Combining Distributed and Centralized Systems in Disaster Response

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Abstract

Hierarchical control models have dominated organizational structures for thousands of years. Increasingly, the power of distributed organizations for performing complex tasks is becoming apparent. The strength of centralized decision making systems lies in consistency, continuity, and availability of resources. However, the inherent structure which leads to these strengths also limits the ability to respond to highly complex information. In this paper we explore the strength of the Occupy Sandy mutual aid organization.

Where centralized systems fall short are in areas requiring responsive flexibility to dynamic conditions. Networks operating as distributed systems have intrinsic qualities of adaptivity, immediacy, and appropriateness that allow them to succeed where centralized systems fail. Despite having complementary modes to the other's gaps, these two modes of decision making are generally not mixed in response situations. Overcoming the strategic challenges of combining distributed and centralized systems can add capacity to the overall system. This paper outlines an example of such a combined system working successfully in the field, contributing to a more complete overall response to Superstorm Sandy. Understanding the components that make such a mixed-mode system possible requires understanding how a distributed network and the interfacing between the modes function. The insights gained provide an intentional mixed-mode, holistic approach to response capable of being extrapolated to other systems-based operating contexts.

Overview

Much of management practice is concerned with distributing control, authority, and decision making. It is increasingly apparent that hierarchical organizations face challenges in responding to complex environments and tasks[1]. When the complexity of the environment exceeds the capacity of the individuals at the top, tasks cannot be performed effectively. New approaches are being developed for unconventional structures in which the role of hierarchies is limited or nonexistent, and control is distributed in alternative networks[2]. The problem of distributing control is critical in disaster response. Conventional response institutions struggle with (and sometimes outright fail at, e.g. Hurricane Katrina) responding to needs, despite ample resources and experience. In this article, we discuss the experience with combining conventional hierarchical and unconventional distributed control organizations during the response to Superstorm Sandy. Conventional organizations are capable of providing large amounts of resources and large scale logistical support for disaster response. The distributed organization provides the ability to recognize and respond to highly complex local needs.

Intentionally combining systems enables large-scale and widespread impact with awareness and responsiveness to local needs. Past attempts at combining formal, state-backed response with informal response efforts have been hampered by mutual distrust, lack of communication, and apparent incompatibility in methods of operation[3]. In contrast to previous failings, response in the wake of Superstorm

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[1] *Making Things Work*

[2] Holocracy, Fifth Discipline, etc

[3] *A Paradise Built in Hell*

Sandy implemented a mixed-mode system in which hierarchical and distributed groups collaborated with moderate success. The mixed mode system in Sandy response contained Federal Emergency Management Agency (FEMA) and the Occupy Sandy network.

Here we explain why distributed networks are effective at the high complexity tasks of disaster response. We describe the underlying structure and mechanisms of the Occupy Sandy system. We provide insight and guidance based upon our experience with Occupy Sandy and FEMA into interfacing between formal and informal organizations. Our objective is to demystify the workings of distributed control in the absence of hierarchical management processes, and to promote new experiments with mixed mode systems in disaster response. This case study may serve to identify principles that can be abstracted for other purposes as well.

The Occupy Sandy mutual-assistance organization that arose in the aftermath of Sandy, and which by default inherited much of the Occupy Wall Street (OWS) organizational makeup, is considered an exemplar of a distributed, or networked, system.[4] While many consider the Occupy system to be "leaderless," the empowerment of individual action by this structure inversely enables it to be considered "leader-full," where control is distributed throughout the organization. The widely acclaimed success of OS motivates a review of its innovative structure and the inherent implications for social organization more generally. The effectiveness of distributed structures is linked to the ability to disseminate information fluidly, and for actors to shift focus and roles according to arising needs. Differentiating OS's mode of operation from traditional centralized organizations' strategies, focus is centered on the mechanisms of decision making, functional nodal structures, and learning processes found in networks. These characteristics in addressing emergent complex challenges stand in contrast to the limitations encountered by centralized organizations where information and accountability supposedly follow strict paths of control. The ability of the OS system to respond adaptively to local needs of individuals in the devastating aftermath of Hurricane Sandy, independently of, and through collaboration with, formal response efforts offers a case study in support of a mixed-mode system of response.

The underlying framework we use for understanding distributed control structures is provided by a complex systems science characterization of information flows and coordination. According to this analysis, systems that are adapted to simple large scale tasks are not effective at complex tasks that require responding to specific local information. Hierarchical control structures can be effective at simple and large-scale tasks. Distributed control structures that are appropriately organized, on the other hand, can be highly effective at fine-scale complex tasks. Hence, just like arms, hands, and fingers combine large scale actions with fine scale manipulation, a mixed-mode system may be able to provide the best features of each without the corresponding limitations.[5] This analogy also allows us to better consider how these systems can be integrated. Each serves a distinct and interlinked purpose, and neither is an extension of, or in service to, the other. An example of such misconceptions are disaster preparedness campaigns in which community-based individuals become implementers of a centralized plan, rather than as actors in distributed networks.

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[4]

http://www.theatlantic.com/technology/archive/2011/11/a-guide-to-the-occupy-wall-street-api-or-why-the-ner diest-way-to-think-about-ows-is-so-useful/248562/

[5] Making Things Work

Combining hierarchical and distributed systems is not just relevant for disaster response. In functioning communities, an ongoing balance is struck between the formal and the informal.[6] However, this mode of operation has been eschewed for centralized power in response to extreme events, as it is in many authoritarian governance systems[7]. The ability to effectively respond to diverse natural and man made crises around the world requires establishing coexistence measures.[8]

Background
Our Struggle is Your Struggle

On October 29, 2012 Superstorm Sandy struck the coastline of New Jersey as sustained hurricane force winds and a record storm surge. Following Hurricane Katrina which struck New Orleans in 2005, Sandy is the second most destructive hurricane on record, causing tens of billions of dollars in damage across an entire region and destroying hundreds of thousands of homes.[9]

Response was carried out by a variety of formal institutions including the Federal Emergency Management Agency (FEMA) and grassroots efforts including Occupy Sandy (OS). Formal response deployed commodities, generators, communication preparation, and personnel in advance and after landfall. The formal sector additionally supported urban search and rescue task forces, ambulances, over a half million meals, and specialists in preparation for response to the superstorm.

