The Network Structure of Organizational Vocabularies: Extending Network Thinking

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THE NETWORK STRUCTURE OF ORGANIZATIONAL VOCABULARIES

Alessandro Lomi, Stefano Tasselli and Paola Zappa

ABSTRACT

We study organizational vocabularies as complex social structures emerging from the association between organizational participants and words they use to describe and make sense of their experiences at work. Using data that we have collected on the association between managers in a multi-unit international company and words they use to describe their organizational units and the overall company, we examine the relational micro-mechanisms underlying the observed network structure of organizational vocabularies. We find that members of the same subsidiary tend to become more similar in terms of the words they use to describe their units. Members of the same subsidiary, however, do not use the same words to describe the corporate group. Consequently, the structure of organizational vocabularies tends to support consistent local interpretations, but reveals the presence of divergent meanings that organizational participants associate with the superordinate corporate group.

Keywords: Organizational vocabularies; social structure; meanings; multiunit companies; bipartite networks; exponential random graph models

INTRODUCTION

Inspired by recent attempts to understand the social production of shared meanings (Kirchner & Mohr, 2010), organizational research is gradually

discovering the key role played by organizational vocabularies – systems of words used in the construction, interpretation and transmission of categories, identities, and work practices (Loewenstein, Ocasio, & Jones, 2012). Research on organizational vocabularies remains fragmented. Its developments are quasi-independent from the broader movement within relational sociology interested in meaning and meaning structures (White, 2008; White, Godart, & Corona, 2007). Despite early opportunities for convergence (Mische & White, 1998; Mohr, 1994; Mohr & Duquenne, 1997), it is only in relatively recent times that the analysis of the social mechanisms underlying the construction of shared meanings has been placed at the center of institutional theories of organizations (Mohr & White, 2008). As a fundamental component of language, vocabularies play a central – albeit not exclusive – role in our understanding of how shared meanings develop and change in organizations (Carley, 1994). This view is articulated in current organizational research examining how organizational vocabularies reveal underlying institutional logics (Nigam & Ocasio, 2010; Suddaby & Greenwood, 2005), shape discourse (Ocasio & Joseph, 2005), contribute to the institutionalization of social categories (Ocasio, Loewenstein, & Nigam, 2015), and sustain framing and organizational sense making processes (Fiss & Hirsch, 2005).

Defined as "systems of words and their meanings commonly used by social collectives" (Loewenstein et al., 2012, p. 45), organizational vocabularies provide the material basis for understanding the micro-mechanisms by which individuals develop shared meanings in organizations. For this reason, vocabularies may also help to establish common grounds that facilitate the understanding of coordination within and across organizational units and teams (Cramton, 2001). With few notable exceptions (Gibson, 2012), in much available organizational research the role of discursive elements has been eclipsed by the heavy emphasis on the segregating properties of formal organizational structure. Similarly, the role of meaning structures has been surprisingly neglected in studies of organizational networks that typically prefer to focus attention on the time-honored "formal" vs. "informal" dichotomy (McEvily, Soda, & Tortoriello, 2014). Research has typically focused on whether two or more individuals are "structurally" connected (Brass, 1984) or "structurally equivalent" (Burt, 1987), neglecting the possibility that individuals might be "indirectly connected" by sharing the same structure of meanings associated to their organizations. It is only in relatively recent times that organizational research has started to recognize the fact that organizational structures cannot claim causal agency unto themselves if divorced from fundamental social identity processes by which individuals give meaning to the organization (Lomi, Lusher, Pattison, & Robins, 2014) – an argument richly articulated by Pachucki and Breiger (2010).

In this paper, we seek to advance this more recent line of research by exploiting the opportunity that the analysis of organizational vocabularies provides to explore the micro-structure of shared meanings that individuals assign to their

organizations. Specifically, our work extends previous research in at least two ways. First, we show that membership in the same organizational subunit is associated with shared vocabularies that organizational members use to describe their unit. This result is important because it suggests that formal organizational structures triggers system of meanings generated by organizational participants. This result contributes to current organizational research on the mechanisms that regulate permeability (Lomi et al., 2014) and permeation (Gibson, 2008) of organizational units. Second, shifting from organizational subunits to the whole organization, we show that participants in different organizational subunits sharing membership in the same organizational function are also more likely to share the same vocabulary to describe the overall organization. This result is important because it clearly reveals the multilevel character of social identity processes and the multiplicity of social foci existing in organizations (Feld, 1981). This result contributes to current organizational research by showing how vocabularies may help to reveal not only global meaning structures − linking sets of individuals to aggregate intersubjective concepts, but also the network micro-relational structure of meanings − linking each individual to specific words.

We situate our study in the context of data that we have collected among members of the top management team in a multi-unit industrial group. We analyze the bipartite association between managers and the organizational vocabularies they used to describe respectively (i) their organizational unit (subsidiary firm), and (ii) the organization (superordinate corporate group). The study clarifies how organizational vocabularies help to reveal some of the network mechanisms through which meanings are constructed and shared across levels of organizational analysis. The application of recently derived Exponential Random Graph Models (ERGMs) for the analysis of affiliation (bipartite) networks (Conaldi & Lomi, 2013; Wang, Sharpe, Robins, & Pattison, 2009) suggests one way in which organizational vocabularies may inspire future research on meanings as a legitimate object of network investigation.

