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Organization in the crowd: peer production in large-scale networked protests

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How is crowd organization produced? How are crowd-enabled networks activated, structured, and maintained in the absence of recognized leaders, common goals, or conventional organization, issue framing, and action coordination? We develop an analytical framework for examining the organizational processes of crowd-enabled connective action such as was found in the Arab Spring, the 15-M in Spain, and Occupy Wall Street. The analysis points to three elemental modes of peer production that operate together to create organization in crowds: the production, curation, and dynamic integration of various types of information content and other resources that become distributed and utilized across the crowd. Whereas other peer-production communities such as open-source software developers or Wikipedia typically evolve more highly structured participation environments, crowds create organization through packaging these elemental peer-production mechanisms to achieve various kinds of work. The workings of these 'production packages' are illustrated with a theory-driven analysis of Twitter data from the 2011–2012 US Occupy movement, using an archive of some 60 million tweets. This analysis shows how the Occupy crowd produced various organizational routines, and how the different production mechanisms were nested in each other to create relatively complex organizational results.

Keywords: connective action; crowd organization; Occupy; peer production; communication as organization

A remarkable protest wave swept the world in the first decade of the twenty-first century, beginning with a popular uprising in Iceland following the financial crisis in 2008, and moving through Tunisia, Egypt, Spain, the United States, and dozens of other countries (Castells, 2012; Gerbaudo, 2012). Although local issues and political contexts differed dramatically, all of the uprisings were characterized by local physical occupations and protest activities in which core participants were linked by digital media to each other and to more peripheral participants and bystander publics. The images, videos, websites, and other media artifacts also provided models for successive protests to appropriate, enabling very different mobilizations to learn and share practices and action repertoires despite differences in time, place, opportunity structures, culture, and issues. In

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addition, news of these events signaled a global integration of different types and systems of media – personal and mass, national and international – as the activation of vast social networks carried iconic videos and other participant content from cell phones and laptops into the mass media. As those images and direct citizen reports circulated within and beyond national borders, they engaged larger publics, both near and far, who, unlike the often passive audiences of mass media, had opportunities to also become participants by using the many affordances that interactive media offer.

Such mobilizations are characterized by what we have termed the logic of connective action in which participants engage with issues largely on individual terms by finding common ground in easy-to-personalize action frames that allow for diverse understandings of common problems to be shared broadly through digital media networks (Bennett & Segerberg, 2013). Among the strengths of connective movements are the speed of mobilizations, the flexibility of mediated crowds to shift among issue foci and action tactics, and the capacity to reach large-scale publics both directly through digital media and indirectly via conventional mass media channels. The outcomes of these mobilizations have often been impressive. The uprisings in Iceland forced new elections, led to the arrest of bankers and corrupt politicians, the nationalization of banks, and the creation of a citizen assembly to write a new constitution. Governments were toppled in Tunisia and Egypt. Popular challenges to the democratic legitimacy of governments arose in Spain and elsewhere in Europe. And a long ignored public discussion of inequality and political influence was initiated by the Occupy Wall Street protests in the United States (Bennett, 2012; Castells, 2012). Beyond these impressive outcomes, the limits of mediated crowds are also evident, as efforts to form parties, and other, more bureaucratic forms of political organization often meet with limited or undesirable results, as indicated by the aftermath of the Egyptian uprisings. Moreover, political transition efforts often encounter resistance from within as conflicts develop among participants who join the action with conflicting understandings, commitments, and goals (Bennett & Segerberg, 2013).

Despite the evident differences from conventional political organization based on more familiar principles of bureaucratic organization and collective action (Bimber, 2003; Bimber, Flanagin, & Stohl, 2012; Bennett & Segerberg, 2012, 2013; Olson, 1965), these dense networks of networks behave as hybrid organizations (Chadwick, 2013) that can produce remarkable levels of coordination. Many connective networks have been able to regulate their ranks to promote particular ideas and frames and to filter out or limit the dominance of others. While bureaucratic organizations still play a decisive role in some networks, established political groups and organizations have been marginalized in others because they were perceived as politically incompatible with the ethos of the crowd. Thus, despite its well-developed organization, the Muslim Brotherhood was not elevated to a position of leadership during the Tahrir Square mobilization in Egypt in 2011 (Kirkpatrick, 2011). Similarly, labor unions in Spain were kept on the periphery of the 15-M (or *indignados*) uprising in 2011 (Ancelovici, 2012; Anduiza, Cristancho, & Sabucedo, 2013). Meanwhile, the Occupy protests in the United States did not take up the overtures of various established political organizations such as Moveon.org (Harkinson, 2012). Examples of other kinds of work that crowds can do include: establishing various participation norms (e.g. non-violence, deliberative decision-making); shaping and shifting issue focus (inequality, corruption, real democracy); and developing action frames and participatory ethos (e.g. 'we are the 99%').

This paper focuses on large-scale networks of public action in which bureaucratic organizations are marginalized. The logic of connective action broadly suggests why organizational properties can occur among individuated populations using media networks to bridge and transcend their face-to-face interactions. Earlier studies show that highly personalized participation can occur within inclusive organizations such as the social forum movement that invite 'flexible political identities' (della Porta, 2005). We also know that personalized and loosely coordinated

action can occur within technology-enabled networks such as consumer campaigns against corporations (Bennett, 2003). However, it is less clear how fine-grained organization develops in large-scale protest in the relative absence of structured or commonly bounded organizations with established norms, targets, demands, and broadly shared values. This paper offers preliminary answers to the question of how crowd organization is produced: how crowd-enabled networks are activated, structured, and maintained in the absence of recognized leaders, common goals, or conventional organization.

The puzzle is how large-scale crowd-enabled networks achieve coherent organization. The key empirical question is: What finer-grained associative mechanisms create and support that organization? We develop an analytical framework for examining basic organizational processes of crowd-enabled connective action, and, by extension, for understanding the role of communication as central to the organization of such networks. We argue for the significance of particular communication technologies and practices that serve as *stitching mechanisms* that connect different networks into coherent organization. We further identify a set of key peer-production mechanisms that, together, accomplish this network stitching, and show how crowd-enabled networks can grapple with the myriad inputs, demands, and events that shape the qualities and the fates of movements. These elements of peer production include: the *production, curation*, and *dynamic integration* of various types of information content and other resources that become distributed and utilized across the crowd. The workings of these mechanisms are illustrated with a theory-driven analysis of Twitter data from the 2011–2012 US Occupy movement, using an archive of some 60 million tweets. The analysis focuses on the large-scale public Occupy network over time (not the organization of a specific action or camp), and shows how the Occupy crowd produced various organizational routines by nesting or packaging different production mechanisms to create relatively complex organizational results. Identifying these peer-production mechanisms illuminates the role of communication as organization in crowd-enabled action and offers a more fine-grained understanding of how large-scale digitally networked protest crowds work.

The puzzle of organization in crowd-enabled action

It is easy to find many particular instances of coordination and organization in large-scale protests. The wave of protests mentioned earlier all involved physical sites of concerted local actions such as encampments, marches, and meetings. Such physical and often ritualized enactments provide the symbolic vocabularies, the dramatic narratives, and the provocations for reactions from authorities and other citizens that sustain action and focus public attention. However, it is challenging to identify the overarching coordinating processes that give the large-scale public media networks around these sporadic dispersed local activities varying measures of coordination, thematic coherence, and public recognition – in short, *coherent organization*.

The search for overarching organization begs a closer look at just what we mean by that term. We begin with a broad definition of organization aimed at bridging bureaucratic and less-conventional post-bureaucratic (Bimber, 2003) variants that require continuous peer production in order to function. There are many distinct forms of non-bureaucratic organization, ranging from networked organization, in which interdependent actors engage in reciprocal relationships in pursuit of common goals (Mueller, 2010; Powell, 1990), to virtual organizations, in which distributed and diverse entities collaborate by electronic means (De Sanctis & Monge, 1999). As we have discussed elsewhere (Agarwal, Bennett, Johnson, & Walker, forthcoming; Bennett & Segerberg, 2013), what these variations on conventional organization have in common with more bureaucratic forms are several fundamental capacities: (a) *Resource mobilization*: the capacity to produce, allocate, and utilize material and symbolic goods that enable recurring patterns of

collective action to occur; (b) *Responsiveness to external conditions*: the capacity to react to near-term threats and opportunities, resulting in asserting different repertoires of action, and assessing their results; (c) *Long-term adaptation, change, or decline*: the capacity to develop new patterns of association internally as the organization grows, suffers resource loss, or receives less recognition by relevant publics. Such basic standards of coherent organization can be applied to a range of networked organization types, from highly bureaucratic coalitions (organizationally brokered) to loose bureaucratic networking (organizationally enabled), to crowd-enabled protests.[1] Some protest networks, of course, do not display these elements, but others do. We have shown elsewhere that crowds can display these qualities (Agarwal et al., forthcoming; Bennett & Segerberg, 2013), but it is less clear how they do it.

A first clue about how such organization works comes from earlier theory and research on peer-production communities. As large-scale crowds organize, we often see in the early stages the cooperative development of websites, the customization of social media platforms and channels, and the creation and sharing of content through these and other means of communication such as phones, SMS, and email. The processes and results of such communication resemble the self-organization of open peer production (Benkler, 2006) and open collaboration (Forte & Lampe, 2013). This is to be expected, as the logic at the heart of connective action, self-motivated sharing, is also the logic at the heart of much peer production (Benkler, 2006; Bennett & Segerberg, 2012, 2013).[2] Classic examples of peer production include information and knowledge commons such as Wikipedia, collaborative software such as Linux, and online news and discussion groups such as the political blog site the Daily Kos. They also include collaborative activist projects such as the network of Independent Media Centers (IMCs) of the global justice movement. Such projects may involve vast numbers of dispersed and differently engaged individuals that come together to create a common good – be it protest or software – around which further collective action will revolve (Bruns, 2008; Calderaro, 2011; Schweik & English, 2007). Despite the open-ended nature of such participation, peer-produced projects involve self-motivated production and self-organization: participants ideally contribute to the project in modular and granular ways and help shape the conditions of the action so that the projects build on self-selection and decentralization rather than coercion and hierarchically assigned tasks (Benkler, 2006, p. 59).