At the same time formal groups were organizing their responses, so too were informal groups starting up their own. Participants of the Occupy Wall Street (OWS) movement were activated through existing personal and social media ties to respond directly in support of those affected by the storm, under the name Occupy Sandy (OS),[10] which carried out a significant portion of overall response efforts. Cultural norms such as solidarity and mutual aid made manifest through historical response initiatives such as Common Ground Collective[11] were also demonstrated in the speed of deployment and level of effectiveness of OS. For many OS participants, the altruistic and empathic framing of "your struggle is my struggle" reflects critique of both state-supported response as bulky, inappropriate, and ill-placed; and privatized response as opportunistic, alienating, and "fix for pay." While individuals in these formal organizational models are frequently motivated by altruistic ideals, the economics of salary provides a distinct set of incentives, and assigned roles may geographically distance individuals from their self-identified communities and preferred roles. Due to the limitations of the organizational structure, regardless of the intent and altruism of the individuals making up these agencies, that care may not be easy to express via available centralized mechanisms.

While a trend has emerged in the past few decades of centralized response blocking or at least deterring frontline communities from being participants in their own rescue,[12] Having learned from the experience of Hurricane Katrina, FEMA instead actively collaborated with other response organizations, local groups, and individuals[13] based on a commitment to be "survivor-centric."[14] One portion of FEMA's "Whole of

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[6] *The Private in the Ostroms' Polycentrism: A Case Study of Post-Sandy Recovery in one Orthodox Jewish Community* (Haeffele-Balch, Grube, Storr; George Mason University, Oct 2014)
[7] *A Paradise Built in Hell*
[8] *Open Data for Resilience Field Guide* (Crowley)
[9] FEMA, *Hurricane Sandy FEMA After-Action Report*, 2012, p4
[10] FEMA, *Hurricane Sandy FEMA After-Action Report* (Washington: FEMA, July 1, 2013)
[11] Black Flags and Windmills (scott crow, 2011)
[12] *A Paradise Built in Hell*
[13] FEMA, *Hurricane Sandy FEMA After-Action Report* (Washington: FEMA), 4, 5

Community" response initiative included the Field Innovation Team (FIT), tasked with strengthening overall response by amplifying the connection between the formal and informal sectors,[15] [16] terms here used interchangeably with "centralized" and "distributed."

OS's entirely volunteer-based network operated autonomously from formal response groups, with a limited pull function from groups like FEMA through clearly articulated needs. OS delivered 300,000 meals and primarily locally sourced donated goods worth $700,000, raised over $1,000,000 in cash to support of projects and materials, and cleared thousands of houses of debris.[17] During this process, the volunteers contributing to these efforts rotated in and out of OS continuously without disruption to the overall efforts, allowing for a constant labor-centric flow of relief. As a result, much of OS's collective efforts successfully addressed arising immediate needs from individual to neighborhood scales. Volunteers contributed according to their vast array of skills, abilities, and resources they could provide. This open-ended model allowed participants to be empowered to recognize and independently address response challenges, adapting to ever-changing circumstances in disaster situations, rather than attempting to control for it. The OS network system was designed to support and, when possible, scale initiative through participatory methods. This process, at first glance, may appear antithetical to formal response organizations' predilection for vetting of volunteers and requiring extensive training. However, the divergent strategic processes of networks and hierarchies in fact prove to be complementary by offsetting each other's shortfalls, together forming a more holistic relief system.[18]

The OS network's effort was praised for its effectiveness while being contrasted with institutional efforts, including by FEMA[19]. The scope of accomplishments realized by OS was acknowledged with esteem, often mixed with perplexity.[20] [21] Here was an "organization" that operated in direct opposition to the conventional terms of hierarchical command systems, yet executed a high level of relief through wide-ranging means, without any obvious control mechanisms or external accountability measures. The structure of Occupy is often described to be "leaderless" from the perspective of those coming from more formal structures. Centralized systems rely upon a top-down structure of accountability and decision making, with an executive position at the top whose role it is to oversee the actions of the organization, who is considered to be responsible for it, and who ultimately may be held accountable. In contrast, OS operates as an informal, bottom-up, decentralized network. While this mode of operation may appear as a collection of leaderless activity, in actuality the nature of OS represents a "leader-full" structure, where every participant is an empowered component of a larger whole, and is therefore responsible for their share of entrusted action.

If centralized response groups have a mandate to deliver support, and are populated by individuals committed to that mandate, why is a distributed group like OS necessary? Why should a seemingly spontaneously organized structure be more successful at some actions than a carefully constructeddesigned formal structure? The answer isn't so much about quantified success as it is about *where* and *how* they've succeeded.

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[14] FEMA, *Hurricane Sandy FEMA After-Action Report* (Washington: FEMA), p15

[15] *FEMA, Hurricane Sandy FEMA After-Action Report (Washington: FEMA),* p17

[16] http://gwob.org/hurricane-sandy-response-overview

[17] http://occupysandy.net/2013/10/support-our-ongoing-work/

[18] I bet this is a holocracy citation

[19] FEMA, *The Resilient Social Network* (Washington: FEMA, July 1, 2013), 29

[20] http://www.thenation.com/blog/171020/occupy-sandy-efforts-highlight-need-solidarity-not-charity

[21] http://news.yahoo.com/sick-frail-struggle-most-storms-aftermath-212528193.html

A fledgling attempt at a mixed-mode system

While FEMA's response was large, 1,700 of the 7,500[22] personnel were present primarily to "explain available programs and assist survivors registering for Federal aid"[23] -- *not* to take any immediate action. Formal aid is focused on addressing long-term, rather than immediate and mid-term, needs of survivors. Furthermore, an indication of the inadequacy of pre-planned response in a context of crippled infrastructure was apparent in that "entire housing projects were left to fend for themselves (in many cases, it must be pointed out, because those responsible for their care and maintenance were stranded off-site by the collapse of the regional transportation network)."[24]

The scale of formal response requires groups such as FEMA and Red Cross look for a parking lot large enough to deploy trucks into, set up registration tables, accommodate long lines of people, and organize inventories of blankets, food, etc. The parking lot, perhaps at a large department store like Walmart, may not be convenient to transportation other than cars (for which such parking lots are designed, and which not everyone has). Notices are sent out into the nearby areas about where and when to come to register for financial assistance and to collect supplies. Those members of the affected population who have received notice, and those they passed word on to, must go to the parking lot if they are to receive aid. Leaving damaged homes and social safety nets may carry its own stresses.[25] Once there, people often have to stand in line for hours, to talk to someone on a phone who is HIPPA certified to take their information for a form… with a 60% call drop rate due to connectivity issues. This is stressful for members of the affected population, but the scale of hierarchical operations is large, and refined mechanisms are outside the scope of that structure.

Given the stated commitment to be survivor-centric, saying "we must not allow ourselves to define success by the implementation of our programs, nor should we make the survivors fit our process,"[26] FEMA acknowledged their mechanisms were inadequate and needed new approaches, some of which were attempted during Superstorm Sandy response[27]. While many of these innovations are openly discussed in the FEMA Sandy After Action Report, here we will focus on the Whole of Community section of these efforts, which included FIT. This provided the interface necessary for a mixed-mode system. Two of the paper's authors, Galit Sorokin and Willow Brugh, deployed with FIT to NYC, spending primarily self-directed time with both FEMA's and OS's logistical and field efforts. The bridging approach was stated to OS as "if you need centralized backup, we will help make that happen. If you need [FEMA] to stay out of your way, we can help make that happen, too." Suggestions were made in parallel to FEMA as to where their efforts and abilities would be most effective.