THE NETWORK STRUCTURE OF ORGANIZATIONAL VOCABULARIES

A consolidated body of research has acknowledged organizational vocabularies as instrumental to sense making and the social construction of meanings. Vocabularies are central to the formation and interpretation of categories and practices within organizations (Colyvas & Powell, 2006; Ocasio & Joseph, 2005). Vocabularies play an important role in establishing common grounds − shared knowledge among social actors − within and across social settings that is critical for coordinated action even down at the level of interacting individuals (Bechky, 2003). It is through rhetorical tools, including vocabularies and

key words that individuals tend to cluster together forming an implicit frame and assigning a "system of meanings" to social situations, groups or social settings (Carley, 1986). While we would expect boundaries around organizational units to induce and encircle meaningful "clusters" of words, meanings, and practices (March & Simon, 1958), the actual mechanisms underlying this clustering process remain under-researched. In the empirical part of the paper, we link the generic notion of word "clustering" to specific dependence mechanisms inherent in the association between individuals and words in organizations. The concatenation of various dependence mechanisms gives shape to the structure of organizational vocabularies or to the "structure of conventional word use captured by the combination of word frequencies, word-to-word relationships, and word-to-example relationships that demarcates a system of cultural categories" (Loewenstein et al., 2012, p. 2).

Considering the importance of vocabularies for many aspects of social life, the study of their role in organizations has attracted the long-standing attention of organizational researchers. It is remarkable that classic research on organizational culture, from Berger and Luckman (1966) to Pettigrew (1979), has emphasized the role of vocabularies in the social construction of the organizational structure (see also Sewell (2005) for a more general sociological argument). According to Berger and Luckman (1966), for example, vocabularies can contribute to the typification of experiences, an essential feature of the process of creating culture in a new organization. Pettigrew pushed this logic further suggesting that organizational vocabularies can also be "a vehicle for achieving practical effects" (1979, p. 575). Words, indeed, "are part of action." Building on these assumptions, classic research envisaged prospects for a growing emphasis on vocabularies in organizational research, considering their prominence "in expressing communal values, evoking past experiences, providing seed beds for human action, and legitimating current and evolving distributions of power" (Pettigrew, 1979, p. 575). More recently, organizational research has taken up this challenge and experienced its own "linguistic turn." Examples include studies on the language of corporate governance (Ocasio & Joseph, 2005), institutionalization (Colyvas & Powell, 2006), and organizational rhetoric (Hirsch & DeSoucey, 2006).

The prescient emphasis of classic organizational research on the study of vocabularies and social structure has progressively shifted toward the study of narratives, categories, and discourse. The basic assumption of most of this research is that "societies, social institutions, identities, and even cultures may be viewed as discursively constructed ensembles of texts" (Alvesson & Kärreman, 2000a, p. 137). Thus, organizational researchers are increasingly investigating how organizations can be understood through the analysis of discourse (Alvesson & Kärreman, 2000b), how strategy can be conceived as a multifaceted and interdiscursive phenomenon (Vaara & Whittington, 2012), and how words and vocabularies can be used for studying the evolution of

broad fields such as entrepreneurship (Gartner, 1993) and corporate governance (Ocasio & Joseph, 2005).

Despite this increased interest in language in and around organizations, the study of organizational vocabularies has been substantially unexplored in relation to the study of organizational social structure. As Loewenstein et al. (2012, p. 37) remind us, "language use pervades organizational life, but its promise has remained elusive." Yet, the argument that words interweave with relations in explaining social structure is grounded in a long-standing tradition of sociological research examining the "individualistic coloring" (Simmel, 1971, p. 257) that people provide to their social settings. From this view, social networks are "stories" about the meaning of social structure; even social networks can be conceived as "systems of meanings" (White, 2008), in which mechanisms of meaning formation help understand how individuals maintain and move between different social positions. Vocabularies are important because social interaction is indeed deeply embedded in local micro-cultures (Collins, 2003), leading in turn to processes of identity formation and change (McFarland & Pals, 2005). But this conceptualization still needs be matched by empirical research.

Building on this perspective, we investigate whether organizational vocabularies are associated with the micro-structure of shared meanings developed by organizational participants. The ability to create and share meanings, practices and even knowledge is one of the defining features of organizations *vis à vis* alternative institutions such as, for example, markets (Kogut & Zander, 1992). Organizations are not only defined by the presence of goal-oriented and relatively stable patterns of interaction over time, as the literature in organizational design and social networks typically suggests (Kilduff & Tsai, 2003). The idiosyncratic nature of organizations also derives from evidence that their formal structure (in terms of interconnected, quasi-independent subsidiaries composing the overall organization) creates resonant patterns of similarity and difference in the vocabularies that members attribute to the distinct layers of the organizational settings in which they live and work.