Some critics of mediated protests regard such participation as inherently weak, intermittent, and generally lacking in the leadership, commitment, and organization required to create effective movements (e.g. Gladwell, 2010). It is true that many attempts at scaling up protests fail, much as most production communities end up with few participants, most videos never go viral, and most blogs are seldom read. This said, successful peer production also often involves highly uneven levels of participation, experience an ebb and flow of participants, and rely on relatively small ratio of core participants even as smaller input from the broader crowd plays also plays a role (González-Bailón, 2013; Hill & Monroy-Hernández, 2013). The unfortunate critical equation of weak involvement with 'clicktivism' overshadows the point that large-scale and sustained (if uneven) involvement is achieved in some crowd-enabled networks. Our larger aim is to understand how this works.

Impressive headway has been made in understanding how mechanisms built into platforms and developed by participants help them navigate the many challenges of concerted action in conventional peer-production contexts. For example, filtering, recommendation, and reputation systems enable crowds to discern valuable or disruptive contributions (de Alfaro, Kulshreshtha, Pye, & Adler, 2011; Kriplean, Beschastnikh, & McDonald, 2008; Lampe, Johnston, & Resnick, 2007; Lampe & Resnick, 2004). Harmonizing horizontal participation with stratified access and roles helps intentional communities clarify goals, solve disputes, and encourage quality contribution (Crowston, Wei, Howison, & Wiggins, 2012; Hill, Shaw, & Benkler, n.d.; Kittur &

Kraut, 2008; Luther, Fiesler, & Bruckman, 2013; Reagle, 2007; Weber, 2004; Welser et al., 2011; Zhu, Kraut, & Kittur, 2012). It also matters how community policies and norms are developed and upheld, and how they are coded into platforms (Butler, Joyce, & Pike, 2008; Forte, Larco, & Bruckman, 2009; Shaw, 2012).

Yet such mechanisms for self-organization have been studied mainly in production communities working under structuring conditions that are generally absent in large-scale crowd protests. Many of the commonly studied peer-production environments display some combination of common goals or outputs, bounded arenas of action, participant identification or reputation systems, moderation routines, software code or platforms that structure participation, clearly defined goals, and mechanisms beyond face-to-face processes for rewarding or discouraging particular kinds of contributions. Such features in turn echo the classic design principles that support self-governance in physical communities seeking to manage common pool resources, which include identifying a clearly bounded good and a bounded set of participants (Ostrom, 1990). Fred Turner observes that online commons-based peer-production communities, like their physical counterparts, depend on a specific 'structural and ideological scaffolding':

> Structurally, such work requires a commons, a shared space that in most internet-driven accounts consists of digital messages, but which could be located as easily in some single geographical space. In these arenas, members of diverse social worlds can gather and collaborate toward some end. The commons in turn affords them visibility. Being able to be seen by one another makes it possible for workers to find one another, select projects, and build and maintain reputations. (Turner, 2009, p. 76)

These principles apply to diverse production communities, including Wikipedia, collaborative news collectives, open-source software developers, some technology businesses such as Google, the IMCs of the global justice movement, and even the annual Burning Man festival.

Structuring conditions may of course vary. Different communities emphasize some conditions over others, achieve them with better results, or substitute digital processes for physical locations and routines. For example, digital contexts that support stable user identities produce some of the effects of bounded participation without requiring formal 'membership', by enabling the reputation, recommendation, or stratified access systems that facilitate the peer organization of contributions. Further, in systems in which it is easy to change identities, core participants concerned with boundary work may concentrate their critical attention on those who remain anonymous or do not have a history (Crowston et al., 2012; De Alfaro et al., 2011; Forte et al., 2009). Similarly, gathering around a functional or clear common goal or self-awareness as an intentional community helps bring additional direction and focus to an arena or a project within it (Crowston et al., 2012; Haythornthwaite, 2009; Hill & Monroy-Hernández, 2013; Kittur, Pendleton, & Kraut, 2009). Highly stable crowd organizations such as Wikipedia may display organizational elements such as policies, rules, registered contributors, clear mission, stratified leadership, and a bureaucracy of sorts.[3] In short, peer-production projects may also change dramatically over time from their initial conception into more stable forms (Butler et al., 2008).

Such structuring conditions are less clearly present in the kind of large-scale public protest networks we focus on here. The face-to-face assemblies of the Occupy movement, which were critical to its core identity, did partly function as structuring arenas. However, there were also many of them, they were not bureaucratically coordinated, and they surely did not all share the same local concerns. Perhaps most importantly, the activists at the center of these dispersed physical arenas were a minority of total participants in the larger crowd. Both in numbers and impact, the whole crowd was larger than the sum of its parts, which magnified the movement's voice, impact, and palpable sense of public presence. This does not mean that peer production cannot

occur in chaotic crowded contexts. However, without such contextual structuring, it is less clear how crowd production can manage more or less coherent organization. And yet it can.

The puzzle of organization in crowd-enabled action, then, is how large-scale protest networks achieve coherent organization in the absence of clear, codified structuring conditions that characterize the most commonly studied peer projects. We suggest one part of the answer lies in identifying the micro-sequences of different peer-production routines that constitute the organizing 'communication packages' in crowd-enabled networks. Through the resulting networks of crosscutting relations, distributed resources, and action plans, the broader crowd produces the discursive and technological routines that animate connective action – along with the noise that often disrupts and destroys it. We now turn to locating and identifying the finer-grained mechanisms involved in the production of coherent organization in the crowd. The analytical framework proceeds in two steps: (a) deciding where to look for higher-level organization in crowd-enabled networks and then (b) identifying the key peer-production mechanisms that produce order in the crowd.

Stitching mechanisms in crowd-enabled networks

Given their diffuse, densely layered, and dynamic character, crowds offer many arenas and technologies to study. However, not all of these myriad elements of crowds help understand the overarching organization. For example, some technologies may connect hyper-local networks (e.g. the email list for local assembly members), while others may serve as news and discussion sites at various levels of the crowd (e.g. Facebook pages for city protests). Our first aim is to identify the mechanisms for stitching such different networks together, and to understand how these network-management technologies work under different conditions.

Crowd-enabled protest networks often involve networks of many kinds and layers. A movement such as Occupy encompassed many kinds of actors, including Adbusters, participants in local camps and protests, Anonymous, supporters, and opponents who shared information and other resources mainly online, and broader publics who followed the protests as they emerged in daily life or in the media. It is also clear that many important elements that may be crucial to understanding the development of the networks are never digitally recorded or archived for public consumption. For example, many crucial elements of face-to-face assemblies have been lost despite being important at particular moments in time. However, our focus is on the ways in which crowds 'go public' through the digital production, sharing, preservation, and strategic routing of different types of resources. The aim here is to explain how crowds rise above local and face-to-face action to achieve large-scale, patterned organization. The diverse and dispersed layers in a crowd-enabled movement form a dynamic network of networks in which linking and switching activity directs the flow of information, frames, and other resources throughout the movement (Castells, 2009).

Figure 1 models the digital communication in a complex and multi-layered crowd-enabled network (Bennett & Segerberg, 2013). The three views of the same simple model show distinct networks (such as campaign and action sites, Facebook groups, Livestream, or YouTube channels) connecting via the dynamic networks that thread the layers together through stitching technologies (such as Twitter or SMS trees). This does not imply that everyone uses any particular platform or medium, but that linkages among different ones become crucial in the large-scale network for engaging participants and coordinating their relationships more broadly. Indeed, as Figure 1 suggests, the layers of networks may involve separate micro-networks that only partially overlap. These often disjointed networks of networks highlight the importance of the multiple points of connection via crosscutting agents and technologies that cut beyond reciprocal ties to traverse the different network levels, and circulate content and other resources through them.

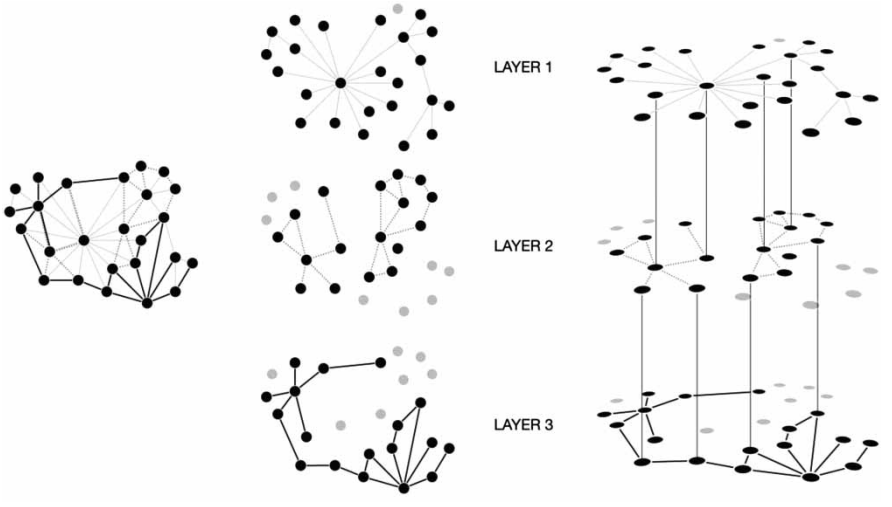

Figure 1. Layered crowd networks connected by stitching technologies. Used with permission of Martin Krzywinski, University of British Columbia Cancer Research Center (www.hiveplot.com).

Similar to the idea that content that fails to spread is dead (Jenkins, Ford, & Green, 2013), the large-scale crowd will disintegrate if there is no connection between and circulation across its networks. This in turn suggests that stitching technologies (and the ways in which they are used) constitute important points of focus for understanding the role of communication as organization in the crowd-enabled network. The stitching technology is itself a key organizing mechanism in this context.