Some of the overarching complementary behaviors and terms

Centralized	Distributed
Hierarchical	Network
Formal	Informal

[22] FEMA *Hurricane Sandy FEMA After-Action Report* (Washington: FEMA), p5
[23] FEMA, *Hurricane Sandy FEMA After-Action Report* (Washington: FEMA), p7
[24] *Diagram of Occupy Sandy* (Greenfield, 2013)
[25] Disaster Myth and Fact
[26] FEMA, *Hurricane Sandy FEMA After-Action Report* (Washington: FEMA) p 17
[27] FEMA, *Hurricane Sandy FEMA After-Action Report* (Washington: FEMA), p1

Institutional	Grassroots
Directed individual	Empowered individual
Consistent	Adaptive
Planned	Responsive to local information
Persistent	Rapid mobilization
Training	Orientation
Role assignment	Self assignment
Task assignment	Request for help and self-assignment
Preset structure	Adaptive nodes
Preset comms channels	Environmental writing and group meetings
Policies and Procedures	Protocols
Work for pay	Mutual aid
Disruptive/Paternalistic	Coextensive

By intentionally combining these two styles, holistic systems which can respond and prepare predictably and appropriately might emerge. This requires distributing control throughout the system, rather than placing networks low in an overarching hierarchy, and resembles Ostroms' polycentric systems[28] as well as holocracy.[29]

To demonstrate methods for achieving such a mixed mode system, this paper explores the case study of Superstorm Sandy response by FEMA and OS, including the associated tractable obstacles. For example, bridge figures spent several hours each day with both OS and FEMA, leaving little time for action in the field. This can be alleviated through clearer communication, data sharing, and protocols -- the use of which are independent of structure. Additionally, formal organizations risk losing predictability and legibility when striving to become more agile and permeable.

The most difficult challenge to overcome is addressing the need for pre-existing trust between groups like OS and FEMA, the obstacles to which are numerous. Attempts to distribute power through a system (OWS) to address ongoing humanitarian crises such as homelessness and income inequality are repeatedly ended through state-sanctioned force,[30] drastically inhibiting the likelihood of establishing mixed-mode system. As trust begins with understanding, this paper removes some of the mystery related to interaction with a

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[28] University of Michigan Press *Polycentricity and Local Public Economies* (Ostrom, Elinor and Vincent, 2002)

[29] *Holocracy*

[30] *The Private in the Ostroms' Polycentrism: A Case Study of Post-Sandy Recovery in one Orthodox Jewish Community* (Haeffele-Balch, Grube, Storr; George Mason University, Oct 2014)

distributed group like OS. Endorsement and implementation of distributed control systems are an exercise left to the reader[31].

Occupy Sandy

Origins

"We Wish Not to Seize Power, but to Exercise It"

Much of the technical and social infrastructure used for OS was developed, but only lightly used, during the OWS political movement focused on social and economic inequality. OWS activities employed a bottom up organizational structure centered in self-sustaining settlements primarily in urban parks. The "leader-full" structures of OWS and OS were of a surprising nature, evident in its characterization by traditional media seeking a single leader and clear message to reference, and were therefore instead seen as leaderless[32]. OWS represented both mutual aid and protest, with protest eventually gaining more attention with demonstrations, sit-ins, and direct actions. In this transition of focus to a sudden onset extreme event, mutual aid component and distribution of decision making and responsibility carried over from OWS to OS.

The necessary overlap of disillusionment in centralized ability[33] with a pressing need to act was easily achieved in the timing of Sandy's landfall[34]. Commitment to supporting networked response to Sandy was framed by the previous month seeing the re-creation of OWS camps and protests violently put down rather than seeing success on the one-year anniversary of OWS. Activists, including those awaiting court dates from these actions, sought a place to put their energies in alignment with their political and social views. Similarly, individuals active during the 2008 presidential campaign trail, who had become disenchanted with the ability of state structures to deliver on responsibilities, joined OS seeking new ways of fulfilling civic ideologies. Just as many of the most impacted neighborhoods in New Orleans after Katrina in 2005, many of the neighborhoods most impacted by Sandy have long-standing histories of neglect from the state. These political issues become highlighted in the aftermath of extreme events. While the phrase of the day in 2005 was "doin' it for ourselves,"[35] the phrase in 2012 was #wegotthis[36]. In short, there was more trust and investment in the network delivering necessary aid than in the formal sector doing so, potentially a boon given the history of failures from centralized response to extreme events.[37]

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[31] Network Weaver's Handbook (Holly, XXXX)

[32] http://www.slate.com/articles/news_and_politics/politics/2011/10/how_ows_confuses_and_ignores_fox_news_and_the_pundit_class_.html

[33] *A Paradise Built in Hell*

[34] http://www.vice.com/en_uk/read/hurricane-sandy-rockaways-election-2012-new-york-laurie-penny

[35] *Black Flags and Windmills* (scott crow, 2011) p 62

[36] http://www.occupy.com/article/occupy-sandy-we-got

[37] *A Paradise Built in Hell*

The OS system was self-tasked to deal with the immediate day-to-day needs as members of, or in solidarity with, neglected populations in the absence of infrastructure which has failed due to political and/or environmental reasons[38]. In the case of OWS, the need for infrastructure arose due to settlements in parks and other public spaces. The hurricane's disruption of infrastructure and services led to similar needs, precipitating the transfer of processes and technical tools from OWS to OS. This pre-existing connectivity and capacity is not essential to self-supporting networks, but is strongly linked to effectiveness of such a network.[39]

Based on OWS's ideals of political and social power being distributed, the OS networks organized outside of traditional hierarchical methods to directly aid a large area severely affected by a hurricane. This is often referred to as "self" organization based on those from a hierarchical background being unable to see or understand the small group of dedicated organizers creating frameworks for engagement rather than assigning tasks to participants. For this style of organization to work, response and recovery tasks had to be completed by people, often via self-selection and -assignment. Rather than a specific, out-of-the-box response task list, frameworks for discovering and responding to needs were created and shared across the OS network (and later, to other Occupy response groups as well). From a complex systems science perspective, this evolutionary response framework formed ways of discovering needs within a community, guidance in responding to common needs, and ways of further iteration and sharing of those practices[40].