EMPIRICAL SETTING AND DATA

Empirical Setting

We examine data that we have collected on words used by the 42 members of the top management team in an international multi-unit industrial group to describe their organization. The managers included in our sample were key managers as determined by the organizational chart and indicated by the President and CEO of the Group. Under the CEO's suggestion, we included in the sample also five external design consultants who were systematically and

directly involved in product development strategies and decisions at the corporate level.

The corporate group (henceforth simply "The Group") contains five distinct subsidiaries (henceforth, "Subsidiaries" or "Firms"). The subsidiaries are distinct independent firms in the sense that they are characterized by their own lines of products, management, brand, suppliers, and dealer networks. The products of the different subsidiary firms are targeted to different market segments. The subsidiary firms are located in different geographical positions and do not share production facilities. While membership in the corporate group is not hidden in market communication, companies are presented as having distinct market identities. Each subsidiary firm has its own CEO and management team (all included in our sample). A central unit plays the double role of independent company and corporate headquarters. The CEO of the central unit is also the corporate CEO. Additional descriptive information on the organizational setting may be found in Lusher, Robins, Pattison, and Lomi (2012) and in Lomi et al. (2014). The data on the association between managers and words was not used in these prior studies.

Data

Following a well-established approach to study organizational vocabularies, we focused on key words (Burke, 1989; Hirsch, 1986; Mills, 1940; Mohr, 1994; Suddaby & Greenwood, 2005).

We carried out qualitative interviews with the CEOs of the subsidiary companies to identify words that might describe their sentiment toward their company. Examples of words recurring in the interviews with our key informants included technology, luxury, team, conflict, family, and trust. We then validated the relevance of the set of words that we identified as particularly resonant with the help of President and the CEO of the corporate group. The result was a consensus on a restricted list of 30 words. The final number of words was the outcome of a combination of pragmatic considerations imposed by analytical constraints, and empirical considerations suggested by fieldwork. The former type of considerations were suggested by the need to arrive at an affiliation (2-mode) network of managers-by-words with adequate overlap. More substantively, the words proposed by the CEOs of the subsidiary companies were validated by our informants who recognized and confirmed their contextual meaning. The words that were not included in the final list were either contextually ambiguous, or simply unable to generate consensus among the key informants.

We asked participants to identify the words that they would associate to their subsidiary firm and the overall corporate group, respectively. Participants were presented with the list of 30 words arranged in alphabetical order, and

were asked to indicate the degree to which each word described their subsidiary, and the overall organization, on a Likert scale ranging from 1 to 5 (where 1 = Not at all; and 5 = Very much).

The same list of 30 words was presented in two separate pages of the questionnaire to the respondents: the first list contained words used to describe the subsidiary in which they worked, and a second, identical list contained words used to describe the corporate group. The data were arranged in two 42 × 30 (managers × words) rectangular arrays where each cell contained the value (v_{ij} = 1-5) assigned by each individual manager (i) to each word (j). For the purpose of the analysis that we present in the next section, we dichotomized the manager-words valued affiliation matrices to produce binary affiliation matrices whose cells a_{ij} =1 if the corresponding value in the original matrix was greater than 4. In other words, the dichotomization rule we imposed was a_{ij} =1 if and only if $v_{ij} = 5$, the maximum value of v_{ij}. This transformation produced networks of words whose density is approximately 20% and ensured the strongest possible association between the managers and the words they choose as meaningful descriptors of the organization[1]. The bipartite ego network of two participants is depicted in Fig. 1.

The words used by the two participants "Tommy" and "Stefano" to describe their subsidiary firm (starting with "F" in Fig. 2a) and the superordinate corporate group (starting with "G" in Fig. 2b) overlap only in part (names are fictional). Fig. 1 shows that Stefano tends to associate the "Group" with words having mostly positive connotations (Cooperation, Fun, Luxury, Family, Efficiency, etc.). "Tommy" seems to be similarly positive about the "Group," but his sentiment seems to be based on slightly different dimensions (Technology, Leadership, Innovation, etc.). Unlike Stefano, Tommy also associates "Group" with "Stress." Both participants adopt the words "Luxury" and "Leadership" to describe their organizational unit, and the word "effectiveness" to describe the Group. In the empirical part of the paper, we examine the dependence micro-mechanisms underlying aggregate patterns of word overlap that we have observed in each participant dyad.

Fig. 2a and b present the two-mode networks of manager by words that we examine in the empirical part of the paper[2]. The managers are positioned at the bottom of the figures (names are fictional) while the words are at the top. The width of the black bands (the "nodes" of the network) at the bottom of the figures is propositional the outdegree of the managers, i.e., the number of words selected by each participant. The width of the black bands at the top of the figures is proportional to the indegree of the words, i.e., the number of choices received by each word.

