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Argumentation in Large, Complex Practices

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Abstract: Differences arise in macro-activities, such as the production of energy, food, and healthcare, where the management of these differences happens in polylogues as many actors pursue scores of positions on a variety of issues in numerous venues. Polylogues are essential to the large-scale practices that organize macro-activities but present significant challenges for argumentation theory and research. Key to the challenge is conceptualizing the variety of argumentative roles that go beyond the classic normative definition of protagonist and antagonist. A macroscope is devised for identifying argumentative roles in the communicative work of organizations, and the communicative work of the network of organizations, related to the production of gas from shale in the Marcellus region of the Northeastern United States. The macroscope scaffolds a design thinking inquiry into the variety of argumentative roles in the communicative work of organizations in a polylogue and finds: (1) innovation and entrepreneurialism in the design of organizations as devices for managing disagreement; (2) argumentative roles as services specializing in particular aspects of argument; and (3) networks of organizations with prominent types of specialized roles that give shape to the disagreement space around a large, complex practice. It is proposed that the varieties of argumentative roles in polylogue are not random or arbitrary but derive from more general pragmatic principles about how disagreement is organized and how methods of disagreement management emerge within communication relative to a macro-activity.

Keywords: argument roles, design, disagreement management, fracking, institutions, macrosopes for argumentation, natural language processing, organizational communication, polylogue, practice, social network analysis

1. Introduction

The extraction and production of Marcellus shale gas in the Northeastern part of the United States has in recent years received tremendous attention. Shale gas is extracted by the process of hydraulic fracturing, or “fracking,” where large volumes of water are forced underground into shale with high pressure that releases the gas for capture (Howarth, Santoro, & Ingraffea, 2011). The combination of this technology with the more recent innovation of horizontal drilling has led

to a significant industrial boom around gas from shale development. The production of shale gas, however, is not just the instrumentally rational orchestration of technological activity. The production of gas from shale is a macro-activity with an evolving large-scale practice for production. Large scale practice, as in any practice, is not uniform and stable but rife with differences among many stakeholders about what the practice achieves, how, and why (Nicolini 2012; Reckwitz 2002). The rise of “fracking” is associated with a variety of stances, or dispositions, of the numerous organizations taking a stake in the production of gas from shale. This includes, for instance, technical practices of drilling and distributing, the economic value of development, the environmental and health consequences, the social and economic disruption, the ethics of consumption, and local, regional, national, and international policy. Indeed, what is knowable and actionable through a practice is contingent on the ways in which such differences are worked out.

Macro-activities and the large scale practices that organize these activities present a significant challenge for argumentation theory. In their work on large-scale deliberation and polylogue, Lewinski and Aakhus (2014; Aakhus and Lewinski in press; Aakhus and Lewinski 2011) have made the case that underpinning much argumentation theory is the normative assumption that argument involves two parties (pro and con) exchanging reasons on an issue while engaging each other in a fixed setting. However, the large scale practices organizing macro-activities such as energy production, healthcare, and food involve polylogue (i.e., many players engaging over many issues in many places). In the case of gas from shale as in others, for example, the management of these differences is consequential for what is known and actionable about natural resources and the environment. This argumentative reality poses a challenge for argumentation researchers as the capacity of argumentation theory to offer insight into such complex societal processes can only scale to its conceptualization of argument.

The present study picks up one aspect of the challenge presented by large scale practice by articulating the variety of argumentative roles and the function of these roles within the communicative work of organizations in the production of gas from shale in the Marcellus. The study integrates techniques from social network analysis (SNA) and natural language processing (NLP) to scaffold a *macroscopic* view of the polylogue related to the conduct of the large scale, multi-stakeholder activity of shale gas production and consumption. The main claim, following Aakhus (2013), is that the varieties of argumentative roles discernable in the communicative work of organizations are designs for argumentation that offer specialized communication-information services for disagreement management. The variety of argumentative roles can be distinguished by the ways in which these services are attuned to particular intrinsic demands of argument in communication: the maintenance of premise-conclusion relations, the relation between what is said and actions performed, and the relevance of actions performed in activities undertaken (Aakhus 2013).