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http://newsjunkiepost.com/2012/11/05/occupy-sandy-should-not-act-as-an-ngo-to-replace-bad-governance/
[39] Paradise Built in Hell
[40] *Diagram of Occupy Sandy* (Greenfield, 2013)

Geography of Effort

"Everything for Everyone, Nothing for Ourselves"

After ~~the hurricane~~ extreme events, people naturally congregated and ~~brought~~ bring their problems and resources to community centers, places which are already well known and serve in community support[41] [42]. If enough people congregate to one such center (such as a school, religious building, or tent), critical mass is achieved. A sign might be placed outside and word-of-mouth spreads for others to also visit to receive and provide help. OS, seeking local places in which to directly support the community ("solidarity, not charity") would ask for consent in joining these locations. OS individuals and processes then augmented the inherent response capacity of the community. Tasks and needs beyond the capacity of the community center would emerge, and be brought into the work flows and wider network of OS. The distinction between "community centers" and "OS nodes" became blurry, with some centers primarily consisting of community members and others primarily of externally originating OS members.
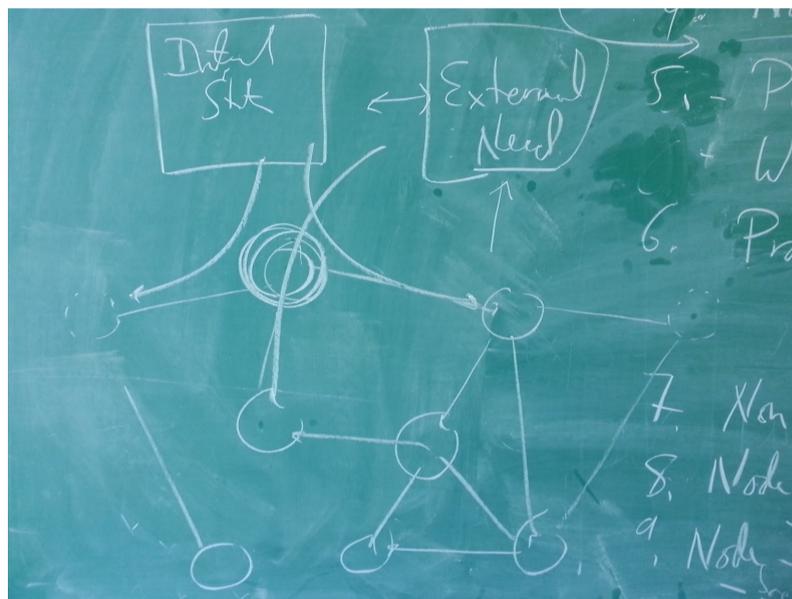
Distinctions blurred even further as the naming conventions allowed community members to become just as much part of OS as OS was of the community.

From a complex systems perspective, this approach results in a natural non-disruptive intervention in which the intervening system doesn't dramatically alter the original structure, which prevents the pre-existing system changing to become dependent upon the interceding one. Since social systems, like other complex systems, are adaptive, any intervention must result in a change ~~of the system itself~~ at least one of the systems. If the intervention itself is coextensive with the existing structure, minimal change and thus minimal disruption of community processes should result. A smooth transition back to autonomy and independence from external intervention, ensuring the sustainability of both systems.

The overall structure of the OS/community system consisted of geographical centers with greater or lessor community/OS participation, including some nodes that were unique to OS (ie, not at community centers) serving as primary distribution centers. These linked OS to the external resource flows that were needed for the response, forming a permeable network in resource flow as well as participants.

The community center based structure is conducive to information gathering and small-scale organization and distribution. Contrasted with FEMA parking lot distribution centers, the available resources are far fewer in any given community center. However, there is more information about needs, so the response can be more exact[43]. In complex systems science, a structure that includes fine scale response is necessary to address complex local challenges, while larger scale structures are effective in efficiency relevant to large scale flows.

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[41] Disaster Myths
[42] *Paradise Built in Hell*
[43] Disaster Myths

When resources beyond local capacity are coordinated according to this community model, the types and quantities of resources and tasks are based on the assessment of local individuals. The mechanism for coordination required essential OS communication infrastructures, through nodes. A node is a loosely-formed group of people and associated resources dedicated to a purpose, often working with node-specific guidelines and identity - people who like to chop and cook, equipped with stoves, permits, pans, and ingredients would be the "kitchen" node. Such nodes are permeable - a person can join or depart the node at low cost, such as showing up to chop vegetables one day without the assumption they will show up again the next day (although return and consistency are valued). Nodes might encompass individuals across multiple geographical sites of the network, such as information communications technology (ICT) in the Communications Node ("comms"), or might be site-specific but replicated, such as providing meals for volunteers and the affected population through the "kitchen" nodes at 520 Clinton, and again at Jacobi. Individuals could move freely from node to node, and be a member of multiple nodes at the same time - working from comms one morning and kitchen one evening, though after a certain level of skill was gained this was generally avoided outside of pressing need or suggested rotation. The distinction between the nodes is in the way information, guidelines, and identity are shared. Such nodes serve as a central aspect of the distributed communication and coordination structure both locally and across relatively large geographical distances. Adam Greenfield's "Diagram of Occupy Sandy"[44] is by far the most thorough participant study of how intake and tasking occurred.

Nodes

Nodes included, but were in no way limited to:

- Communications ("**comms**"): performed two main tasks, one engaging in conversations online, phone, etc as attached to dispatch; the second which dealt with back-end and internet infrastructure;
- **Dispatch**: coordination of requests from the field with resources in distribution centers;
- Distribution ("**distro**"): coordinated via dispatch the incoming and outgoing volunteers, supplies, and food either to relief site nodes or directly to individual locations;
- **Intake**: held orientation for incoming volunteers to learn or demonstrate basic communication protocols, history, and interaction assumptions as well as to verify commitment and to help find need and skill overlaps;
- **Interoccupy**: coordinated between various Occupy groups, including website incubation space and OS to Occupy Oklahoma knowledge transference;
- **Kitchen**: preparation of food for the affected population and volunteers;
- **Relief Site**: on a spectrum of affiliation with OS and often run by churches, local organizations, and local leaders, these sites housed volunteers, supplies, and food coming in and being distributed outward;