The figures show evidence of differentiation in the popularity of words and in the activity of participants. "Luxury" is the word most frequently cited as a descriptor of the subsidiaries (top Fig. 2a), while "stress" is the word that the managers most frequently associate with the corporate group (top Fig. 2b). Giorgio (name is fictional) is by far the most active in the description of his
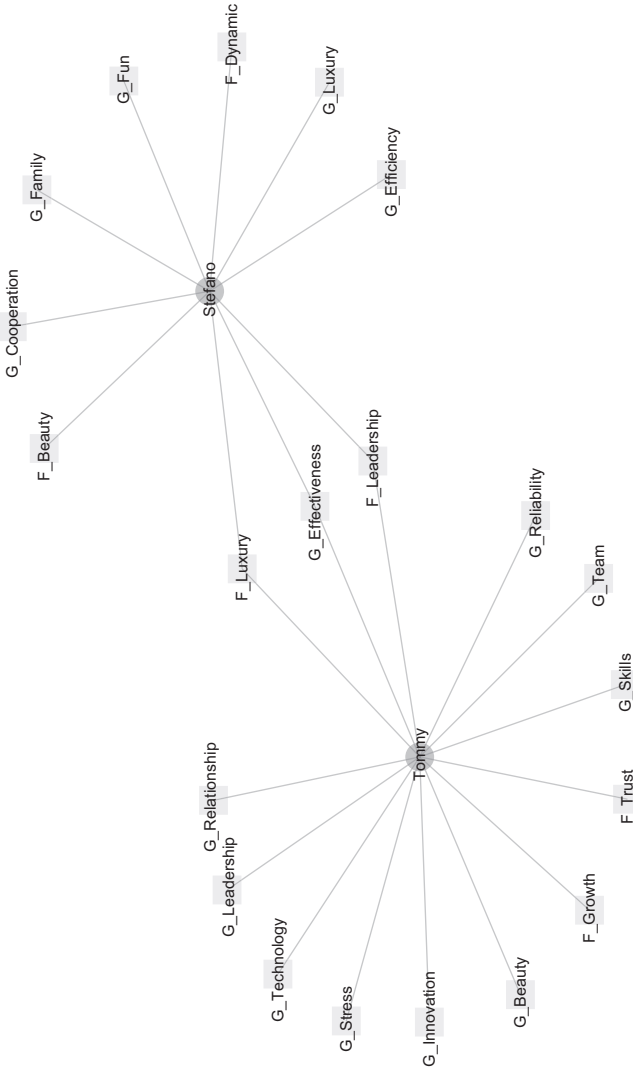
Fig. 1. Bipartite Ego Networks of Two Participants: Tommy and Stefano (Dark Circles). Words Starting with "F" are Referred to the Subsidiary Firms. Words Starting with "Gr" are Referred to the Corporate Group.
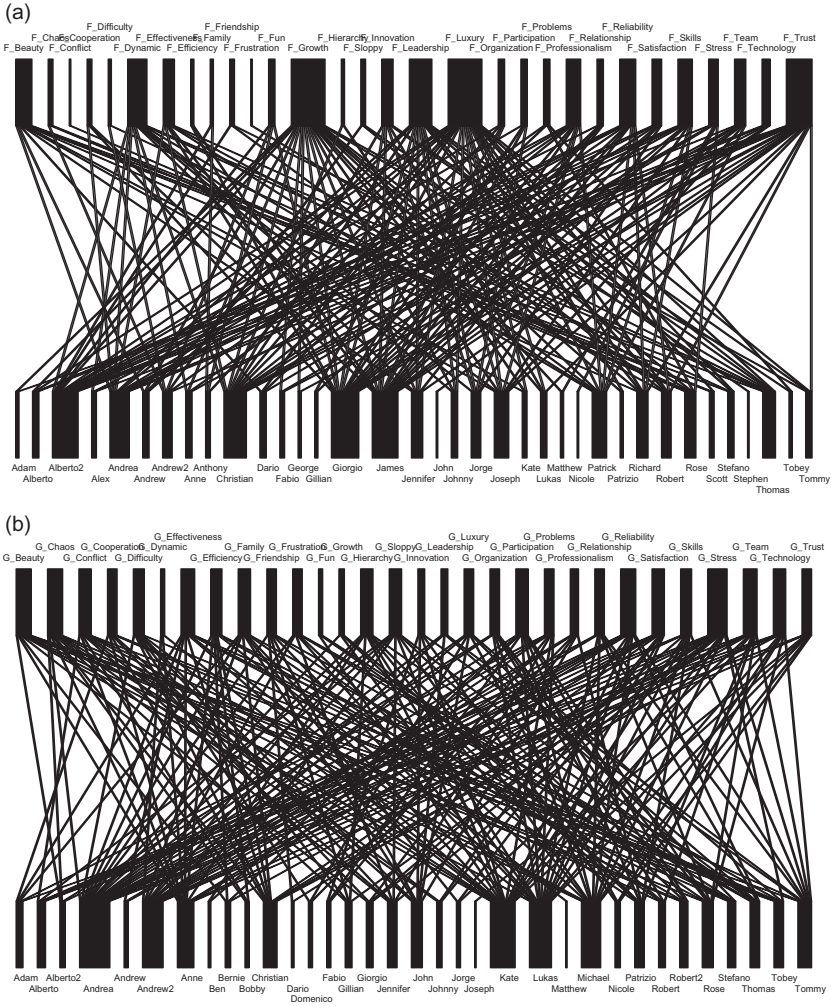
Fig. 2. Network of Association between Managers and Words Describing Their Subsidiary Firm (2a), and Words Describing the Corporate Group (2b). The width of the vertical black bands is proportional to the outdegree (bottom: choice of words made by managers) and to the indegree (top: number of choice received by words).

own subsidiary (he uses many words) (bottom Fig. 2a). Andrea (name is fictional) is the most active in describing the corporate group (bottom Fig. 2b).