Two contributions are made. One is empirical and substantive in the articulation and explanation of the specialized argumentative services organizations develop to participate in and shape the disagreement space related to a large scale practical activity. This addresses the polylogical challenge for argumentation research to conceptualize the variety of argumentative roles (Lewinski and Aakhus 2014) by incorporating design thinking about argumentation in society (Jackson 2015). The other is methodological in devising a method for incorporating computational tools (e.g., SNA, NLP) to scaffold observation of argumentation at a large scale. This addresses challenges in reconstructing argumentation as a polylogue (Aakhus and Lewinski 2015; Aakhus and Lewinski in press).

2. Organizations as devices for argument

A key claim from Disagreement Management research is that argument happens within practical human activities for managing disagreements that arise in the conduct of these activities (Jacobs and Jackson 1989). Against a backdrop of taken for granted assumptions that ground practical activities, participants discover differences and disagreement in the conduct of that activity and naturally occurring argument functions as a repair mechanism for the content and direction of practical activity (Jackson and Jacobs 1980). The original work focused on how people in ordinary conversation adapted their use of language and conversational moves to manage the omni-relevant potential for disagreement over actions in activities, such as promises, requests, assertions, and proposals (Jacobs and Jackson 1989). Disagreement Management sought to elaborate the pragmatic principles of how disagreement is organized and the methods for managing disagreement. A significant implication is that Disagreement Management does not see the use of premises and conclusions as the only means for managing disagreement and affording reasonableness (Aakhus 2013; Jackson 2015).

The aims of disagreement management are scaleable and scaffold inquiry into the designs for argumentation that permeate modern life. The original focus on everyday conversational argument gave way to attending to a variety of inventions designed for managing disagreement including techniques, such as devil’s advocacy (Jacobs 1989); specialized roles, such as third-party dispute mediators (Jacobs and Jackson 1992; Jacobs and Aakhus 2002); institutionalized procedures, policy and legal procedures (Aakhus 1999; Jacobs and Jackson 2006), and information-communication technology, such as decision support systems (Aakhus 2002; de Moor and Aakhus 2006). An interest in argumentation theory and practice should include such attention to the variety of inventions and innovations devised for augmenting reasoning and regulating disagreement.

A design stance, as Jackson (2015, p. 244) explains, moves “outward from analysis and appraisal of individual arguments to analysis and appraisal of the inventions that allow new forms and patterns to emerge in individual arguments.” From the design vantage point, argument products, processes, and procedures are not only objects for evaluation but matters of design.¹ As Jackson (2015, p. 251) argues, evaluation is only one theoretical concern while another is with devising means – argumentation schemes, procedural rules, institutional arrangements, and strategic repertoires – to augment reasonableness within less than ideal contexts of disagreement. This includes examining the past and present to discover means for managing disagreement to understand how these social-cultural devices worked, were made to work, whether they worked, and how they were normalized or surpassed. A design stance demands attention to the infrastructures built for managing disagreement and cultivating reasonableness to understand how the devices for interacting and thinking function and whether these devices function in efficacious and legitimate ways.

One general type of device for argumentation is the organization. Organizations have been understood in organizational theory as mechanisms that afford the division of labor and means for coordinating that division into collective action that achieves particular goals of production. In particular, organizations are a set of rules that coordinate information processing and define decision making structures that enable the management of differences essential to collective action (Simon 1976; March and Simon 1993; Weick 1979; see also Gaskins 1992; Tompkins, Tompkins, and Cheney 1989). Forms of organizing have evolved as additional

¹ Argument as product, process, and procedure is taken from Wenzel (1979).