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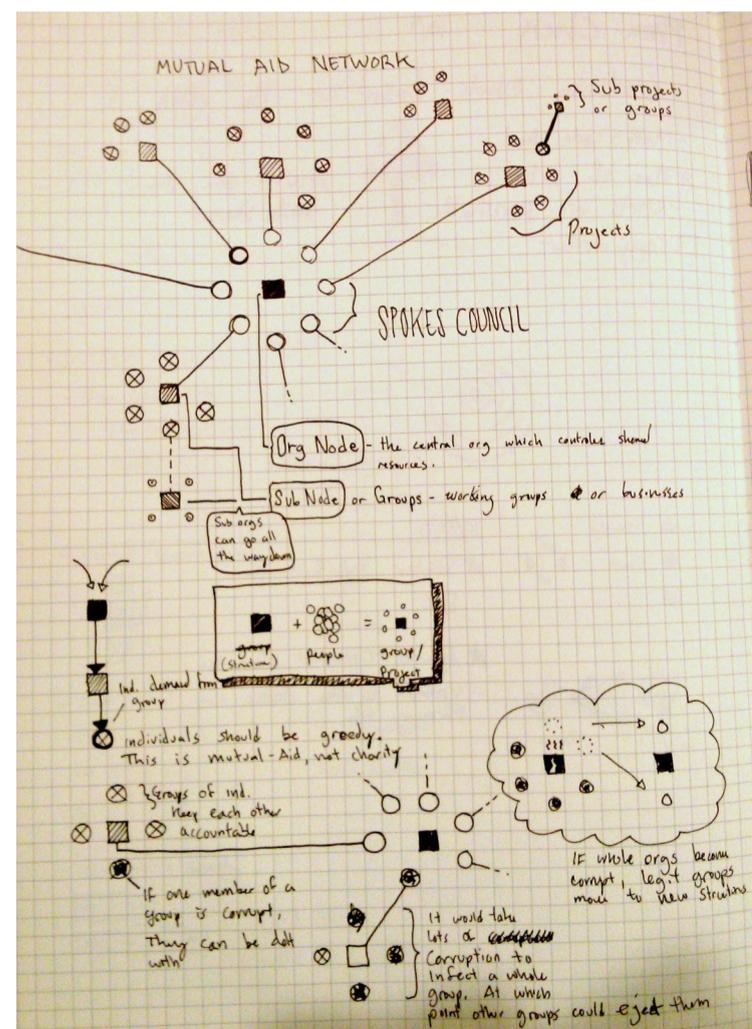
[44] *Preliminary notes to a diagram of Occupy Sandy* (Greenfield)

- **Warehouse**: overflow / pre Relief Site staging for supplies and volunteer surge periods.[45]

The functions carried out by nodes in community centers were even more finely grained, with more mobile participants dispersing into the community to find and respond to people who were homebound. This became a major part of the response, and was further facilitated through the creation of an Amazon Gift Registry,[46] [47] where individuals or nodes with a data connection could indicate specific need. This benefited logistics by automatically updating the registry after a successful placement of an order, centralizing information and logistics rather than material goods. Additionally, the registry more directly connected those giving and those receiving, enabling visibility to the benefits of their support and demystifying the effects of Superstorm Sandy. Outsourcing shipping logistics to large companies like FedEx and UPS which have centralized delivery logistics well suited to such tasks further freed time for OS and community members to instead focus on other needs.

Decision Making
"Lead by Obeying"

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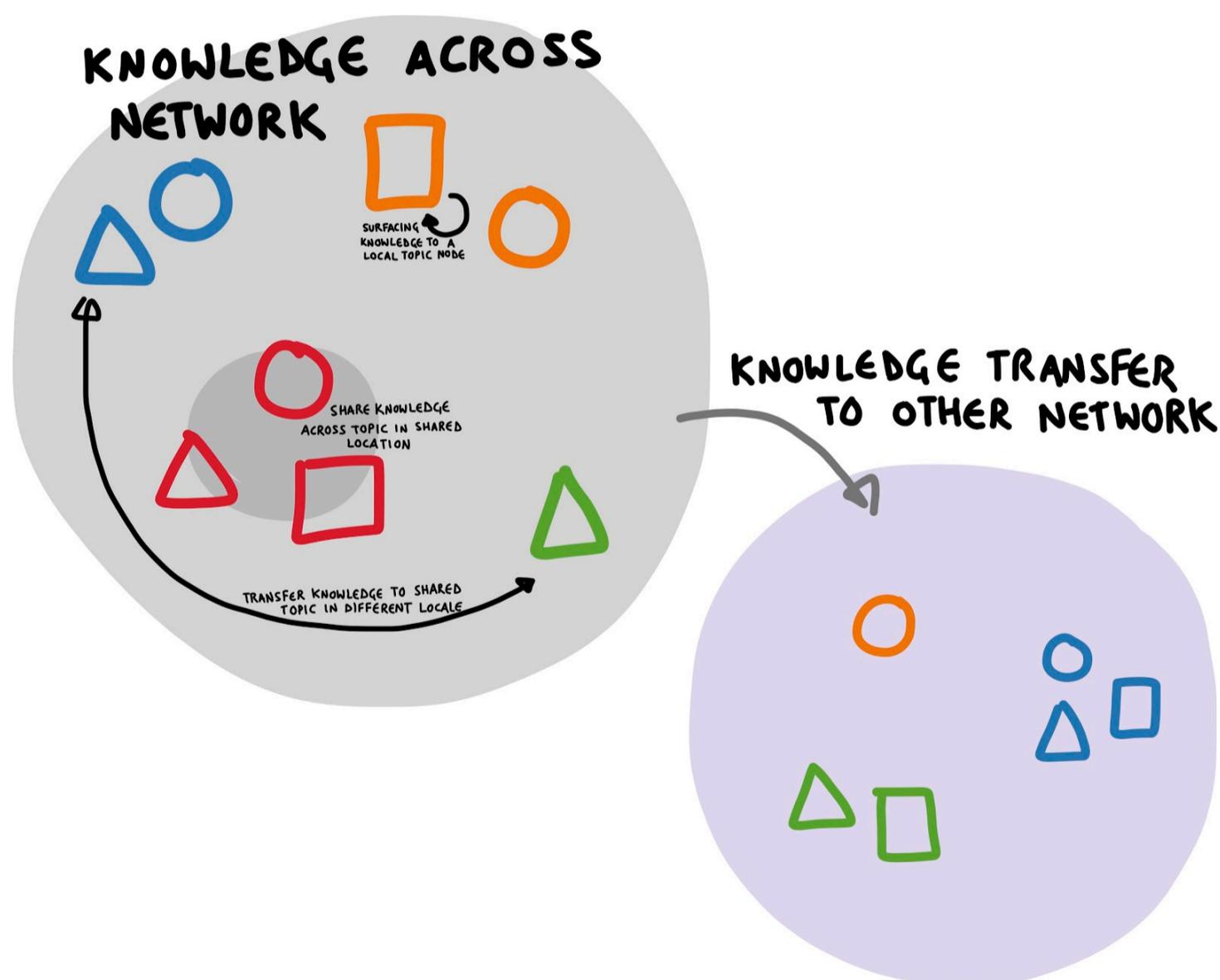
[45] Interview with participant Devin Balkind

[46]

http://www.theatlantic.com/technology/archive/2012/11/occupy-sandy-hacks-amazons-wedding-registry-in-a-good-way/264543/

[47] http://interoccupy.net/occupysandy/registries/

processes within organizations which simplify this, such as task or individual categorization for automatic assignment. These processes are well studied for hierarchies, but less so in networks.