Network stitching technologies – and the roles of particular platforms such as Twitter – may vary from one situation to another and change over time as old technologies decay and new ones emerge. For example, IMCs and other activist media hubs played a kind of stitching role in the global justice movement in ways that were partially echoed in various media work groups and bridging resource sites in Occupy (Juris, 2005; Lievrouw, 2011). Our first task was to identify key stitching or integrating mechanisms in Occupy. At first glance this may seem a dizzying task, as the protests involved numerous digital media platforms with millions of users interconnecting and feeding information in and out of dispersed physical communities over a period of many months. Multiple groups and networks surrounded the physical camps, as well as commercial platforms (such as Facebook, Twitter, Livestream, and YouTube) and custom technologies (such as city websites, phone conference schedulers, or apps providing assistance in case of arrest). Some of these networks involved quite distinct networks or sub-crowds. Yet analyses slicing this digital traffic in different ways all revealed Twitter to be structurally central to the workings of this network of networks. Network crawls by the authors and members of the Social Media Lab at the University of Washington using different starting points and methods of analysis all revealed Twitter to be the most linked to node (see also Hemsley, 2011).[4] Various methods of mapping Occupy networks show Twitter to provide the dynamic network stitching mechanisms represented by the threads connecting different network layers on the right side of Figure 1.

Twitter is certainly not the only conceivable stitching mechanism in a crowd-enabled network, and there is likely to be more than one stitching mechanism in play in any given case. Moreover, it is important to note that Twitter can have quite different roles in other kinds of protest networks, such as those that are more tightly managed by conventional organizations (Bennett & Segerberg,

2013). This said, the technology's public, fine-grained routing, and quasi-broadcast qualities may make it particularly well suited to thread together the network of other networks that characterize crowds. Thus, in the case of Occupy, Twitter is central not simply because the data are 'there', or because Twitter data grant insight into all parts of the movement (which they do not), but because of their importance for dynamically connecting or stitching the multiple sub-networks into a large-scale movement. The next step for our purposes is to examine the micro-organizing processes that accomplish this stitching.

Processes of peer organization in the crowd

Understanding how large-scale crowd-enabled networks achieve coherent organization requires considering the organizing processes at work within the stitching mechanism(s). We propose a set of elemental processes that explain how stitching technologies such as Twitter can lend organization to the broader crowd. The mechanisms we propose are analytically distinct and may occur in nested sequences to build more complex organization. The set is basic, but not exhaustive. It consists in three basic categories of peer-production mechanisms:

- *Production*: This category of mechanisms involves creating and publicizing (sharing) various kinds of resources within an action network. Basic production involves content created or distributed through one platform and shared across its network of users (be it Twitter, Facebook, Livestream, news sites, or blogs).
- *Curation*: This family of mechanisms entails the preservation, maintenance, and sorting of digital assets created in the production process. Empirical measures of curation may focus on the negotiation and selection of content to be preserved; the affordances for accessing and sharing that content; archival distribution across sites that share a common resource pool such as music files or activist software development. Curation can thereby also entail the creation of norms and boundaries in particular user communities and their platforms.
- *Dynamic integration*: This category of mechanisms enables contact, transmission, and switching among different actors, networks, platforms, and technologies. This mechanism is evident in switching and linking affordances such as patterns of links found over time in directed hashtags in tweets and in hashtag co-occurrence.

The first two mechanisms are familiar from the work on peer production discussed earlier: crowd-enabled networks share the challenges of ensuring the contribution and processing of content, and participants employ some of the same mechanisms to negotiate these challenges. While other familiar processes such as moderating and editing (important in projects focused on deliberation or the definitive development of content) seem less important in this stitching context, the third mechanism may be more particular to the needs of a multi-centered movement: the crowd-enabled network depends fundamentally on mechanisms that dynamically connect different parts of the crowd and circulate contributions across the different layers.

We distinguish the three processes analytically, but in practice they may nest into more complex operations. For example, a tweet is a unit of production that may be broken down into several sub-elements such as message content, links, retweets, hashtags, mentions, and other aspects of syntax which enable users to combine production with curation and dynamic integration. The logic of nesting in our framework is hierarchical. We can empirically demonstrate that production may occur without higher-level operations such as curation. By contrast, curation always implies production (as when messages are archived) and dynamic integration implies both production and curation (as when particular hashtags or numbers of hashtags are attached to

tweets containing particular types of links). The important issue theoretically is how different production mechanisms occur (or do not occur) at critical junctures in the history of a crowd. For example, when the volume of crowd activity tails off, indicating that protests may be dying out, how do actors respond? Does the pattern of production (who produces what) change? Do patterns of curation (who retweets or follows whom) change? Do strategies for dynamic (re)integration change (how many of what hashtags are attached to particular patterns of production and curation)? In this analysis we track separable nested elements of these production processes. There are clearly mechanisms that blur these conceptual boundaries, as might be expected when actors see ways of performing more complex operations in fewer moves. For example, 'favoriting' a message on Twitter is used both to endorse and to bookmark. It archives the message, publicly signals that it is worth attention, connects two account holders (the source account is alerted), and is a message-specific public display of connection (Donath & boyd, 2004), since the message shows the number of times and by whom it has been favorited. While observing such operations may be useful for some analyses, we begin with more elemental units and their sequences.

Further, although the three elements of the peer-production package are integral to the organization of crowd-enabled networks, what is important is whether the crowd as a whole produces the package, not that all participants produce all parts. As in other peer-produced projects, participants in large-scale protest networks do not necessarily engage the different mechanisms equally, and many may contribute in seemingly insignificant ways. They also contribute for varying reasons and undertake different roles, with some preferring more (or less) vigorous roles and some shifting in their activity over time (Crowston et al., 2012; Fang & Neufeld, 2009; González-Bailón, Borge-Holthoefer, & Moreno, 2013; Hill et al., n.d.; Welser et al., 2011; Wilkinson, 2008). Even if participants do not always contribute to the larger cause wittingly, the broader crowd may identify particular contributions as valuable and therefore work to highlight some contributions and contributors more than others. Stable patterns of production and utilization emerge as people or sub-networks take particular actions, share responses to external events, or seek to transform the network's organizational form. It is the capacity of the broader crowd to produce the package of organizing processes at critical junctures that accounts for the organizational capacities of the larger network.

The following sections illustrate how the organizational mechanisms work in the crowd-enabled network of US Occupy 2011–2012. As should be clear, focusing on the production package highlights the action going into the organizing structure rather than the structural properties of the network per se. This analysis therefore complements but would also be enriched by closer analysis of diffusion mechanisms (Vasi & Suh, 2013) and other elements developed within social network analysis (Diani, 2011; Pavan, 2012). In what follows, however, we discuss each category of mechanism in turn. In each case we concentrate on the digital mechanism that most cleanly captures the gist of that category (respectively the link, the retweet, the multiple hashtag), but also successively trace how the categories (and their most associated mechanisms) nest in each other. The final empirical section spotlights how different parts of the crowd contribute to the whole.

Crowd-organizing mechanisms in action

The following study builds on an earlier project involving two of the authors that established that the Twitter networks in the Occupy movement in the United States displayed the general markers of organizational coherence outlined above (i.e. resource mobilization, responsiveness to external conditions, and long-term adaptation or change). That study identified empirical indicators of these organizational patterns in the Occupy-related Twitter traffic over time (see Agarwal

et al., forthcoming). This section reviews the Twitter database developed in the earlier study, which we here re-analyze to examine how such coherence was achieved.

As already noted, numerous analyses using different network crawl starting points and methods showed unambiguously that Twitter was the overarching stitching mechanism of the Occupy movement. The Social Media Lab gathered a nearly complete set of Occupy Twitter data from mid-October, 2011, when a national network of occupations had been established and protest activity was at its peak, through the summer of 2012, when the national protests tailed off into scattered local actions.[5] (In addition to the data collection methods sketched below, the reader may wish to consult a more complete review of methods in a Social Media Lab working paper by Eckert, Walker, Hemsley, Nahone, & Mason, 2013). The peak data captured from 19 October 2011 to 31 December 2011 contained roughly 20 million Tweets (20,645,921). The archive collected tweets using Twitter's Streaming API track method, which returns tweets matching any of the search keywords occurring in the text, hashtags, @mentions, or URLs within a tweet. A curated list of 109 popular hashtags, keywords, and Occupy city accounts related to the Occupy movement was created by a panel of faculty and graduate students. The data stream was examined at regular intervals for emerging hashtags and keywords as the panel of experts tracked events related to Occupy and followed the burgeoning lists of hashtags (e.g. #occupywallstreet, #ows, #occupyoakland, and growing numbers of cities), places such as Zuccotti Park, key concepts such as '99%', political actions such as 'Occupy the ports', and 'Occupy Obama', and events such as 'pepper spraying cop'. The terms were added to the keyword list after review by the research team, resulting in a dynamic archive based on a list of 355 keywords as the collection continued through the summer of 2012, by which time the database included more than 200 million tweets.[6] A new data file was created each day and the file from the previous day was backed-up and processed. Processing included expanding shortened URLs, adding metadata to each tweet in order to make searching and sampling easier, and inserting it into a NoSQL database for storage and querying.[7]

The earlier study then coded links in tweets from the archive as proxies for various kinds of resources being produced and shared in Occupy networks. Random samples were drawn from three Occupy hashtags.[8] Two were keyed to local city protests (#occupyoakland and #occupyseattle), and samples were coded for their link content during the period of greatest protest activity from mid-October through the end of December 2011. The third hashtag, #ows, was the one that was most actively used over the course of the protests following its early emergence as a simpler version of #occupywallstreet. The hashtag #ows provided a common channel for actors at all levels – the stitching within the stitching mechanism – as well as serving as a feed for events specifically surrounding the New York City encampment in Zuccotti Park.[9] This tag remained active even after the camps were evicted and the protesters scattered in the early months of 2012.