strategic functions were incorporated into the organization's design that require the coordination of new kinds of information and decision rules (Galbraith 2012). For instance, vertical integration focused on production while the multidivisional form that dominated the 20th century incorporated the geographic reach of large organizations. At the turn of the century, the voice of the customer was integrated into organizational designs and the next strategic element to be integrated appears to be big data and data analytics (Galbraith 2012). The latter two shifts co-occur with changes in media in the rise of the networked society around networked computing (i.e., Internet; social media). While organizational design for information coordination and decision making remains, the form continues to evolve as organizations appear to be taking on more and more communicative functions adapted to the varieties of stakeholders that organizations engage (Cummins 2001; Sutcliffe 2001). As organizational forms have evolved, organizations have developed communicative means in which they become ever more deeply involved in societal communication including matters of public concern (Kuhn and Deetz 2008; Ziek 2012).

Organizations can readily be understood as performing communicative work and in particular as devices for managing differences across a range of relations to other actors including other organizations. As organizational forms integrate new capacities within the organization for communicative work, organizations that offer specialized communication-information services emerge to fill the need. These often address particular aspects of managing disagreement. Aakhus (2010; Aakhus and Ziek 2008) surveyed various technological innovations for augmenting argumentative communication that function as communication-information services for argument. These include: *Argument Builders*, *Argument Articulators*, *Argument SenseMakers*, *Argument Generators*, and *Argument Framers*. Aakhus (2013) explains that each type of service addresses a different aspect of the intrinsic demands of argument. Some services are directed at premise-conclusion relations (e.g. Argument Builders, Argument Generators), others address gaps between what is said and actions taken (e.g., Argument Articulators, Argument SenseMakers), and yet others are directed at defining what counts as a relevant argument move (e.g., Argument Framers). As organizations become more deeply intertwined in communication, and develop specialized services, a division of argumentative labor appears in societal deliberations and controversies across the communicative work of organizations (Aakhus 2013).

The present study explores the idea that organizations are devices designed for disagreement management within a practical macro-activity and that the design of such devices is consequential for the content and direction of the large-scale practice organizing the macro-activity. Using the case of organizations involved in gas from shale production in the Marcellus shale region, this study asks: What kinds of argumentative roles do organizations take up in their communicative work related to shale gas production? The answer to such a question can contribute to the development of design thinking about argumentation and to understanding polylogue, especially the diversity of roles in argumentation beyond protagonist and antagonist.

3. Identifying argumentative roles in communicative work

In a polylogue there are many players, many positions, and many places involved in the management of disagreement and one of the methodological challenges for argumentation is modeling and mapping this diversity (Aakhus and Lewinski in press). Jackson and Lambert (2015) have suggested the value of developing *macrosopes* for inquiry into argumentation

processes. A macroscope scaffolds a view of complexity that is “at once too great, slow, or complex for the human eye and mind to comprehend” and that helps “synthesize related elements and detect patterns, trends, and outliers while granting access to myriad details” (Börner 2011, p. 60). A macroscope stands in contrasts to research tools that function as telescopes and microscopes in research. Jackson and Lambert (2015), for instance, have demonstrated how a particular macroscope they devised illuminated complex arenas of controversy about public health and the role of argumentation.

The present study devised a macroscope by using a combination of tools for gathering network data about the url linking behavior of organizations (i.e., Issue Crawler, Rogers 2009) and scraping the text from the about-pages of the organizations in the network (i.e., Outwit Hub). Techniques from social network analysis (SNA) and natural language processing (NLP) were used to identify the communicative work of organizations and to analyze the argumentative roles within the communicative work of organizations.