For instance, OS's autonomous mechanisms within the system provided feedback based on group response. OS also made use of environmentally embedded (stigmergic) information for informing autonomous and collective group decision processes. How might this interoperate with formal response? To understand how a mixed-mode system is possible to achieve, here is explored how decisions are made so that cross-sector collaboration might happen in future.

Pairing individuals to tasks
Map and Compass

In a centralized structure, individuals higher up in the hierarchy describe the purpose of the system and the specific tasks necessary to be completed. Individual employees are directly assigned to tasks by a manager or equivalent. Any tasks not previously defined must be passed back up the hierarchy for approval and assignment.

In networks such as OS, tasks are instead self-assigned. This responsibility in self-assignment of tasks and time slots is commonly seen in cooperative houses[48] and businesses, and based on this embedded capacity throughout the OS network, emerged here~~emerged in OS systems~~ as well. The group cooperating sees what tasks need to be done, lists them, and self-assigns based on skill and need. While a specific participant might generally love cooking and be free on a Tuesday, perhaps the only open slot on Tuesday is delivering boxes. In the commitment to functioning response, this box-delivering task is performed by the person who is good at cooking. If a shipping logistics professional arrives ready to work, they might offer to take over for the less experienced person by announcing their field of experience or suggesting workflow changes. The cooking enthusiast might then go on to tear out moldy insulation from houses that day, and create hot meals for stranded residents on another day[49]. This makes use of whatever individuals are present, rather than only performing task and individual pairing when there is a distinct match, and to the exclusion of task completion when specific individuals are unavailable.

Meta-level stigmergic organization meant OS participants focused on what was of most interest to them, while communicating to neighboring nodes or the larger network using low-transactional-cost shared signaling. Informal horizontal ties kept the network's purpose in mind during these interactions. Stigmergy assumes traces of these interactions are left in the environment, to stimulate and inform further action for indirect coordination, and is explored further in the "Protocols over Hierarchies" and "Surfacing Knowledge to a Local Node" sections. How does such self-assignment reconcile with the possibility of contradiction or collision with other activities? For this there is the mechanism of feedback in collective meetings, which serve as a key mechanism of coordination in the context of enabling innovation based upon individual initiative.

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[48] also Intertwinkles
[49] Black Flags and Windmills p 63
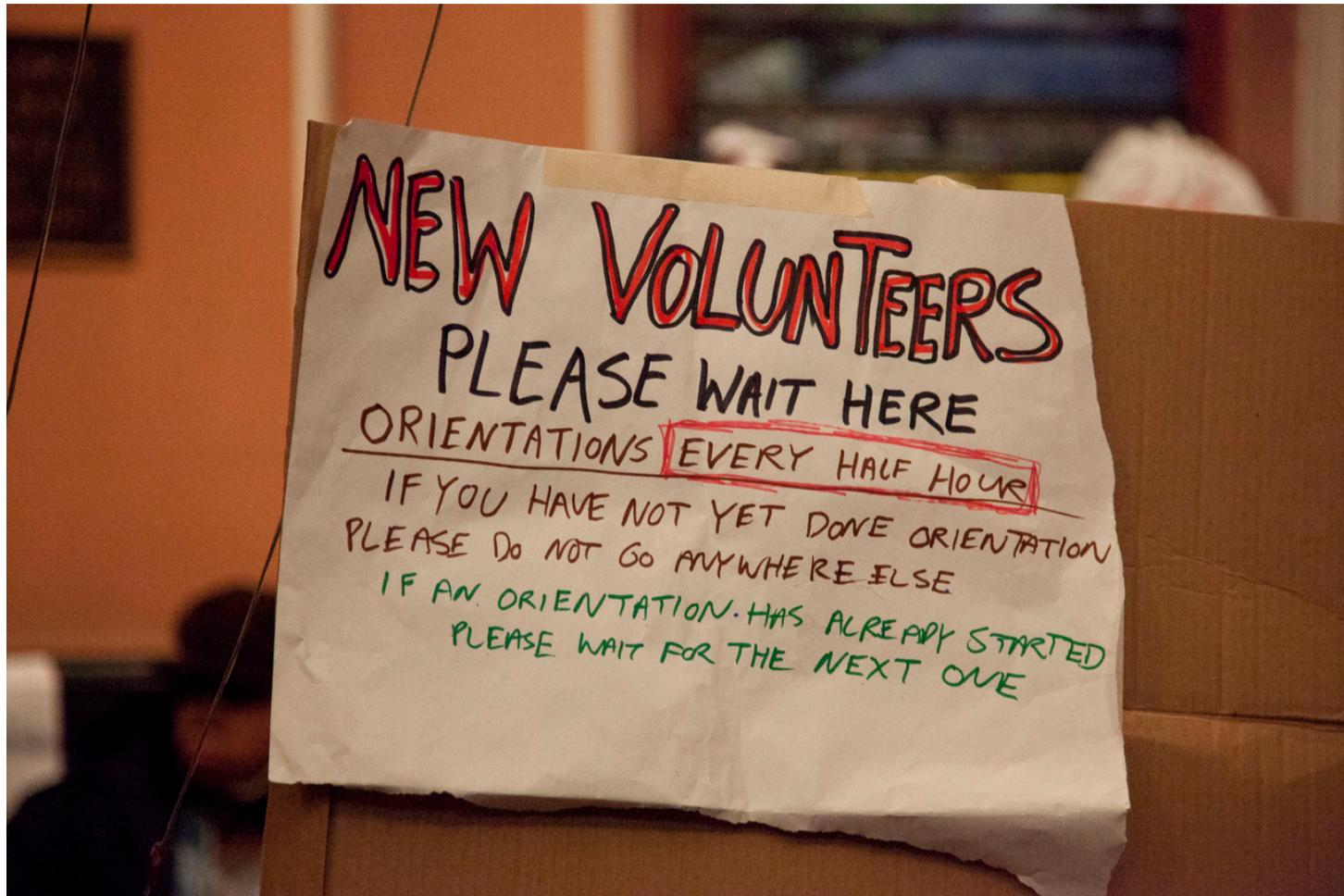
Pairing individuals to collections of responsibilities

Direct pairing of individual to task is burdensome in both hierarchies and networks, and often only occurs for new or outlying tasks. To increase efficiency, automation based on rules and categorization are used to replace direct and piecemeal assignment. Known tasks are grouped together, in hierarchies to be assigned to a role which an individual might hold, or to a team of people in a department. Individuals are then hired into a team or position based on the skills they hold associated with that set of tasks. OS had tasks emergently grouped into nodes. That collection of tasks was determined by processes of iteration, stigmergy, and consensus. After going through the intake node, incoming participants of OS assigned themselves to nodes based on current network needs and their individual skills. This emergent macro-task completion is in direct contrast to the time-consuming assignment of individuals to positions in centralized power structures[50], where only one position is assumed to be held at a time by an individual, and those high in the hierarchy create set working teams with adaptability or personality rarely considered.