The density of the network that affiliates managers to words describing their subsidiary firm (Fig. 2a) is approximately 16 percent. On average, managers

used approximately 5 words (standard deviation 4.55) to describe their subsidiary. The density of the network that affiliates managers to words describing the superordinate corporate group (Fig. 2b) is approximately 19 percent. On average, a manager uses approximately 6 words (standard deviation 5.03) to describe the corporate group.

For each participant we also collected basic demographic information (such as age, educational experience, gender, nationality, tenure), and information on membership in professional families (organizational functions) and in the subsidiary firms. In the empirical analysis we focus on the network structure of organizational vocabularies, and on how organizational factors may affect such structure. Individual differences do not play a central role in the analysis we present.

METHODS AND MODELS

Methodological Approach

The results we report in the empirical part of the paper are based on the specification and estimation of an Exponential Random Graph Model (ERGM), a class of models for tie variables originally introduced by Wasserman and Pattison (1996) as *p-star (p*)* model − and later refined and extended by Snijders, Pattison, Robins, and Handcock (2006). ERGMs are becoming increasingly common in studies of organizations (Lomi et al., 2014; Srivastava & Banaji, 2011). ERGMs are the only modeling approach currently capable of accounting explicitly for the dependence between observations typical of network data. When these dependences are of theoretical interest − like in the empirical case that we present − ERGMs afford direct specification and estimation as local configurations of network ties. In the empirical case we develop, the configurations of interest derive from patterns of affiliation with words through which participants define the structure of organizational vocabularies.

ERGMs can be conceived broadly as logit models for binary tie variables. Given that our data are generated by affiliation of people to words, it is appropriate to adopt ERGMs for the analysis of 2-mode networks (Conaldi & Lomi, 2013; Skvoretz & Faust, 1999; Wang, Pattison, & Robins, 2013; Wang et al., 2009). In this model, the dependent variable Y is the probability of observing a tie between organizational member i and word j that she uses to describe respectively her subsidiary firm, and the superordinate corporate group. In the corresponding rectangular matrix $\mathbf{Y}$, the generic element y_{ij} takes value 1 if the organizational member i uses the word j and 0 otherwise. The probability is modeled as a linear function of network configurations. Each configuration enters the model specification as a statistic that counts, for organizational member i, the number of configurations of each type in which i is involved in the

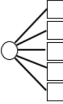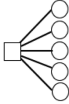observed network. Each configuration is associated with a parameter θ_Q that may be estimated from the data.
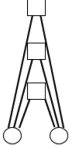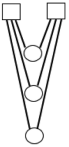
Variables and Measures

Table 1 reports the configurations that are included as independent variables in the empirical model specification in order to capture the structure of association between organizational members and words. We refer readers to Wang et al. (2009) and Wang et al. (2013) for the formal definitions of the effects reported in Table 1.

We distinguish between two classes of configurations. The first class accounts for mechanisms describing the connection between members and words (Wang et al., 2009). *Participant activity* is included to account for the centralization in word choice activities expressed by organizational members. The connection between organizational members and words is assumed to be shaped by the number of words indicated by members. Accordingly, the higher the number of words that organizational members use to describe their company or the corporate group, the higher the probability that they use further words. *Preferential affiliation* is included to account for the centralization in preferences received by words. The assumption underlying this configuration is that the likelihood of observing a connection between organizational members and a selected word is higher (or lower, if the parameter is negative) if the same word is indicated by many members to describe their company or The Group. *Structural equivalence (participants)* accounts for the general tendency of pairs of members to indicate the same multiple words — i.e., to be structurally equivalent with respect to words chosen. This configuration suggests that organizational members are likely to converge on similar interpretations of their work experience. *Structural equivalence (words)* is included to account for the general tendency of pairs of words to be indicated by multiple members — i.e., to be structurally equivalent with respect to organizational members. *Structural equivalence (words)* indicates that words are likely to support convergent interpretations of work experience.

One way to think about our model specification is in terms of (unobservable) local mechanisms capable of reproducing salient global ("structural") features of the (observed) network. In this perspective "degree-based effects" (*Participant activity*, and *Preferential affiliation*) are included in the model to capture the skewness in the degree distribution that is typical of network data. As Figs. 2a and 2b suggest, our data are no exception. In our specific case for example, few words are chosen by many participants and many words are chosen by few. This preferential affiliation of participants to words tends to generate a skew degree distribution that the corresponding "effect" is trying to capture. The "closure-based" effects (*Structural equivalence*) are included to

Table 1. Summary Description of the Effects Included in the Model. Circles are organizational participants. Squares are words. Black circles indicate an organizational participant with a given categorical attribute.