To identify organizations relevant to the macro-activity of shale gas production in the Marcellus, a seed list of organizations was developed by searching for a diverse collection of organizations ostensibly involved from news stories and Internet searches. An organization was defined as any kind of association of individuals who join together to achieve a purpose or pursue some value as a composite actor (i.e., an organization). So, a drilling company, a watershed commission, a newspaper, and a local advocacy group all count as an organization, as do membership and trade organizations that are made up of member organizations. The seed list was composed of 210 organizations and the urls of these organizations were crawled using Issue Crawler at two different times (September 2012 and March 2013). Issue Crawler identifies any organizations on the web that link to the seed organizations. For September 2012, 192 organizations were identified as being part of the network and 32 of these were new (i.e., not part of the original seed list) while 50 from the original seed list were dropped from the network. For March 2013, there were 194 organizations in the network of which 32 were new and 48 were dropped. Comparing the networks identified at each point in time revealed that 130 organizations were part of the network at each point in time. Moreover, the network density for September 2012 was 53% and for March 2013 was 59%, which is a moderate network density indicative of an appreciable number of ties among the organizations and yet ties that are still evolving (Taylor and Doerfel 2003). The approach thus identified a network that persisted over time with a moderate density that is meaningful for analysis.

To identify the communicative work of organizations and the argumentative roles, the about-pages were scraped from the urls in April 2013 crawl using Outwit Hub. An about-page is an organization’s self-description of what it does (i.e., verbs) and the objects of those actions (i.e., direct objects). The resulting corpus of text was parsed using the Stanford Parser which identifies and tags the grammatical role of each word in each sentence in a text for subsequent analysis. The indicators of the communicative work of each organization were the verbs and direct objects of verbs in each about-page. An action, for the purposes of this study, is defined as conduct oriented toward some object. The organizations of the Marcellus organizational field undertake a variety of actions (e.g., drilling, protecting, distributing, advocating, informing, researching) toward a variety of objects of action (e.g., health, gas, rivers, profit, policy, information) when engaging the biophysical and institutional world around them. Clearly, there are limitations to using about-pages to determine what an organization does but an about-page is one indicator that was useful for the purposes of the present study.

The SNA and NLP were integrated in two different analyses to examine the argumentative roles of organizations. First, the communicative work of organizations in the network was identified by analyzing the most central organizations in the network to characterize their potentially unique argumentative roles. The organizations with very high betweenness centrality within the network were identified so that the communicative work of highly central organizations could be analyzed. *Betweenness* is an SNA measure that identifies organizations that “fall between” others (Doerfel & Barnett 1999) in that they connect other organizations by, for example, filling some sort of structural hole in the network (Burt 1992) or functioning as a gatekeeper of information flows through a network (Krackhardt 1992). The self-descriptions of the high connectors were characterized as particular kinds of communicative work by using the terms in their self-description indicative of *action* the organization takes and *objects of action*. For instance, fracfocus.org describes its role as:

“The site was created to provide the public access to reported chemicals used for hydraulic fracturing within their area. To help users put this information into perspective, the site also provides objective information on hydraulic fracturing the chemicals used, the purposes they serve, and the means by which groundwater is protected.”

For the purpose here, fracfocus.org is characterized as performing communicative work composed of a focal action (information provision) and a focal object of action (hydraulic fracturing chemicals). In this way, organizations, which are complex entities that do many things, can be seen for the communicative work they ostensibly perform that in turn provides grounds for understanding the argumentative roles organizations take up relative to a macro-activity such as the production of gas from shale in this case.

Second, the communicative work of the network was identified by first identifying factions, or sub-networks, of organizations in the network and then aggregating the terms about action and objects of action and mapping the predominant verbs and direct objects used by organizations across the overall network and within its sub-networks. Within the overall network, four sub-networks were identified. Using the UCINET software for SNA, it was found that the four sub-networks had the highest goodness of fit. The final proportion of correct fit for September 2012 and March 2013 of 77% was high, especially as compared to other models of two, three, or five subnetworks (e.g., Ansell, Reckhow, and Kelly 2009). With the factions identified the verbs and direct-objects were aggregated for each faction to assess the relative predominance of focal actions and focal objects of action across the network and within sub-networks.