The study coded the content of links in the three hashtag streams, and coded #ows over a longer period (October 2011 through March 2012) in order to capture behavior in the tail. A total of 30,675 links in tweets were coded for the three hashtags, and particular links and link types were tagged and tracked back into the entire data archive to examine broader flow patterns. For the present purposes, since the links represent different kinds of resources produced by the crowd, identifying the production, curation, and integrative engagement with various kinds of link resources offers a direct look at crowd-production processes. Analyzing these processes in three different hashtags enables comparison of different layers in the crowd and their reactions to events, and the possibility to monitor change over time. This analysis is supported and contextualized by ethnographic study of different Occupy networks conducted by other teams from the larger project.

Linking in the dataset was impressively diverse. Links included conventional news sites; political organizations; Occupy organizations; specialty and hybrid sites such as Kickstarter or Boing Boing; personal blogs and photo pages; and links to assistance with food, shelter, medical care, financial help, and legal services. The links were hand coded to distinguish the following categories:[10] (A) conventional news reports; (B) political commentary and activist media; (C) specialty sites beyond daily news and politics (e.g. Boing Boing, Tumblr pages, best of the web features, business reviews, Kickstarter fundraising initiatives.); (D) conventional government-linked organizations, such as parties, government institutions, and websites of officials; (E) issue-oriented, ideological, activist, and NGO organizations not specifically identified as Occupy groups; (F) clearly identified Occupy websites, campaigns, events, or organizations; (G) individuals' personal sites and postings; (H) music or individual celebrity websites; (I) other (including non-English-language sites), and (J) broken links. The coding also included sub-categories for E and F to capture whether the link pointed to sites based on branded commercial or more customized platforms: (E1) NGO and activist organizations not identified as Occupy and built on commercial media sites such as Facebook or YouTube, (E2) custom-built activist platforms and sites; (F1) Occupy sites based on commercial media platforms and (F2) custom-built Occupy sites.

Analyzing the broader patterns in the three hashtags, Agarwal et al. (forthcoming) found coherent organization in the form of resource allocation, responsiveness to external conditions, and long-term adaptation over time. In the analysis going forward, we focus on the finer-grained processes involved in achieving such coherence. At the time of Occupy, Twitter users could post messages of up to 140 characters, but could also insert shortened URL links into the messages. Account holders could remain anonymous behind pseudonyms, but whether anonymous or named, the account profiles and production patterns remained consistent over time. Users could retweet (resend) or mark as favorite messages to which they wanted to call attention, and could address other accounts publically by using the @mention function. The community-engendered convention of adding a hashtag (e.g. #keyword) to collate messages on a topic and make them publically searchable was widely used. While tweeting with a hashtag was a public, network-creating move, messages only appeared in public searches for a brief period of time (Bruns & Burgess, 2011; Murthy, 2013). Such specifications play into the organizing mechanisms and patterns that users develop within the streams to deal with such issues as the enforced brevity of the messages, anonymous contributors, and the ephemerality of a hashtag stream.

Production

The first category of mechanisms concerns the production and provision of content and resources. Forms of production may vary greatly. Resource provision in crowd-enabled protest networks requires contribution, but it does not require the contribution to be particularly original, created expressly for this purpose, or even offered knowingly with a larger crowd in mind. It can nevertheless provide raw material for organizing around different kinds of resources, including useful information, symbolic themes and identity frames, and resources for taking and coordinating action either immediately or in the future.

In Twitter, the main ways to introduce content resources into a network are the message text itself and links to content on other platforms (which also invokes curation). Our analysis of linking in the Occupy dataset indicates the variety of resources circulating at different levels of the larger movement. Figure 2 presents the resource linking distribution in the most-used hashtag, #ows, and the two local hashtags #occupyseattle and #occupyoakland during the peak period of protest activity in 2011. As the pie charts show, the #ows tweets linked fairly evenly to news (link coding category A) and to personal content (G) such as blogs, YouTube videos,

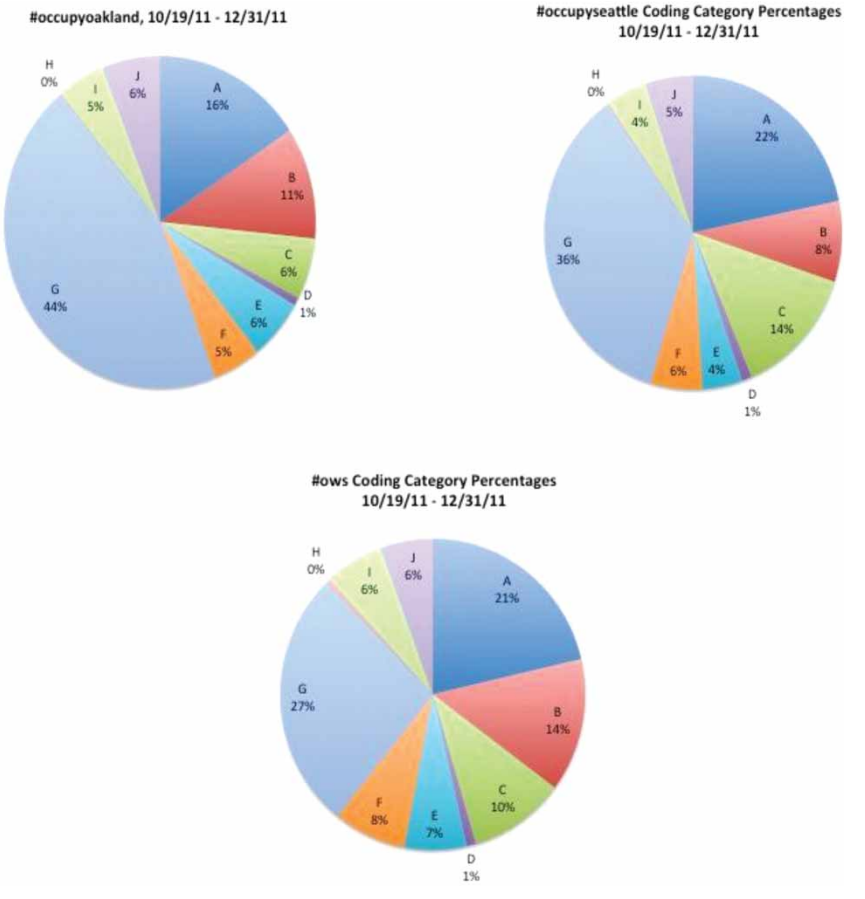

Figure 2. The proportions of each link resource category in each hashtag from 19 October 2011 through 31 December 2011. A = news; B = commentary/opinion; C = specialty sites; D = government; E = general political organization; F = Occupy site; G = personal content; H = music/celebrity; I = other; J = broken link. Source: Agarwal et al. (forthcoming).

and Flickr pages (27%). By contrast, contributors to the two local hashtags linked disproportionately to personal content (36% for Seattle and 44% for Oakland), reflecting the prominence of networks of interpersonal connections and on-the-ground organizational resources in the more local settings.

These overall patterns result from complex divisions of production within each stream. The coded sample of non-retweeted tweets in the #ows stream revealed that 90% of contributors consistently linked to one type of resource only. As Figure 3 shows, the single-link producers linked disproportionately to news sites (A) or to personal site postings (G). The colored edges that connect different link-type clusters reveal that roughly 10% of user accounts in the coding sample produced more than one resource type. Figure 4 shows how this multiple resource production was spread more evenly across a variety of resource categories. Mapping the coded links back into the larger dataset enabled us to track a more dynamic and complete picture of resource production, picking up members of the crowd who also retweeted each coded link type or who produced the same links independently of each other. Adding up the volume of actors who produced more than one type of resource via non-retweeted links, retweeted links,

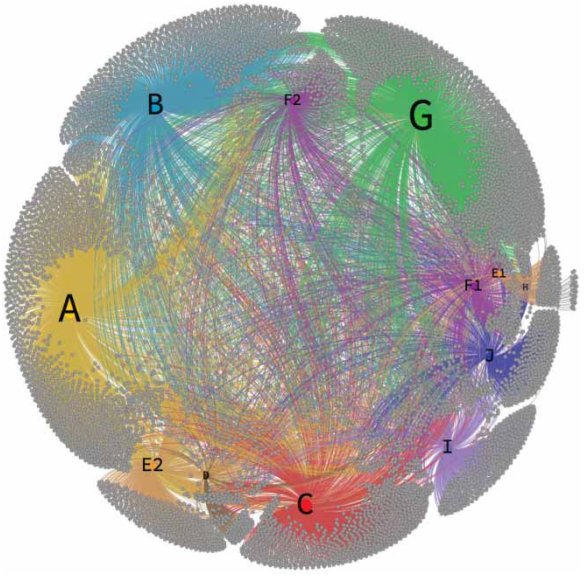

Figure 3. Individual tweets containing different resource links. Nodes represent user accounts linking to particular kinds of resources. Edges connecting different link categories represent users producing multiple kinds of link resources. Data come from the #ows link coding samples of 22,407 tweets with links drawn randomly every other day from 19 October 2011 to 30 April 2012. A = news; B = commentary/opinion; C = specialty sites; D = government; E = general political organization; F = Occupy site; G = personal content; H = music/celebrity; I = other; J = broken link.