Process or rule determined through meetings

In a centralized system, policies and procedures are set up over time by the individual (or individuals) towards the top of the hierarchy, and embedded into policies and rules which individuals follow. Bureaucratic rules and inertia make these hard to change, in part as the meaning behind them is often obfuscated or lost. Only occasionally do additional processes for changes exist for individuals to critique or improve those rules or processes[51]. In OS, the very protocol for determining processes for tasks and assignment was a feedback mechanism. In this, we see the "leader-full," rather than "leaderless" tenant of OS play out, with every member of the larger group as both actor and decider.

Coordination around the purpose and process of a node happens local to that node, with coordination across nodes in a shared location ("kitchen" and "distro" in 520 Clinton) happening via meetings in person,

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[50] FEMA, Sandy After Action Report, p13
[51] Fifth Discipline

or across various locations (Clinton and Jacobi) happening via a conference line. This can be understood as being similar in many ways to a committee meeting, but where anyone can opt into being on the committee, with non-anonymous voting, and being about course correction rather than task assignment. At meetings, updates about processes and task status were proffered along with potential upcoming actions, and the group would discuss any questions which arose. Such sessions were sometimes single-tracked, to be sure everyone heard the same things, and other times parallel break-out groups formed so several topics could be focused on at a time by those most interested or affected by it. At the end of each round, a "vote" of sorts would take place via in person hand-signals or conference line number-pressing. In person, votes were visible to other participants, and were visible to moderators via the phone line, so social pressure was present. Responses could fall into 'agree,' 'disagree,' 'abstain,' or 'block.'[52] If sufficient disagrees appeared (with the amount locally set, and majority was not the general rule), further discussion was needed, and the proposing group was expected to alter their course of action. If even one 'block' appeared, it indicated adamant resistance necessary to be further explored. This is different from a town meeting because it is focused on feedback loops around actions, rather than legislation to be externally executed. In a "leader-full" group, the decider and executor roles are interlinked, and checked by the rest of the network.

These meetings were heavily facilitated, with facilitators often rotating in and out so as to not centralize power into any given individual, a political statement towards the trust and inclusion of network members in protocols[53]. While time-intensive up front, meetings to course-correct allowed individual network participants to be self-directed in choosing and taking appropriate actions while maintaining network cohesion. This optimized the ratio of time in collective decision making in relation to overall effectiveness.

Knowledge Transfer and Network Structure

This section covers how nodes (such as "kitchen") surfaced knowledge to themselves, to other nodes of that topic in other locations ("kitchen" at 520 Clinton to "kitchen" at Jacobi), to the different topic nodes in a shared location ("kitchen" to "distro" at Jacobi), across the entire network (all nodes in OS), and then to another network (OS to #OpOK in Oklahoma when tornadoes affected the area months after Sandy[54]).

Protocols in place of hierarchies

The Defense of Memory Against Oblivion

Rather than be dependent upon one person or set of people to decide how things should work as in a hierarchy, network participants embed assumptions and expectations into protocols, which are visible through orientation or intuition. Orientation was performed by the intake node tasked, which not only described the purpose and setup of different nodes, but like other nodes was also self-improving orientation through continuous iteration and updating[55]. Updates comprising the "complete" knowledge often found in company handbooks is created through appending additions based exceptions as understood through execution or external remark. In contrast, "relevant" knowledge in a network is prioritized and condensed through iteration and clarification of the most vital patterns and guidelines.

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[52] *Intertwinkles: Online Tools for Non-Hierarchical, Consensus-Oriented Decision Making* (Charlie DeTar, August 2013), p40
[53] *Intertwinkles: Online Tools for Non-Hierarchical, Consensus-Oriented Decision Making* (Charlie DeTar, August 2013)
[54] http://interoccupy.net/blog/opok-update-oklahoma-relief/
[55] *Preliminary notes to a diagram of Occupy Sandy* (Greenfield)

While some attention has been paid to the technical abilities of OS[56], too little has been focused on the underlying cultural methods and practices of organizing applied in free, libre, and open source software (FLOSS)[57]. In these, issues ("bugs") with a software program can be filed by anyone, which anyone else can see and, hopefully, fix ("patch"). These patches are reviewed for appropriateness by individuals trusted by the community before being accepted back into the core code base, and the change and associated metadata are logged in a changelog. For OS, it was not just software that was being patched and updated, but rather the protocols of interaction and working practices of the distributed network. If there are questions as to why a method of practice is the way it is (or if an idea or change has been attempted before) changelogs can be perused to better understand alterations in assumptions and trajectory. It is desirable for the most eloquent expression of a pattern to purpose to be the current visible version, with the history of other versions available for reference. This dynamic network is distinctly different from bureaucratic rules in that any person interacting with the system is encouraged to examine **and** change the structure. In a bureaucratic system, rules and processes are set top-down[58] [59], and are revised only when a decision-maker experiences ill effects. OS's iterative approach encouraged an evolutionary process with detrimental practices being critiqued and abandoned and new practices being attempted in an intentional way[60].

Protocol-driven interactions are not unique to networks[61], and can also be found in formalized processes such as ambulance/EMT protocols[62], for wilderness first responders, airline maintenance inspection checklists[63], etc. However, these do not allow altering the protocol through iteration based on the judgement of the individuals involved, but rather focus on preventing dangerous aspects from recurring. While an individual might make a snap judgement based on training and context, it is highly improbable that deviation would then be considered for an overall shift in protocol. This lack of adaptability removes the possibility of evolution. In recent decades, corporate management improvement strategies have often been designed to shift control and decision making from a centralized structure to distributed processes[64] [65] [66]. This allows for fast and appropriate actions to be taken close to the source of the information. For example, decisions about production of goods are driven laterally through the organization by demand rather than by reports that go to upper management for decision. Still, these organizational structures rely upon a hierarchical structure by default (rather than through examination and intentional selection) for many aspects of their decision-making processes, such as overall objective and pay rates, as the distribution of decision-making often plateaus after it reaches some point of discomfort to a central office. Various approaches are being adopted to more radically change management structures, such as adhocracy and holacracy. While such shifts might, on the

[56] *The Resilient Social Network*

[57] https://github.com/orgs/occupynet

[58] http://blog.bl00cyb.org/2014/04/mutual-aid-and-the-crowd/

[59] http://www.ctheory.net/articles.aspx?id=499

[60] *Black Flags and Windmills* (scott crow) p 69

[61] *Protocol: How Control Exists After Decentralization* (Alexander R. Galloway, Feb 2006) MIT Press