4. Findings about the communicative work of organizations and argumentative roles

Two findings are reported here regarding the communicative work of organizations and the communicative work of networks of organizations relative to a macro activity. The first helps in recognizing the variety of argumentative roles organizations take up beyond protagonist and antagonist in a polylogue relative to a macro-activity. The second helps in recognizing that in the aggregate the communicative work of organizations constructs disagreement space and shapes the means for regulating that disagreement.

4.1. Communicative work of organizations and argumentative roles

Based on the self-described roles of the most central organizations in the overall network, it appears that high connector organizations were engaged in communicative work relevant to shale production more so than direct involvement in the material production of gas from shale.

Across both time periods, four organizations had betweenness centrality scores within the overall network of at least one standard deviation above the mean betweenness score of all organizations: usa.gov (+5 s.d., Sept12; +4 s.d., Mar13), ferc.gov (+4 s.d., Sept12; +1 s.d., Mar13), epa.gov (+3 s.d., Sept12; +2 s.d., Mar13), and fracfocus.org (+2 s.d., Sept12; +4 s.d., Mar13). The self-described role of these organizations indicates a focus on communicative work that emphasizes information provision or versions of it. The objects of action varied but were primarily symbolic and discursive – that is, social, institutional, and political matters – rather than physical matters of production (see Table 1)

Table 1: Communicative Work by Network Connectors common to Sep12 and Mar13

High Connector Organizations	Self-Described Role	Action	Object of Action
usa.gov	“We provide trusted, timely, valuable government information and services when and where you want them. USA.gov is an interagency initiative administered by the Federal Citizen Information Center, a division of the U.S. General Services Administration's Office of Citizen Services and Innovative Technologies.”	Information Provision	Government Information
ferc.gov	“regulates the interstate transmission of electricity, natural gas, and oil. FERC also reviews proposals to build liquefied natural gas (LNG) terminals and interstate natural gas pipelines as well as licensing hydropower projects.	Monitoring and Reviewing	Energy Regulation
epa.gov	“Our mission is to protect human health and the environment.”	Regulate and Research	Health Environment
fracfocus.org	The site was created to provide the public access to reported chemicals used for hydraulic fracturing within their area. To help users put this information into perspective, the site also provides objective information on hydraulic fracturing the chemicals used, the purposes they serve, and the means by which groundwater is protected.	Information Provision	Hydraulic Fracturing Chemicals

A key aim of the data collection and analysis was to generate a macroscopic view of controversy and argumentation. The particular means was through the identification of plausible kinds of generic communicative work organizations perform (e.g., information provision, advocacy) relative to some broad activity. With such a macroscopic view, the pattern and variation in communicative work across the network of organizations becomes more apparent. Additional high connector organizations were identified by defining sub-networks of organizations within the overall network using the SNA factions routine described above. The self-descriptions of these high connector organizations revealed further focal communicative actions and objects of action relative to the shale gas production. These are summarized in Table 2. Advocacy appears as another prominent communicative action while the objects of action become more diverse. What is notable about the objects of action is that these tend to be about the functioning of the macro-activity and its consequences. (The labels for each sub-network in Table 2, will be explained in the next section.)

Table 2: Highest Connector Organizations within Sub-Networks of Overall Network

High Connector Organizations within each Sub-Network	S.D. above mean betweenness Sept12	S.D. above mean betweenness Mar13	Action	Object of Action
“Governing”				
usa.gov	+3	+3	Information Provision	Government Information
epa.gov	+3	+2	Regulation and Research	Health + Environment
house.gov	+3	+2	Legislation	Federal Laws
“Industrializing”				
fracfocus.org	+3	+3	Information Provision	Hydraulic Fracturing Chemicals
aga.org	+3	+2	Advocacy (+ Information Provision)	Natural Gas Delivery
eia.gov	+2	+1	Information Provision	Energy Impacts
api.org	+1	+1	Advocacy (+ Information Provision)	Natural Gas Industry
“Localizing”				
catskillcitizens.org	+3	+3	Advocacy	Clean Energy
earthworksaction.org	+2	+3	Advocacy	Community + Environment

un-naturalgas.org	+2	+2	Advocacy	Hydrofracking
marcellusprotest.org	+1	+1	Information Provision	Gas Drilling
fracracker.org	+1	+1	Information Provision	Energy Impacts
shaleshock.org	+1	+1	Information Provision	Community + Environment