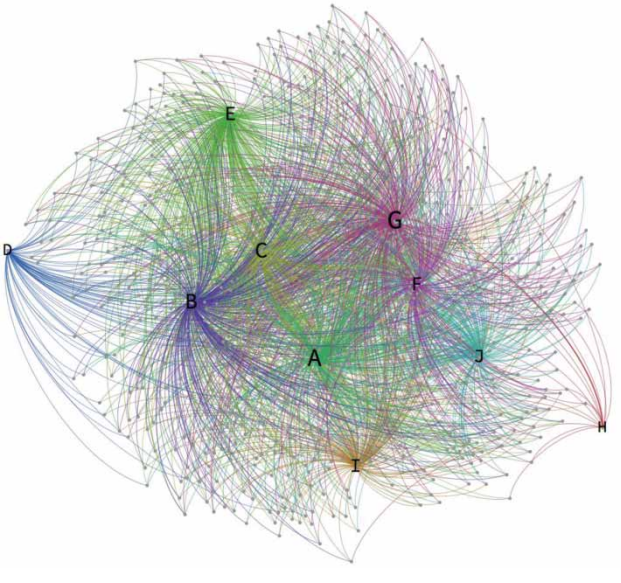

Figure 4. User accounts producing more than one link type in the #ows coding sample, representing about 10% of the sample of coded accounts shown in Figure 3. (This figure becomes 27.7% when the coded links are mapped back into the whole dataset, picking up retweets and multiple independent linking to the same resource site.) A = news; B = commentary/opinion; C = specialty sites; D = government; E = general political organization; F = Occupy site; G = personal content; H = music/celebrity; I = other; J = broken link.

and independent production of the same links showed that fully 27.7% of users in the dataset for the 2011 peak phase of the protests sent multiple link types. The curation and dynamic integration processes involving these multiple-resource producers will become important later in our analysis. For now, the production pattern shows that the dominant numbers of news links and personal site postings in #ows came from a large number of 'specialist' resource contributors, whereas a smaller but still impressive number of multiple-resource contributors ensured a diverse flow of link types. Both specialists and generalist producers are in this sense important in the stream.

Figures 2–4 thus suggest interesting divisions of labor in the production of resources. Not only are different layers of the crowd characterized by production of different resource types (Figure 2), but within a given network, some users produce fairly specialized types of resources (e.g. their own blogs or YouTube videos) while others generate more diverse content, as shown in Figures 3 and 4. Moreover, these production dynamics shift over time, both in response to specific events and as the crowd tails off. For example, during police raids the general production of links declined in all three hashtags, as people used Twitter more for direct communication about what to do in the crisis. Within such critical episodes of crisis or confrontation, the types of links that were produced also shifted. Confrontational events were often accompanied by spikes in news links to share impressions of how news media and public officials were engaging with events. As the camp-centered movement tailed off, production again changed: links to news (A) and personal postings (G) that dominated the #ows in 2011 (Figure 2) gradually receded, and the proportion of total links to Occupy (F) sites rose to constitute some 21% of total links by April 2012. This suggests that resource production shifted in efforts to point activists to Occupy sites where regrouping and reorganization might take place. A critical question about these large and shifting resource-production patterns is whether the crowd can make sense of the flood of resources coming in, and keep track of them for future use. This is where curation comes in.

Curation

Our second category of peer-production mechanisms involves the preservation and maintenance of digital assets. Faced with the noise created by millions of producers, the crowd must sort, distribute, and draw timely attention to resources and sources. It is not so much viral spread that is significant from this perspective, but rather the on-going work to process what is of interest, and to distinguish it from less valuable or counterproductive contributions (including rumors and spam). Users monitor, filter, preserve, amplify, and endorse relevant, useful and desirable content in various networked curation processes (Barzilai-Nahon, 2008; Jenkins, Clinton, Purushotma, Robison, & Weigel, 2006; Lampe & Resnick, 2004; Meraz & Papacharissi, 2013; Shaw, 2012). As we discuss in later sections, complex forms involve cross-platform curation and promoting the contribution of specific participants.

Platforms such as Twitter are associated with relatively intense curation practices: contexts in which posts are only visible temporarily put pressure on users to preserve and highlight potentially important contributions before they disappear (Bernstein et al., 2011). We here focus on the most basic form of preserving and amplifying content on Twitter, which is to retweet, or forward, a message so that it is seen by one's followers or by those following the hashtags that may be attached to the message. Retweeting draws attention to a message (and its resource link), while suggesting possible endorsement,[11] adding longevity, and circulating it beyond the original network for which it was posted (boyd, Golder, & Lotan, 2010; Starbird & Palen, 2012). Other forms of Twitter curation include following, @mention, and favoriting.

As we discuss further below, there was a fair amount of noise in the Occupy Twitter traffic in the form of malignant spam and commercial promotion. However, various curation processes in the crowd such as selective retweeting and following helped dampen this noise.

Indeed, the retweeting activity of the overall crowd was impressive. We matched the coded link sample of 13,424 codes in #ows for the period October–December 2011 with tweets in the entire dataset for the key link types A (news), B (commentary), C (specialty), F1 (commercial Occupy site), F2 (custom-built Occupy site), and G (personal site). This procedure identified 228,254 tweets with the same URLs, and 109,048 of them were retweets. This suggests a robust production flow (the same links being tweeted or retweeted by different accounts), resulting in broad crowd curation of the resources regarded as interesting or important to share. Occupy activists have reported retweeting deliberately to 'boost signals' and spread resources to people within but also beyond the movement (Penney & Dadas, 2013, p. 9). Emerging studies indicate the discernment with which this was done. Thorson et al. (2013) show that while almost half of the YouTube material that was linked in Occupy-related tweets was retweeted at least once, videos tagged with Occupy but actually promoting something else were not retweeted at all. As can be seen in Table 1, roughly half of the activity in the streams #ows and #occupyoakland consisted in retweeting, with some interesting differences between the streams as circumstances change.

Our earlier studies of Twitter as a stitching mechanism in crowd-enabled protest networks indicate that periods of relative normalcy favor the production and retweeting of links to mobilize resources across networks. The volume of links (especially to particular types of resources such as links to potentially stabilizing political organizations) also increases dramatically as the crowd tails off (Bennett & Segerberg, 2013). Times of crisis or confrontation, by contrast, typically involve less linking and higher volumes of retweets (also with fewer links), suggesting more real-time communication about the actions and needs of protesters. This pattern was also echoed in the #ows stream as the crowd shifted to respond to external crises. Table 1 shows the rise in retweets corresponding with a drop in tweets with links in the #ows stream from 15 to 18 November 2011, three days that saw police raids and camp evictions in New York City, which was both a local and national crisis for the movement. The period stretching to the end of the year marked a return to relative calm for #ows as indicated in the increase in both tweets and retweets with resource links. By contrast, Oakland was among the most active local protest sites, with numerous, nearly continuous confrontational activities such as camp evictions, strikes, port closures, and other clashes with police and city authorities scattered across the entire period of time shown in Table 1. Displaying something of a permanent crisis pattern,

Table 1. Tweets with links and retweets with and without links in hashtags #ows and #occupyoakland during peak activity periods in 2011.

	Tweets			Retweets			
Date	Total	With URLs		Total	% of all tweets	With URLs	
#ows							
19 Oct. – 14 Nov.	1,504,643	816,276	54%	669,897	44%	351,443	52%
15 Nov. – 18 Nov.	792,623	312,676	39%	428,671	54%	161,389	38%
19 Nov. – 31 Dec.	1,496,575	849,264	57%	643,762	43%	343,555	53%
Total tweets	3,793,841	1,978,216		1,742,330		856,387	
#occupyoakland							
19 Oct. – 14 Nov.	345,381	149,343	43%	202,800	59%	81,126	40%
15 Nov. – 18 Nov.	21,025	9,193	44%	11,192	53%	4,446	40%
19 Nov. – 31 Dec.	85,099	39,464	46%	45,536	53%	18,999	42%
Total tweets	451,505	198,000		259,528		104,571	

Source: Adapted from Agarwal et al. (forthcoming).

#occupyoakland contained more direct communication with fewer links and higher levels of retweets across the entire period. Tightly managed local camps with a focus on staging protest events may in general be expected to generate more direct personal communication focused on messaging and curation of important messages via retweeting rather than focusing on less action-oriented resource linking.

The different production and curation patterns in the two streams illustrate how different networks within a larger movement may develop their own production cultures and direct participant focus on different events. This is not surprising: as noted earlier, highly adaptive and flexible technologies such as Twitter may fulfill different functions in the different contexts. Our data further suggest that the #ows stream was both a local and national stitching mechanism, making it all the more interesting from an overarching organizational perspective. While curation helps explain how particular actors in the crowd keep resources in play, other mechanisms are involved in helping people channel those resources as the crowd itself changes in composition. The final category in the production package thus concerns the work to selectively integrate networks and resources over time.

Dynamic integration

Where the first two organizing processes involve the provision and ordering of resources in crowd-enabled networks, the third category of mechanisms concerns the work to integrate different parts of the crowd in response to events and states of organizational growth or decline. Since large-scale protests involve networks of networks, a continuing challenge is to connect the networks in meaningful ways. Fuller integration would likely involve a transition to a different organizational form. The crowd-enabled network depends more on partial integration and circulation, which in turn depends on the capacity of participants to create and recreate multiple connections between different network parts. This may include decisive brokerage or 'switching' connections between two significant networks (Castells, 2009), but must also involve multiple mundane connections that stitch the different networks in the crowd together. The capacity to connect networks is crucial for coherent organization in large-scale crowds.

One basic means of network integration involves circulating content across platforms (Baym & Shah, 2011). Elemental ways of achieving such cross-platform integration in Twitter is by linking to particular platforms and retweeting those links. What distinguishes this integration operation from basic production and curation is the type of platforms involved in the cross-linking. For example, tweeting and retweeting links to Occupy web sites, Livestream channels, or city Facebook groups better accomplish cross-platform organizational integration than retweeting a news story in *The New York Times* or *The Guardian,* or simply linking to an individual's blog or YouTube channel. We illustrate differences in these link patterns below. These kinds of nested and directed flows show how actors can use simple combinations of communication moves to create important shifts in crowd attention and engagement.