Effect	Configuration	Qualitative Description	Underlying Mechanism Structural Interpretation	Interpretation
Participant activity		Tendency of participants to indicate multiple words	Centralization in word choice activities expressed by participants	A positive effect would indicate the presence of few participants choosing many words
Preferential affiliation		Tendency of multiple participants to indicate the same word	Centralization in the preferences received by words	A positive effect would indicate that a limited number of words attracts nomination form many participants
Structural equivalence (participants)		General tendency of pairs of participants to indicate the same multiple words (i.e., to be connected by multiple bipartite 2-paths)	Structural equivalence of participants with respect to words (two participants are structurally equivalent if they select the same multiple words)	A positive effect would indicate the tendency of participants to converge on similar interpretations of work experience
Structural equivalence (words)		General tendency of pairs of words to be indicated by multiple participants (i.e., to be connected by multiple bipartite 2-paths)	Structural equivalence of words with respect to participants (two words are structural equivalent if they are selected by the same participants)	A positive effect would indicate the tendency of words to support convergent interpretations of work experience
Participant 2-path (company, location, function)		Tendency of members with a similar attribute (i.e., same company, location, organizational function) to indicate the same word	Homophily: tendency of similar participants to indicate the same word.	A positive effect would indicate that two participants sharing membership in the same company (or in the same location or function) are more likely to nominate the same word (and hence to be connected by a bipartite 2-path)
Clustering of words by participant attribute (company, function)		Tendency of members with a similar attribute (i.e., same company, organizational function) to create 4-cycles by indicating the same pair of words	Bipartite clustering (within companies or within functions)	A positive effect would indicate that two participants sharing membership in the same company (or in the same function) tend to become more similar in terms of words they use to describe their work experience

account for the tendency of network data to self-organize into clusters. In 2-mode networks such as those we examine the smallest possible configuration representing closure is known as a 4-cycle (Conaldi & Lomi, 2013; Wang et al., 2009), consisting of pairs of participants and pairs of words. Additional discussion on 4-cycles in the context of ERGMs is contained in Wang et al. (2013), in Conaldi, Lomi, and Tonellato (2012) in the context of dynamic network models, and in Opsahl (2013) in the more general context of 2-mode networks.

The second class of local configurations, or "effects," is defined in terms of interactive attribute-relations configurations that may affect the likelihood of using the same words to describe their work experience (Agneessens & Roose, 2008). *Company* controls for the propensity of organizational participants sharing membership in the same company toward nominating the same words. This configuration allows testing the influence of the formal organizational structure − i.e., formal intraorganizational boundaries − on choice activities expressed by organizational participants. *Organizational function* accounts for the likelihood that organizational members in the same function − within or across companies − nominate the same words. *Location* is included as a control for the effect of geographic proximity on the tendency to choose the same words. *Company*, *Organizational function*, and *Location* are all examples of *2-path effects* representing a form of local cohesion − the tendency of participants sharing an attribute to be indirectly linked at short distance through the same word.

As we have mentioned in our earlier discussion of 4-cylces, *Clustering of words by participant attribute* accounts for the propensity of organizational members with a similar value of an attribute (i.e., company, organizational function) to generate 4-cycles by indicating the same words − i.e., clustering of members and words due to similarity among members. Specifying this configuration for *Company* and *Organizational Function* helps us to assess the extent to which formal affiliation to a company or functional role are driving forces behind clustering of organizational members and words.

Model Estimation and Interpretation

ERGM parameters are estimated using Monte Carlo Markov Chain Maximum Likelihood (MCMCML), a simulation-based technique (Snijders, 2002). A similar procedure is used also to assess the goodness of fit of our models (Hunter, Goodreau, & Handcock, 2008). Parameter estimates θ_Q are interpreted similarly to log-odds. A positive (negative) and statistically significant estimate indicates a greater (smaller) number of the corresponding configuration in the observed network than the number that would be expected by chance alone (Goodreau, Kitts, & Morris, 2009). A positive (negative) and significant parameter associated with a given local configuration of ties in the observed bipartite

network, makes organizational participant i more (less) likely to be associated to word j.

RESULTS

The results are presented in Table 2 reporting the (bipartite) ERGM estimates for the association between organizational members and words used to describe their subsidiary firm and the corporate group, respectively. In order to make the two models comparable, we include the same configurations[3].

The parameter for *Participant activity* is positive and significant in Model 1 only. This effect suggests the presence of a restricted number of organizational participants indicating many words only when the words describe subsidiary companies.

The odds of observing organizational members who nominate many words indicating an additional word are $\exp[1.647] = 5.191$ times the odds of not observing it. The same parameter is not significant for nominations of words used to describe the corporate group (Model 2). There seems not to be significant differences among organizational members in the number of words indicated to describe The Group. The positive and significant parameter for *Preferential affiliation* in both models points to a substantial difference in attractiveness of words that organizational members use for describing their company and The Group: a limited number of words is nominated by a disproportionate share of organizational members. The odds of observing a popular word (a word attracting the preference of many participants) being indicated by an additional participant are respectively $\exp[0.856] = 2.354$ in Model 1

Table 2. ERGM Estimations for Association of Organizational Members to Words (Standard deviations are in parentheses).