The identification of communicative work across a network of actors provides a view from which to identify patterns and variations in communicative work and in the more particular kinds of argumentative roles and functions organizations take up relative to the practical activity around which the network is organized. The classic argument roles of protagonist and antagonist seem to gloss over the interesting inventions and entrepreneurialism evident in the particular argumentative functions of the specialized communication-information services identified here.

Organizations, when taken as devices for argument, can be seen as innovations for disagreement management and means of entrepreneurialism in managing disagreement in societal deliberations and controversies. Some organizations are argument devices that are novel inventions of a service for disagreement management. For instance, new entities, such as fracfocus.org (attends to hydraulic fracturing chemicals) and fracracker.org (attends to impacts of fracking), are intermediary organizations based on information provision that have emerged at the intersection of various demands, expectations, or opportunities to provide information and data. Each is a service designed and delivered by an alliance dedicated to compiling information about fracking and providing those seeking information methods for retrieving, displaying, and using the data. Aakhus (2010, p. ; Aakhus and Ziek 2008) have described this as an “argument builder service” that “aggregate and interpret evidence that is otherwise hard to collect and organize [that] provide arguments or the grounds for building arguments or for raising doubts and disagreements” (p. 7). These two services do not directly make arguments but their services are enrolled in the making of arguments.

Other organizations are entrepreneurial in the design of the communication-information service for argument. For instance, api.org is the website of the American Petroleum Institute (API) whose mission is to “influence public policy in support of a strong viable U.S. oil and natural gas industry” and speaks on behalf of “the oil and natural gas industry to the public, Congress, and the Executive Branch, state governments, and the media” (<http://api.org>). The api.org website as affiliated with three other websites sponsored by the APA that innovate on advocacy. One site, energytomorrow.org, aims advocacy toward the general understanding of energy and related policy. A second site, energynation.org, aims its advocacy toward the employees, and alumni, of the energy industry. A third site, energyfromshale.org, aims its advocacy toward issues related to gas from shale production. These sites function as “argument generators” that “create arguments to be used by others in deliberating” (Aakhus 2010). What’s entrepreneurial is the tailoring of the service to the particular stakeholders with a unique service for each and their potential role in deliberation about energy and gas from shale.

This study did not consider the particular positions and arguments taken by organizations but identified the direct objects of action to reveal the variety of matters of concern relative to the macro-activity (e.g., direct objects such as energy impacts, gas drilling, clean energy, gas delivery, community, environment, chemicals, regulations). The diversity of objects indicates where disagreements can arise and the opportunities for innovation and entrepreneurship within

the disagreement space for argument products, processes, and procedures for managing disagreements. The pattern and variation of actions performed in communicative work, however, appears to be less diverse. While it is fair to say that Information Provision and Advocacy are significant types of work performed by high connector organizations, it should not be concluded that one organization’s information provision or advocacy is the same as another’s. That communicative work is presumably designed toward a particular direct object of action and for intended recipients with a particular stake in that direct object and with an awareness of the bystanders who might claim a stake in that direct object. Furthermore, these innovations and entrepreneurship point to some division of argumentative labor in shaping disagreement space in the communicative work of organizations.

4.2. Communicative work of networks and collective construction of disagreement space

While it may be more typical to evaluate the role of a particular organization in a societal controversy, argumentative analysis can also consider what happens when many organizations pursue the management of disagreement simultaneously over time. Such insights, as Disagreement Management has shown, have proven valuable in understanding interpersonal and group conflict and it is worth entertaining the possibility that there is some kind of parallel process in the case of organizations engaged around a macro-practice. A macroscopic view can be given that helps make sense of these possibilities by aggregating the action and direct object terms relative to the overall network and its subnetworks. This makes it possible to consider the communicative work of a network in terms of the prominent focal objects in the macro-activity and the prominent actions highlighted by the network.