Cross-platform linkages become important for connecting layers or levels of crowds. Many local Occupy networks faced distinct challenges (cf. the discussion of Oakland earlier) and focused on different concerns (Jensen & Bang, 2013; Thorson et al., 2013). By archiving and linking videos and local sites to broadly used platforms such as Livestream or national campaign sites, activists in one sector of the crowd directed broader attention to critical local events such as camp evictions or successful actions that actors in other sectors might emulate. These cross-platform linkages provided more chances for local networks and broader publics to engage with each other. For example, the proliferation of cross-platform links to the trove of personal stories on the original 'we are the 99%' Tumblr blog surely aided the popular adoption of that idea as the master frame for the Occupy protests (Gaby & Caren, 2012). The empirical burden of deciding when

cross-platform linking becomes integrative depends on determining which platforms enable high-volume interaction enabling coordination, commitment, or planning among participants in the crowd.

A more clearly distinguished form of dynamic integration involves Twitter users forging together whole network streams. The most direct way of doing this in Twitter is to insert one or more hashtags into a message to send it simultaneously into different sectors of the crowd and make them aware of each other. As noted, a hashtag makes a message searchable under that #keyword and allows people interested in a topic to gather all messages related to this. Adding multiple hashtags utilizes the stitching potential of a platform such as Twitter to the fullest by momentarily assembling complex networks that may be attentive to different streams. Mark Tremayne notes that some users seem to specialize in such action, and offers an excellent example of when a single instance of brokerage was decisive for the development of an early Occupy-related network, namely when a retired high-school teacher tweeted '#fuckyouwashington & #operationwallstreet' in July 2011 (Tremayne, 2013, p. 10). A large-scale network relies on the calibration and dynamic effected in multiple such instances.

Our Occupy dataset, which was compiled from multiple request terms (not just hashtags), reflected diligent hashtag use throughout the entire period. What is noteworthy is that overall integration strategies of appending multiple hashtags shifted in phase with events. This becomes clear if we examine the trend for messages containing particular link types (suggesting different message types) over time. For example, in #ows multiple hashtag use remained fairly constant amongst those linking to personal sites (coded as G), but, as the protests tailed off, the number of hashtags increased in tweets linking to Occupy sites, particularly to custom-built sites (coded F2) that tended to be more central nodes in most national level networks. Participants using #ows and linking to personal sites and postings (G) consistently included a high number

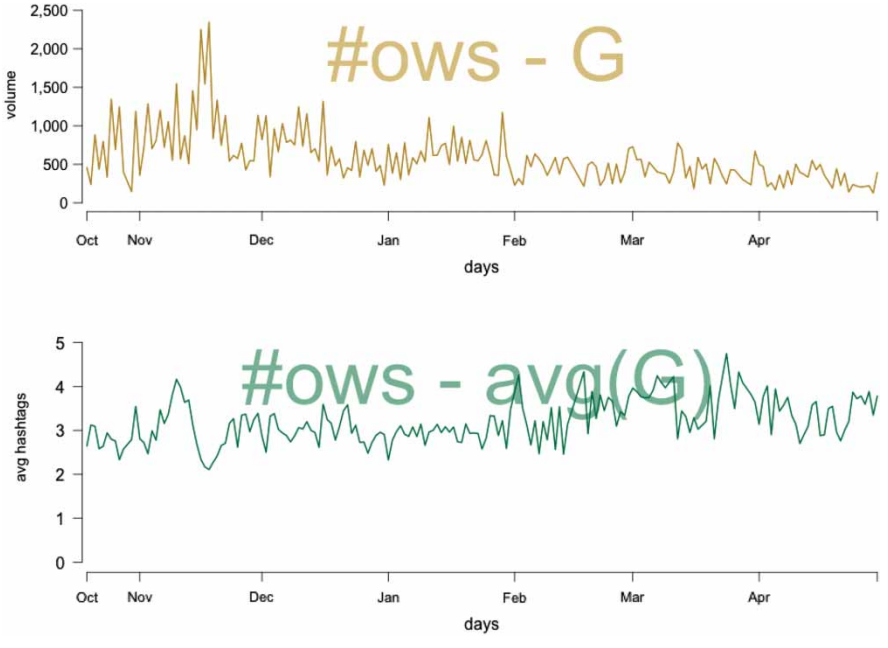

Figure 5. Tweet volumes (top) and average number of hashtags in tweets (bottom) that included links to personal content (G) and that used the #ows hashtag. Based on coded samples matched back into the entire database. Daily from 19 October 2011 to 30 April 2012.

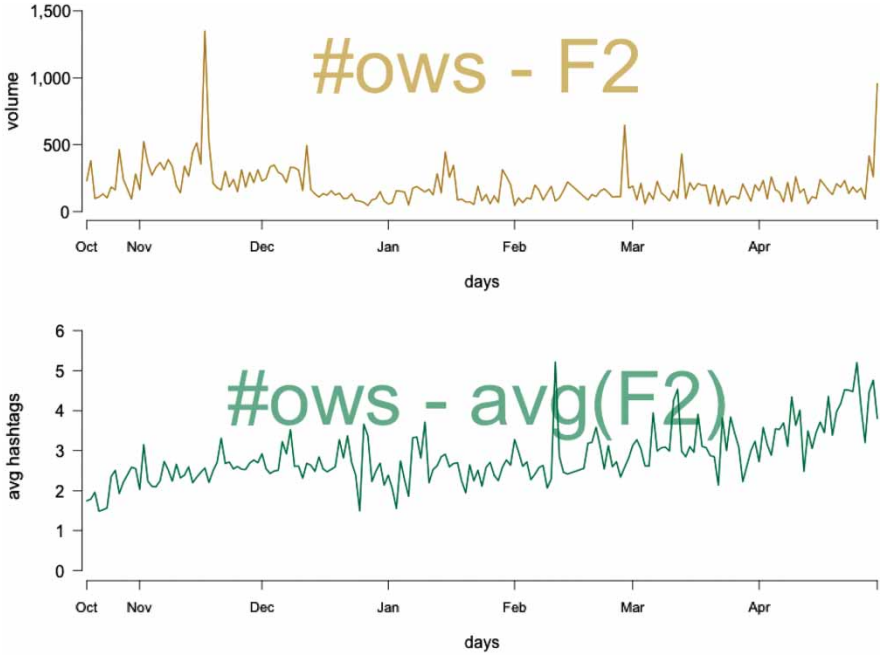

Figure 6. Tweet volumes (top) and average number of hashtags in tweets (bottom) with links to Occupy sites not built with branded commercial technology, such as city, tech developer, and campaign sites (coding category F2) and that used the #ows hashtag. Based on coded samples matched back into the entire database. Daily from 19 October 2011 to 30 April 2012.

of other hashtags throughout the entire period of analysis, suggesting that individuals worked hard to get their contributions distributed as widely as possible. As Figure 5 shows, the hashtag inclusion rate for links to personal sites hovers steadily around 3 and 4.[12] Given the personalized engagement that characterized the protests, it is not surprising that links to personal content were both the most common kind of production (shown in Figure 1) and the type of production that tailed off most slowly as the protests died off (top graph in Figure 5).

By contrast, as noted above, the use and number of multiple hashtags rose in messages linking to Occupy custom-built sites (F2; e.g. city websites or campaigns such as Occupy Our Homes). Figure 6 shows an increase from around 2 tags per message to between 3 and 4 by the end of the protests. Recall that the proportion of total Tweets containing links to Occupy organization sites also rose across time, suggesting that the crowd sought to stabilize and reorganize itself in its dying days. Other crowd-enabled movements that we have studied have displayed similar patterns of increase in hashtags and links to particular types of organizational resources in phases of rupture, decline, and transition. Such integration efforts seem to intensify precisely as other organizational aids (e.g. geographical arenas) disappear (Bennett & Segerberg, 2013).

Up to this point we have concentrated on the three distinct production types involved in explaining the role of communication in the organizing processes. We now approach the Occupy crowd from a more dynamic perspective showing how actors in the crowd worked together to put various organizing communication packages into play.

Producing the organizational package: core and co-producers

Beyond identifying the mechanisms of peer production, it is important to consider differences in how participants engage them and what this means for the development of the broader networks

of networks that constitute the crowd. The capacity for coherent organization of crowd-enabled protest networks hinges on how core contributors and more peripheral participants work together to produce the package of elemental organizing processes.[13]

As noted, not all participants in peer production will produce all or many parts of the organizational package. Contributors will undertake different roles and participate to varying degrees, and most are not mindful of the needs of the whole. Elite or early movers may trigger broad activation and information flows (Barzilai-Nahon, Hemsely, Walker, & Hussain, 2011; Margetts, John, Escher, & Reissfelder, 2012) or create an important 'attention backbone' to highlight other contributions (Benkler, Roberts, Faris, Solow-Niederman, & Etling, 2013, p. 1). Yet protest crowds may also work judiciously, if not with deliberate oversight, to enhance the network's capacity for coherent organization (González-Bailón, 2013; González-Bailón et al., 2013). The many small and fitful contributions of the crowd, whether in production, curation, or dynamic integration, are all potentially important in this process. As noted, participants can make a difference by highlighting contributions, actors, and streams that are deemed valuable. What is interesting is that while crowds often promote elites or those with prior credentials (González-Bailón et al., 2013; Suh, Hong, Pirolli, & Chi, 2010), in-network authority may also shift over time as recognition grows or the needs of the crowds change: curation processes may 'crowdsource to prominence' non-elite actors on the basis of their in-network contributions (Meraz & Papacharissi, 2013, p. 21; cf. Kwak, Lee, Park, & Moon, 2010; Starbird & Palen, 2012). Such activity helps shape the network and its organizational capacity.

The Occupy Twitter data suggest two things: that there is a core group of more active participants and that the contribution of this core is highlighted and amplified by the crowd. It is clear that some participants contributed more intensely than others to all parts of the organizational package. The roughly 27% of accounts in the #ows stream that were the most active dynamic integrators in linking to the most diverse types of resources across platforms (Figure 4) were also the most notable producers and curators: they posted and retweeted the most messages. Figure 7 displays the average Occupy-related tweet production from accounts contributing single vs. multiple links and shows that the more prolific the tweeting, the more diverse the production.[14] Figure 8 shows the curation rate by accounts producing single vs. multiple types of links measured as average retweet (the rate at which the account retweeted other messages). Both figures display a classic power law distribution headed by the producers of multiple-link types.