	Model 1 Company	Model 2 Group
Participant activity	1.647 (0.298)[a]	0.370 (0.320)
Preferential affiliation	0.856 (0.394)[a]	1.968 (0.417)[a]
Structural equivalence (participants)	0.160 (0.027)[a]	−0.313 (0.106)[a]
Structural equivalence (words)	0.122 (0.050)[a]	0.245 (0.066)[a]
Company	0.042 (0.033)	−0.100 (0.094)
Location	0.007 (0.019)	0.010 (0.015)
Organizational function	0.004 (0.070)	0.151 (0.074)[a]
Clustering of words by company	0.038 (0.008)[a]	0.005 (0.039)
Clustering of words by organizational function	0.007 (0.019)	−0.055 (0.034)

[a]Indicates that the ratio of statistic to standard error is greater than 2 (Standard errors in parentheses).

(company), and exp[1.968]=7.156 times in Model 2 (group). Hence, there seem to be a considerably stronger tendency toward centralization in the network of words describing The Group.

The positive and significant parameter for *Structural equivalence (words)* suggests that words tend to support participants' convergent interpretations of work experience in both their company and the corporate group. Odds of observing *Structural equivalence (words)* are exp[0.122]=1.130 in Model 1 and exp[0.245]=1.278 in Model 2. In Model 1 this tendency is reinforced by the positive and significant parameter for *Structural equivalence (participants)*, suggesting the organizational participants tend to develop similar interpretations of their work experience in their company. Odds of observing *Structural equivalence (participants)* are exp[0.160]= 1.174. The negative sign of the parameter for the same configuration in Model 2 suggests that this tendency reverses when the words are associated to the corporate group. Odds of observing *Structural equivalence (participants)* in Model 2 are exp[−0.313]=0.731. One possible interpretation of this result is that organizational members seem unable to provide a coherent interpretation of The Group (i.e., to describe it with the same words).

The positive and significant parameter for *Organizational function* in Model 2 indicates that organizational members sharing the same function (within as well as across companies) are likely to select the same words to describe the corporate group. We interpret this result as providing evidence that membership in organizational functions, rather than subsidiary companies, is what provides the basis for organizational participants to construct shared interpretations of The Group. *Clustering of words by company* is positive and significant in Model 1 only, suggesting that organizational participants sharing affiliation to the same company are more likely to cluster around words used to describe the company itself. The same effect does not hold for The Group: participants in the same subsidiary are likely to describe their own subsidiary firm with similar words, but they are unlikely to converge on the same interpretation of The Group. Clearly, different interpretations of The Group coexist within the overall organization. These differences seem to be organized in terms of membership in the different subsidiary companies.

Moving from the level of individual parameters to the level of the overall model, we now ask: How well does the model reproduce the observations? Table 3 reports results of diagnostic tests of model fit. Following recommended best modeling practice (Hunter et al., 2008), empirical parameter estimates are used to simulate a distribution of 10,000,000 graphs implied by the model. A sample of 10,000 is drawn and compared with the observed graph on selected characteristics. Features of the degree distributions of organizational members and words account for properties of the distribution of respectively the number of words used by member and the number of members' preferences received by word. The global clustering coefficient accounts for the tendency of organizational members to share words, thus forming subgroups of members and words. A model fits well to the extent that the simulated graph distribution contains the

Table 3. Simulation-Based Goodness of Fit Diagnostics of the Model.

	Company			Group		
	Observed value	ERGM Simulated value	*t-ratio*	Observed value	ERGM Simulated value	*t-ratio*
Degree distribution of participants (standard deviation)	6.666	6.418	0.233	7.777	7.632	0.681
Degree distribution of participants (skewness)	−0.962	−1.149	0.875	−0.983	−1.096	1.143
Degree distribution of words (standard deviation)	8.745	8.200	0.937	8.367	8.296	0.777
Degree distribution of words (skewness)	−1.016	−1.052	0.126	−1.064	−1.053	−0.312
Global Clustering Coefficient	0.408	0.326	0.427	0.333	0.303	1.551

observed network with a conventional level of confidence (Robins & Lusher, 2013). For parameters corresponding to effects not included in the model, this is assessed by computing a *t*-ratio. A *t*-ratio smaller than two (in absolute value) is typically taken as evidence that the observed statistic and the statistic computed on the random sample of simulated networks implied by the empirical estimates are sufficiently close.

As the figures reported in Table 3 indicate, all *t-ratio* values are smaller than the conventional threshold value above which the null hypothesis that observed and estimated values are the same can be rejected. The results of our simulation-based diagnostic test suggest that the model represents well the observed association between managers and words.