The overall network appears to be composed of four arenas of activity around the gas from shale production. The frequency of action and direct object terms were mapped to the overall network and to each sub-network. Table 3 summarizes the results by listing the top most frequent verbs and direct objects for each activity arena by term and frequency of its occurrence. Only verbs and direct objects that appeared more than five times are included. The bolded terms indicate the top terms unique to the arena, while the non-bolded are common among two or more sub-networks.

Table 3: Top Lemmatized Verbs and Direct Objects by Activity Arena at T1 and T2

Activity Arena	Top Verbs (Sep12)	Top Verb (Mar13)	Top Objects (Sep12)	Top Objects (Mar13)
Governing	protect 21 provid 16 to be 14 improv 11 mak 11	protect 24 creat 13 provid 12 improv 11 conduct 9	health, millions 6 citizens, awareness, market 5	interests 9 information, resources, fish 7 quality 6 water, health, market, pollution 5

Industrializing	provid 25 to be 16 enhanc 12 represent 12 promot 10	provid 22 enhanc 13 represent 11 to be 11 support 7	service 8 information, gas 7 oil, delivery, system, interest 6	gas 9 information 7 interests 6 oil, system, environment 5
Localizing	protect 24 to be 15 provid 14 do 8 build 7	protect 27 to be 17 provid 16 mak 6 include 6	water 10 environment 10 land 7 work, us, ourselves, communities 6	water 12 land 8 resources, ourselves, communities 6 environment, work, air, us, right 5
Investing	to be 23 protect 15 provid 13 operat 8 produc 7	to be 19 protect 11 provid 8 promot 8 do 7	information, resources, reserves 6 water, oil, act, fish 5	environment 8 health, oil, groups, awareness 5

The prominent terms are about actions (e.g., protect, provide, promote) that focus on communication and objects of action that are more about the consequences of gas from shale production (e.g., water, health, environment). Moreover, the meaning of gas from shale and the issues about it appear significant given the prominence of action objects like “information,” “interests,” “us,” “quality,” and “value.” The communicative work of the network appears to open up disagreement around the macro-activity relative to a range of stakes that might be taken in regard to shale gas production. For instance, the communicative work of the network is directed toward those with particular kinds of stakes in shale to gas development, such as producers and citizens of affected river basins or geographic regions, or those exercising particular types of influence on shale to gas development, such as government based commissions and alliances seeking to develop data and information.

The pattern and variation of unique verbs and direct objects suggest that the network of organizations were organized around four arenas of activity oriented toward key meanings and topics. The “governing” arena is highlighted by actions of *protecting*, *improving*, and *creating* to go along with direct objects of *health*, *citizens*, *markets*, and *awareness*. This suggests stakes in citizens and society with orientation toward the activity of legislating and regulating. The “industrializing” arena is highlighted by actions of *enhancing*, *representing*, and *promoting* along with direct objects of *gas*, *service*, *systems*, *interests*, *delivery*. This suggests activity oriented toward issues about building the industry for gas from shale. The “localizing” arena is highlighted by actions of *doing*, *building*, *making*, and *including* with direct objects of *environment*, *land*, *communities*, *air*, *work*, and *rights*. This suggests activity oriented to the local stakes of communities and regions. The “investing” arena is highlighted by action terms of *operating*, *producing*, and *promoting* relative to direct objects of *resources*, *reserves*, and *groups*. The terms suggest an orientation toward financial issues in gas from shale.