We have been able to determine that these core multi-resource contributors were overwhelmingly serious about and supportive of Occupy. This is not something that can be taken for granted – as noted earlier there was a fair amount of noise in the Occupy Twitter traffic. Nevertheless, as can be seen in Table 2, analysis of the top contributors in the #ows stream showed that

Table 2. Top contributors in #ows (October–December 2011) by numbers of links and type of account.

Account type	1–2 links	3–4 links	5–6 links
Occupy ORG/EQUIVALENT	2% (4)	4% (7)	8% (15)[a]
Pro-Occupy NON-ORG	23% (46)	63% (125)	89% (176)
Anti-Occupy NON-ORG	8% (16)	20% (40)	1% (2)
SPAM	56% (111)	4% (8)	0
No category	11% (21)	10% (18)	3% (5)

Note: Sample size in each link category = 99.

[a]This number should be approached with caution as it includes 8 bot accounts, which for the most part retweeted messages relating to a particular city camp. We cannot verify that they were city-related accounts. While their content suggests that they were straightforward bots, we have also observed a number of bot accounts in the data set mixing serious retweets with spam.

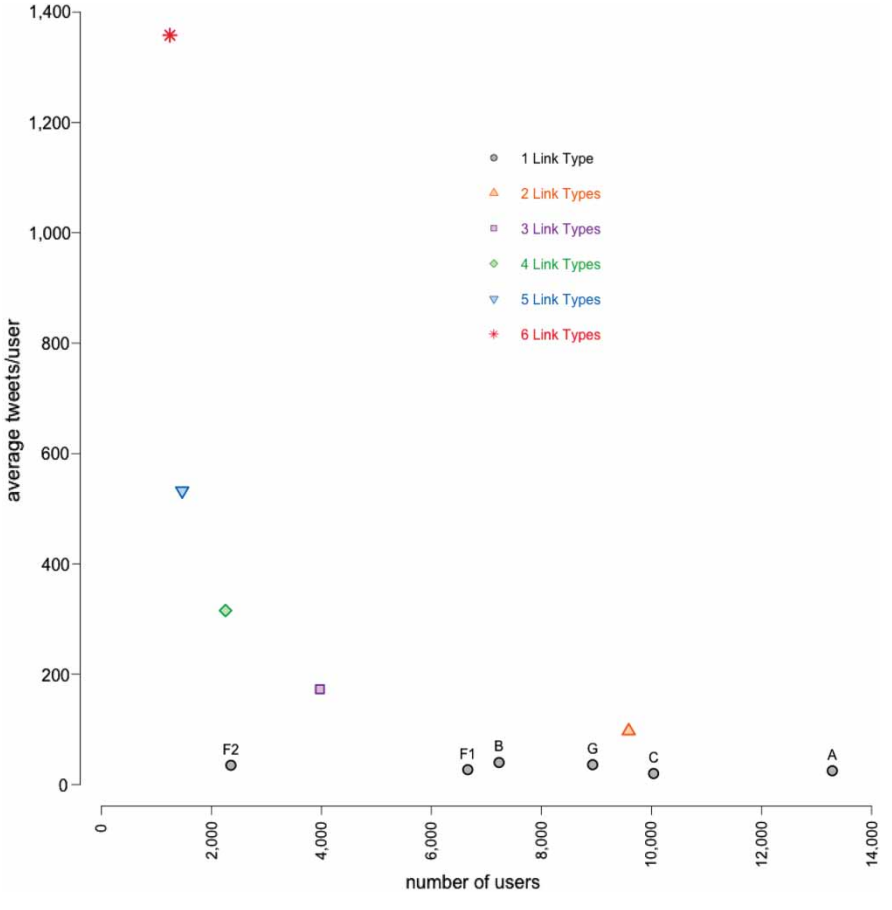

Figure 7. Average Occupy-related tweet production from accounts producing single vs. multiple types of links on #ows. Multiple linkers include combinations from two to six link types tweeted by the same users (e.g. 2 = two types of links only; 6 = links to all six resource types) during the period October–December 2011. *Y*-axis shows numbers of all tweets from those accounts in the whole Occupy dataset. The six key link types: A = news; B = commentary; C = specialty/hybrid sites; F1 = Occupy sites built on commercial platforms; F2 = custom Occupy sites; G = links to personal content.

spam accounts (malignant spam and product promotion) clustered amongst those tweeting only one or two link types.[15] Meanwhile, accounts that were explicitly negative toward Occupy were most visible around the middle linking mark.[16] Accounts tweeting supportive messages could be found throughout this sample, but dominated the category of most prolific producers in terms of tweets, retweets, and links type. It is noteworthy that while this top category included city camp accounts and an Occupy media platform account, it was dominated by unaffiliated (non-organization) pro-Occupy accounts.[17] Some of the unaffiliated accounts were used by activists (possibly several sharing an account) on the ground in demonstrations and city camps or who were highly engaged over time,[18] but others had less clear off-Twitter credentials.

Accordingly, although Figures 7 and 8 display what one would expect to see in a distribution of contributions in online peer production (Wilkinson, 2008), the twist in this case is that the accounts with the largest following are in the tail of the curve while many of the accounts at the head have relatively small followings. In part, this can be explained by the fact that some

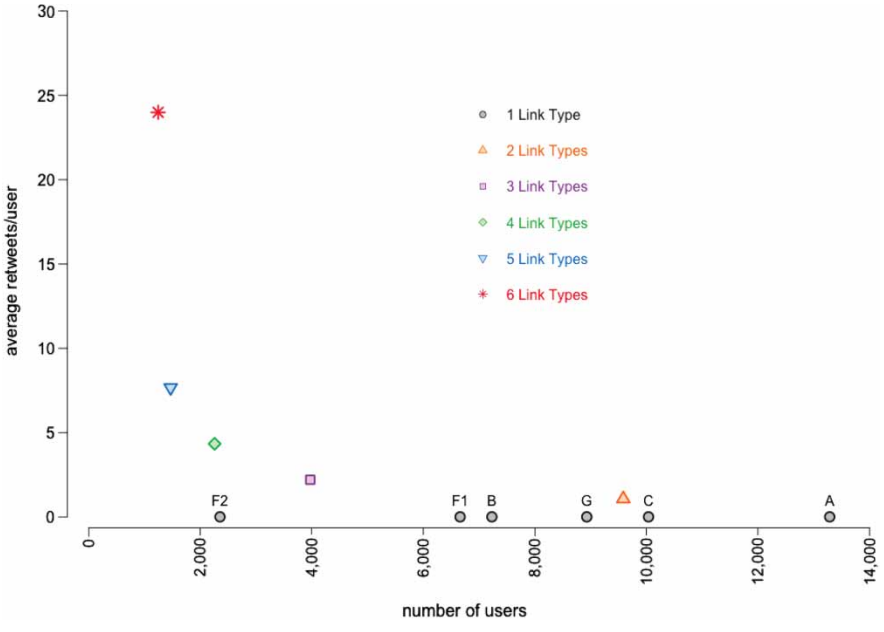

Figure 8. Average Occupy-related retweet production from accounts producing single vs. multiple types of links on #ows. Multiple link clusters refer to the combinations of different link types tweeted by the same users (e.g. 2 = two kinds of links only; 6 = links to all six) during the period October–December 2011. *Y*-axis shows average numbers of retweets from those users in the whole Occupy dataset. The six key link types: A = news; B = commentary; C = specialty/hybrid sites; F1 = Occupy sites built on commercial platforms; F2 = custom Occupy sites; G = links to personal content.

of the producers of only one link type were established news sites or blogs with large followings. What is interesting is that even though the core contributors started out with less-explicit recognition, the crowd propelled them to greater visibility over time. As shown in Figure 9, the average

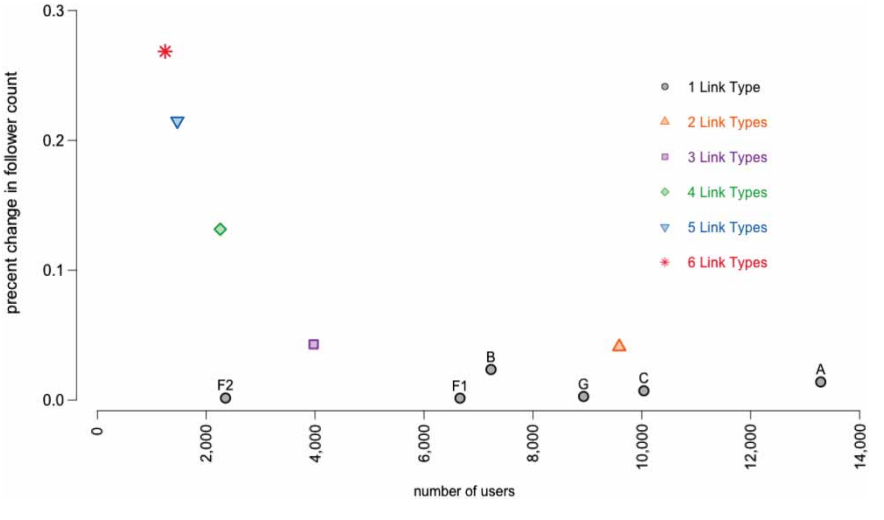

Figure 9. Percentage change in followers of accounts (in whole database) that linked to multiple link types in #ows sample October–December 2011.

increase of new followers was greatest for the accounts tweeting the most diverse array of links. This pattern continued as the protests tailed off: although the total number of active users declined, the numbers of followers for those tweeting all 6 core link types increased from an average of 1,908 per account in the Fall to over 3,000 from January to April 2012. In some cases the relative increase in followers is more extreme because the account was created for the protests and thus started with no followers at all. For example, the account producing six links using #ows that had the greatest follower change in the database was OccupyWallStNYC, which had a total of 100,346 followers by the end of December. However, as just noted, there were few recognizable especially created Occupy accounts amongst the top contributors, and the trend of increased followings indicated in Figure 9 holds also for the other top contributing accounts. Since 'following' an account is a form of curation that signals interest and enables stable resource flows from valued sources, this suggests that the crowd recognized the value of different producers' specific contributions.