DISCUSSION AND CONCLUSIONS

According to Kirchner and Mohr (2010, p. 556): "It is the relations rather than things that are critical for social analysis, and it is the patterning of relations that define and give meaning to the experiences of social life." In this paper, we built on this fundamental theoretical insight by studying the relation between organizational participants and words they use to describe their work experience. We linked recently derived statistical models for 2-mode networks to what Loewenstein et al. (2012) have termed the vocabulary perspective on organizations. The vocabulary perspective has deep roots in organization theory (Meyer & Rowan, 1977; Weick, Sutcliffe, & Obstfeld, 2005), but it still remains less a well-articulated theory than a general research program (Loewenstein et al., 2012: 2). We have shown that a focus on the relations linking

organizational participants and words allows us to reveal important aspects of the network structure of organizational vocabularies, and how such structure is shaped by formal organizational design. More specifically, our work has revealed the network-based mechanisms underlying the multiple meaning structures competing and coexisting within organizations.

The central contribution of the paper rests in its attempt to represent organizational vocabularies not only as simple "bags of words," but rather as the building blocks of a differentiated social structure within organizations. As Loewenstein et al. (2012:37) suggest, a vocabulary approach "provides a concrete and measurable way to link collectives, situations, meanings, and action." We have shown how patterns of affiliation to words that organizational members use to verbalize and communicate their work experience induce and sustain jointly occupied positions in which representing multiple "zones of meaning" coexisting within organizations (Berger & Luckman, 1966). Unlike prior work, we have focused on the (network) structure of meaning rather than meaning structures.

In its current form, the paper suffers from two main limitations that indicate clear avenues for future research on organizational vocabularies. The first limitation concerns the fact that our exclusive focus on the (bipartite) network structure of organizational vocabularies precluded a more comprehensive analysis of social networks − i.e., of specific kind of relations linking organizational participants. Consequently, we are unable to assess the extent to which shared meanings supported by overlapping word choice are conductive of social relations in organizations. Yet, the way social networks may help to bridge "cultural holes" (Pachucki & Breiger, 2010) existing between "zones of meaning" (Berger & Luckman, 1966) around organizational vocabularies, remains a central issue in research on knowledge creation, sharing and transfer within organizations (Caimo & Lomi, 2015; Reagans & McEvily, 2003; Szulanski, 1996). This direction for future research is now supported by a new generation of models for multilevel networks that have just started to be adopted in the study of organizations (Zappa & Lomi, 2015). Our next step will be to model jointly bipartite associations between participants and words, and social networks among participants. Snijders and coauthors (2013) recently derived a model for mixed-mode networks that might allow a straightforward longitudinal extension (Lomi & Stadtfeld, 2014).

The second limitation of the study concerns our decision to select individual words as the basis for processes of meaning construction − an approach that according to Kirchner and Mohr (2010: 561) epitomizes the "typical lay approach to meaning." In the models we presented words come into consideration primarily as sources of dependence within and across organizational foci (Feld, 1981, 1982), rather than separate dictionary-like entries. The identification of words based on interview with key informants clearly exposes our research design to criticism based on the representativeness and the accuracy of informants (Bernard, Killworth, Kronenfeld, & Sailer, 1984). Our approach to

identification and selection of words may lead to a set of words that is too narrow or insufficiently representative to cover the organizational aspects that participants may consider important or meaningful. Clearly, vocabularies need not be restricted to words and may be defined in terms of images, narratives, or conversations (Gibson, 2012). To the extent that more complex discursive objects may be unambiguously identified, we see no reason for restricting the analysis of vocabularies to individual words as we have done in this paper. Examples of material that may serve as a basis for defining meaningful foci may include practices, conversations, company documents, press releases and any other material that may be meaningfully interpreted as an attempt of the company to summarize and communicate its identity to internal and external audiences. To the extent that there can be theoretical agreement on the claim that "meanings are relational" (Mohr & Bogdanov, 2013: 546), the approach to the analysis of organizational vocabularies that we have proposed can be extended to other sources of textual data that organizations routinely produce.

We think that these productive limitations demonstrate that this work makes only an initial step on the road to integration of the organizational vocabularies and the social networks perspectives. Still missing from the picture we have presented in this paper is an analysis of the mixed system emerging from the intersection of meaning structures (produced by the affiliation of people to words) and social structures (produced by the association between people). Rediscovering the mutually constitutive character of "meaning" and "social" structures, and recognizing the opportunity for their joint analysis offered by contemporary network models will present organizational research with new and exciting possibilities for theoretical development and empirical research.

NOTES

1. The only other sensible rule for dichotomizing the original network is $a_{ij} = 1$ if $v_{ij} \geq 4$. This rule is only limitedly useful because it produces binary networks that are far too dense for meaningful statistical analysis (approximately 50%).

2. The number of managers in Figures 2a and 2b (bottom labels) is smaller than 42. This is because the dichotomization of the bipartite network created disconnected nodes (managers not affiliated to any word because no word they indicated received maximum score).

3. Specifications of ERGMs usually include the Density configuration, accounting for the baseline propensity of organizational members to be associated to words. Density corresponds to the intercept of standard logit models. In ERGMs the parameter estimate for Density is typically negative to reflect the relative sparsity (i.e., low density) of the network. To aid model convergence in Model 1, we adopted the common practice of fixing network density − i.e., we did not include a configuration for baseline Density. For making to two models comparable, we also fixed density in Model 2.

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