hierarchy. Different index formulas can be applied to match different situational contexts. Relationships between network measures can be learned via machine learning. The stage of coalitions within an organizational network can be labeled to allow for learning of connectivity patterns in each labeled stage. A probability mass function (pmf) can be used to predict the group-stage of coalitions within a known network [8].

In the example network, WRK 18 (n_{18}) is a broker between the two coalitions in the informal segment. Such structural positions indicate a need to analyze consequences of self-monitoring on the network [9]. Moreover, the CEO (n_1) is in one of the coalitions and the COO (n_2) is in the other. Identifying potential members can be the purpose of a leading agency within the coalition. Moreover, when coalitions grow big, then they should be segmented to maintain effectiveness. There are two main approaches to developing a coalition. Expand the coalition or disrupt competitive ones. In any case, the coalition should be analyzed as a sub-network of the known network. Increasing a coalition's organizational potential requires greater effort than maintaining it. Analyzing a known network's structural holes can provide insight on how to develop coalitions [10].

The proposed index seeks to describe a dynamic social network based on the relationships between measures that monitor two distinct networks, the formal and informal segments. Coalition members can compare information to update the informal segment. A simple method for coalition members to combine their knowledge would be to average their opinions about connections to produce a probability for each connection in the known network. Monitoring network connectivity with weighted ties will allow for a more complex description of social network activity.

Limitations and Future Research

The proposed index formula is very sensitive to the ratio of the informal to the formal size. For empirical data the informal segment size should be replaced by the size of the coalition within the known network. For very large social networks, game theory can be employed to monitor changes and inform coalition development with rational decision-making strategies. Kahneman discuses what are boundaries of rational thinking when making choices [11].

An analysis of structural position without considering ethical consequences lacks completeness. In figure 1, the proposed moderated mediation model of organizational potential suggests that there are ethical consequences from self-monitoring in the informal activity and from structural position in the formal activity. Social network analysis measures can capture potential severity of consequences due to structural position, but only observation of specific behavior can quantify agency against ethical considerations. The same applies to quantifying organizing. Hence, the proposed method is limited to quantifying potential for organizing. Future research will include the extraction of information from computer-based organizational tools in order to measure specific behaviors.

Monitoring the organizational potential identifies important coalition members, but does not provide information on how to protect the coalition from disruption, which is an important topic for future research. The example network is undirected. An analysis of networks as directed graphs would provide more detailed descriptions of the network and its components.

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