Toward an analytical framework of crowd organization

It is important to understand how crowd-enabled networks of the kind that became prominent in recent protests work. One puzzle is that even when participants reject organizations and the bounded conditions conventionally associated with organizational capacity, some large-scale networks nonetheless seem to display coherent organization despite the ebb and flow of participation on personalized terms. We have introduced a preliminary framework for understanding peer-production organizing processes in crowd-enabled networks, and thereby the workings of communication as organization in this context. Further analysis is required to understand the potential and limits of crowd-enabled action in political contexts. This study is a first step.

Our analysis developed in two broad stages. First, we showed that technological stitching platforms play an important role in enabling large-scale crowds to achieve macro-level organization involving many different networks. Importantly, this point does not hang on a particular technology. Twitter was critical for large-scale crowd-enabled organization in the Occupy movement, but other stitching technologies were also in play (e.g. SMS systems) and may be even more important in other cases (Livingston & Walter-Dropp, 2014). Moreover, many crowds are sustained by the interaction of virtual and physical participants who may move between different modes of participation. Second, we identified a basic package of peer-production processes that are integral for achieving the coherent organization that network stitching implies. All three categories – production, curation, and dynamic integration – are important. Deficits or poor implementation in any one undermines the capacity of the network to mobilize resources, respond to events, or adjust in periods of change. Without production, there is little substance in the network, and what there is will not be significantly co-produced among the crowd; without curation the network will be saturated with noise; without the micro-level connections of dynamic integration, groups and networks will scatter or become significantly dependent on key bridging actors. The indicators will differ across contexts, but the presence of the basic processes, along with routinized patterns of use, helps shape the degree to which large-scale crowd-enabled networks attain organization. The preliminary evidence suggests that engaging the full package is a complex achievement involving both core participants and the broader crowd.

At this point it is important to recall that this analysis isolates a slice of the crowd-enabled network that needs to be re-embedded in several respects in order to gain full traction on organization in the crowd. On the one hand, analysis of the stitching mechanism should be carefully reintegrated amongst the networks and parts it connects, with their various actor constellations and symbolic resources as well as conditioning principles, spatiality, and historical residues of practice. On the other hand, it is important to integrate and enrich this kind of analysis with insights

drawn from other analytical and methodological approaches, such as those involved in social network analysis, ethnography, and platform studies. This will open deeper paths to analyzing what sustains and shapes organization in crowd-enabled networks, including how specific actor configurations facilitate framing processes across networks, how different kinds of resources circulate, and how stitching mechanisms change in different crowds and over time as new conditions emerge. Such development will help illuminate not only how crowd-enabled networks spread content and connections, but also how and when organizing mechanisms break down and fail. We also point to future studies of how particular stitching mechanisms (e.g. email, SMS, Twitter, Facebook) condition the character of the large-scale mediated crowd.

Finally, while our study focuses on mechanisms that build organizational capacity, we also note that many larger questions surround the crowd-enabled network as a political organizational form. Crowd networks may transition to other forms, but they do not necessarily represent a phase of emerging organization that must transform into more conventional forms or fail. The fundamental differences in organizational logics between collective and connective action as described by Bennett and Segerberg (2013) make holding crowds up to the standards of more conventional bureaucratic organization a misleading comparison. Since the conditions that produce crowd-enabled networks often do not support bureaucratic participation, we should be wary of using idealized organization or mobilization models as the only measure of political capacity or success. Moreover, although the study of political crowds has often been clouded by strongly diverging ideas about their nature and role, it cannot be assumed that their political character is predefined or that all crowds can be lumped together in terms of capacity, impact, or other normative generalizations (Borch, 2012; McClelland, 1989; McPhail, 1991). In this light, our work suggests the need for focused conceptual and empirical analyses of these organizational forms, along with the development of adequate standards for comparing them, and determining how they combine and clash with other forms of collective action. Such efforts will be important for understanding the workings of crowd-enabled networks across a variety of political contexts, and to learn how organized crowds fit into the democratic politics of claim-making, resistance, and dissent.

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Notes

1. This continuum of political network types (organizationally brokered, organizationally enabled, and crowd enabled) is from Bennett and Segerberg (2013).

2. As we argue elsewhere (Bennett & Segerberg, 2012, 2013), connective action hinges on intrinsically self-motivated – though not necessarily self-*centered* – action. Such personal offerings (messages, ideas, links to other sources, offers of help, stories, reflections, action etc.) may be shared through communication networks. Depending on how and whether those contributions are engaged by others, the result may be the production of valued outcomes for both the original contributors and others. This argument in part draws on peer production as conceived by Benkler (2006). We are however not suggesting that the broader crowd is consciously inspired by peer-production principles (although this has been shown to be the case for key participants in protests such as the 15-M, see Morell, 2012; Postill, 2013).
3. The history of Wikipedia according to Wikipedia contains a reference to its hybrid bureaucracy: http://en.wikipedia.org/wiki/Wikipedia. There is even a contested and dynamic discussion of what kind of bureaucrats Wikipedia has produced: http://en.wikipedia.org/wiki/Wikipedia:Bureaucrats.
4. This means that other nodes, whether individuals or other technology platforms, connected via different Twitter accounts and hashtags. Unlike campaign websites or Facebook pages, Twitter was not itself a singular, stable, or coherent node.
5. Determining the full population is problematic in large technology-enabled crowds. However, context-sensitive building of key search terms, and knowledge of different API streams helps secure reliable data, as does developing various measures of error (e.g., non-relevant vs. relevant tweets) and ways of addressing it. The dataset captured from October 2011 to August 2012 is remarkably complete and well matched to what is reported to be a nearly full population of Occupy tweets released through the commercially licensed GNIP PowerTrack (Driscoll & Walker, 2013).
6. The growth in number does not transparently imply Occupy movement activity (nor that all contributors supported Occupy). The continuing expansion of terms increases noise in a dynamic dataset. In order to check the relevance of tweets in the dataset, we coded a random sample of messages with and without Occupy-related hashtags (e.g., #ows). The coders achieved better than 90% agreement on what distinguished a relevant Occupy tweet. Tweets with Occupy-related hashtags maintained a low rate of error (under 13%), while tweets without Occupy hashtags had a higher error rate, in part because they often pertained to issues other than Occupy. (For example, the search term 'strike' produced messages about strikes unrelated to Occupy.) Sampling on widely used Occupy hashtags enabled us to capture high levels of actual Occupy-related tweets (85–90%) compared to lower Occupy-relevancy rates for the general population of tweets containing more generic key terms (e.g. strike) and satirical references (e.g., Occupy Chipotle). While a percentage of the tweets came from spambots, it is not large or disproportionately distributed in any particular category of the coded data.
7. The added metadata included the expanded URL for any shortened URL; a list of hashtags in the tweet; a list of mentions in the tweet; the number of hashtags, URLs, and mentions in the tweet; a list of data collection keywords that matched within the tweet, and the location of the match (hashtag, @mention, text, or URL) in order to explain why each tweet made it into the archive.
8. Coding files were generated for each of the three hashtags by randomly sampling 225 non-retweeted tweets with URLs from every other day for the respective period studied for each hashtag. Samples were generated via the following process to ensure that each day sampled contained links that could subsequently be tracked through retweets and multiple appearances in other hashtags: 1) All non-retweeted tweets with at least one URL and the appropriate hashtag were extracted from the archive. 2) These tweets were randomly sorted. 3) They were sequentially examined to determine if the URL was part of a prior sample. If the URL was unique across all samples already generated, it was added to the coding sample and randomly assigned to one of three coders (who were not the authors). If the URL already appeared in the coding sample from a prior day, it was excluded. 4) This process was repeated until the coding sample for the day contained 225 URLs or the entire sample of tweets with the date and hashtag from the archive had been exhausted.
9. #ows tops the daily hashtag list over the six months that we checked activity levels (October 2011–March 2012), and surpassed 250,000 tweets per day during the height of police evictions of camps during mid-November. It appeared in over 3 million tweets in the time frame from which we drew our coding samples.
10. Coding reliability among 3 trained coders was .851 based on Krippendorf's Alpha and Fleiss Kappa, and .829 for pairwise agreement using Cohen's Kappa. For details of the development of the coding categories and process we refer the reader to Agarwal et al. (forthcoming).
11. While some Twitter users retweet to show endorsement, some account profiles explicitly state that retweeting should not be regarded as positive endorsement.

12. Twitter states that it is 'best practice' to include a maximum of two hashtags in regular communication (http://www.twitter.com, 2013).
13. Here, as elsewhere in the study, it should be borne in mind that Twitter actors are in themselves a delimited part of the overall movement population.
14. The data in Figure 7 are from the peak activity period of October–December 2011. The pattern for January–April is similar, but the numbers of active accounts dwindles as the protests tailed off.
15. We selected the 99 most active accounts in the database archive in the 2011 time frame using #ows for each link diversity level (1–6) for the key codes A, B, C, F1, F2, and G, including RT and non RT links. The account type was categorized in terms of whether it represented an Occupy group or organization (e.g., city assembly, campaign, etc.) or was unaffiliated according to information in the account profile. Spam behavior and promotion, pro- or anti-Occupy stance was judged on message content. Journalists and news organizations were coded as 'no category', as were any cases in which it was not possible to establish category from the material available.
16. Accounts explicitly expressing complex support, e.g. for both Occupy and the Tea Party, clustered primarily in the upper middle category.
17. In terms of account profile description.
18. A couple of the top contributors already appear in the lists of top ten accounts in the study of Occupy-related Twitter in the summer of 2011 (Tremayne, 2013).

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