Further traces of the communicative work of the network can be seen in the different shared terms across the subnetworks. In terms of objects of action, across both time frames,

“information” was a top common object for governing and industrializing while “oil” was for industrializing and investing. “Water” was a topic common object between localizing and investing in Sep12 and with governing in Mar13. In terms of actions, across both time frames, “protect” was common among governing, localizing, and investing. All arenas shared “provide” as a common action. The common top terms help reveal where the arenas intersect around actions and objects of action. This suggests the broad shape of the disagreement space around the macro-activity of gas from shale production, which in very general terms is not uniform but lumpy. For instance, some objects like “water”, which is the most frequently mentioned direct object in the overall network, is primarily an object in the localizing network while “oil,” which is much less frequent in the overall network than “water,” is a top common term in both the industrializing and investing arenas. A macroscopic view affords a perspective on the what the communicative work of the network grounds the content and direction of the macro-activity.

5. Discussion and conclusion

The macroscopic view of the macro-activity of producing gas from shale offers some promise for further, more refined inquiry into the communicative work of organizations and its implications for understanding the role of argumentation in deliberation and controversies at large scales. In particular, an empirical way forward for understanding the nature of polylogue and observing the conditions for argument design. The many actors in a polylogue suggests that there is a complex mix of organizations that are principals with differences within a large scale practice while others act as third-parties that support the principal organizations in managing disagreement in some way. Some organizations provide argument-as-a-service for others (e.g., fracfocus, fractracker) while others incorporate argument functions into the organizational form (e.g., API, Energy Tomorrow, Energy Nation, and Energy from Shale). This is facilitated by applications of information and communication technology. Making sense of these innovations and entrepreneurship for argument in interorganizational communication is an important task. Organizations, after all, are significant aspects of society that are fully engaged in developing or shaping argument products, processes, and procedures to engage stakeholders and shape the content and direction of deliberations and controversies.

While it would be possible to follow a classic normative modeling of argumentative dialogues by reconstructing the roles of organizations related to gas from shale in the Marcellus as either protagonist or antagonist (or irrelevant) about some focal issues (i.e., whether fracking should proceed), the findings here suggest that there are variations and nuances in the argumentative roles organizations take up relative to the potential for disagreement in a macro-activity to be explained (e.g., Aakhus and Lewinski in press; Lewinski and Aakhus 2013). The innovation and entrepreneurship evident in the findings above is not random or arbitrary but likely indicative of more general pragmatic principles about how disagreement is organized and how methods of disagreement management emerge within communication relative to a practical activity. Following insights from Disagreement Management as suggested by Aakhus (2013, p. 116), the designs of communication-information services as devices for argument emerge “at the gaps between evidence and claims, what is said and actions performed, and actions performed and activities undertaken.”

The varieties of argumentative roles discernable in the communicative work of organizations are designs for argumentation that offer specialized communication-information services for disagreement management. The variety of argumentative roles can be distinguished

by the ways in which these services are attuned to particular intrinsic demands of argument in communication. Some services are attuned to the maintenance of premise-conclusion relations, such as *fractracker.org* and *fracfocus.org* whose work provides content that assesses or creates premises and reasons for linking premises and conclusions. Other services are attuned to the relation between what is said and actions performed, such as *catskillcitizens.org* and *earthworksaction.org* that specialize in calling out discrepancies between what has been said and done regarding clean energy and the environment. Other services are attuned to the relevance of actions performed in activities undertaken, such as *srbc.org* (Susquehanna River Basin Commission) and *ferc.gov* (Federal Energy Regulatory Commission) which are involved in defining the rules about which argumentative moves in the broader deliberation will count. Thus, when looking at the communicative work of organizations and of networks of organizations, it is also possible to grasp that argument design, especially in regard to the development of devices, like organizations, for managing disagreement, may happen relative to types of issues or practical activities but will be conditioned by the demands of communication on argument. The variety of roles reveals a division of argumentative labor in the management of disagreement that offers insight into the subtleties and nuances of the kinds of argumentative roles observable in polylogues around large scale practices.

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