[62] *The checklist—a tool for error management and performance improvement* (Hales and Pronovost, Sept 2006) Journal of Critical Care p 231-235

[63] *Human factors of flight-deck checklists: The normal checklist* (Degani and Wiener, May 1991) NASA

[64] Deming, W. Edwards (1986), Out of the Crisis, Cambridge, Massachusetts: Massachusetts Institute of Technology

[65] Michael Hammer, and James Champy. Reengineering the Corporation: Manifesto for Business Revolution, A. Zondervan, 2009

[66] Nonaka, Ikujiro. "The knowledge-creating company." Harvard business review 69, no. 6 (1991): 96-104
Roos, Daniel, Ph.D.; Womack, James P., Ph.D.; Jones, Daniel T.: The Machine That Changed the World : The Story of Lean Production, Harper Perennial (November 1991)
Neuman, Robert P., and Roland Cavanagh. The six sigma way: How GE, Motorola, and other top companies are honing their performance. McGraw Hill Professional, 2000.

surface, resemble the structures of a group like OS, without the intentional inclusion of marginalized populations, the vital coextant aspect is forgone.

While hierarchical organizations attempting to become more like networks by distributing power outward often stall out due to discomfort or inertia, networks begin to lose their speed, adaptivity, and purpose as hierarchies unintentionally form through unexamined social dynamics[67] or the blind adherence to formalized structures. The network and hierarchy in the same overall system must provide each other feedback and checks, so those parts which should be systematized can be adopted by the formal, while the informal continues to be evolutionary space. Because documentation can be used by both networks and hierarchies, albeit created and deployed in different ways, open access is a key component of interfacing and interaction.

This is not a linear process
Ask Questions While Walking

While there were defined steps to understand how to get involved in any given node or aspect of OS, constant reflection and transference of knowledge between nodes *as an act of participation* meant OS processes were less linear than most processes in Industrialized society. This interaction style is in contrast to the formalized learning approach the United States takes for an education system geared for factory or desk jobs, and so could seem overwhelming, and those inexperienced sought ongoing permission to interact and engage. Instead of clearly defined tasks prescribed by a manager or instructor being tested via questions, informal learning systems such as OS's are evidenced through reflective, iterative, and "know how" decisions.[68] OS processes did not even attempt to present as linear, at maximum providing flow charts or checklists of considerations. The recursive self-correcting nature became manifest in teaching through doing. Knowledge was shared through sharing work. If a participant showed up consistently to deliver on projects, they were given greater trust and respect. While some tasks for incoming volunteers were eventually defined, the mentality of programing for FLOSS again demonstrated in how different components exhibited reliance and effect on one another, in contrast to serial tasking. Based on iterations and reflection, documentation was adapted for clarity and direction for participants to self-organize in a meaningful way, rather than adding sub-clauses for each exception.

People were encouraged to modify, improve, and contribute to documents as representations of current knowledge[69]. Changelogs indicating editors and their edits meant these actions could be linked to an avatar -- while a person's state-sanctioned identity might be kept private, their ability to access and edit was maintained, with permissions for read/write access prioritizing those most likely to make use of those documents. It was assumed that orientation and continued engagement meant contributors could be trusted in these edits - and OS members self-report that no trust-related issues occurred.

This internal creation and curation of massive amounts of information can be overwhelming to those from centralized structures. And yet it wasn't so much to members of OS. Why? How was information structured, indicated, and transferred in this network?

[67] *The Tyranny of Structurelessness*
[68] Seeing Like a State
[69] https://en.wikipedia.org/wiki/Wikipedia:Contributing_to_Wikipedia

Surfacing Knowledge for a Local Topic Node

Embedded in space

This might seem like a lot of information for any given individual to reference or manage, especially when print-outs and internet connectivity are precious resources. However, information on walls, including maps, tasks, goals, and reminders were posted throughout space. Data passed through a crowd sorting function of what information was needed where, and relied upon good faith that updates and deletions were being done in a collectively useful way, therefore meriting no gatekeepers. A highlight of FLOSS mentality over a technical solutionism[70] meant that not everything needed to be online - much information was relevant only a given node for associated tasks. The ease of sharing knowledge through digital channels was sacrificed for immediate reminders of objectives as well as situational awareness, at times intentionally as such, at other times as a way to select a pragmatic option in disputes of where to house these data online. This lightened precious data and cognitive bandwidth loads, and allowed the local topical node to better perform their task, selectively transferring information to other nodes based on relevance. This is in contrast to centralized models, in which new information is expected to be sent back to headquarters for design and decision making, to then be sent back to local offices for execution[71] - a known bottleneck for action and deterrent for appropriateness[72]. For a human system to scale beyond the capacity of an individual (as in a hierarchy),[73] a network participant must be able to access information relevant to their locale, as well as check information present in other parts of the network, without that information being distracting when not needed.
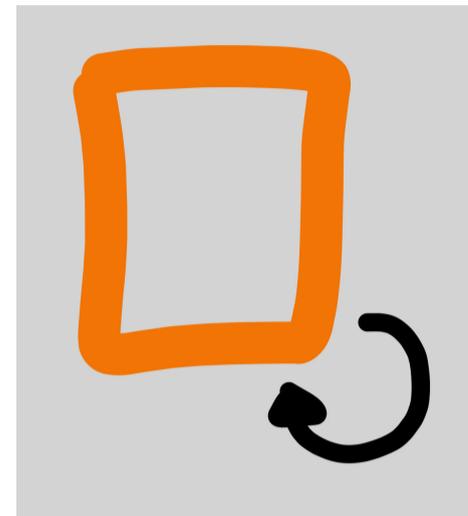
Rolling Assumptions, Emergent Properties

Participants were oriented to a local node on protocols and tasks, and vetted for trustworthiness (to deliver, to act in good faith) through ongoing engagement. Emergent components of protocols necessary to external nodes were often intuited via interaction, and were rarely planned or explicitly stated until the time of discovery ("oh, *you* place your cutting boards on a damp towel, preventing movement and possible slipping and cutting" is not something many people think to broadcast to a larger network, yet seeing it in practice inspires this knowledge transfer). This is in contrast to a task being pre-planned and related performance critiqued on exact delivery as seen in exclusive adherence to task lists. Scaffolding, when it did appear, was based on **structure** and **protocol** being ready-made, rather than the tasks themselves.[74]

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[70] To Save Everything, Click Here (Evgeny Morozov)
[71] Patrick Vinck, MIT Humanitarian Technology Conference 2014
[72] *A Paradise Built in Hell*
[73] *Making things Work*
[74] *Diagram of Occupy Sandy* (Greenfield, 2013)
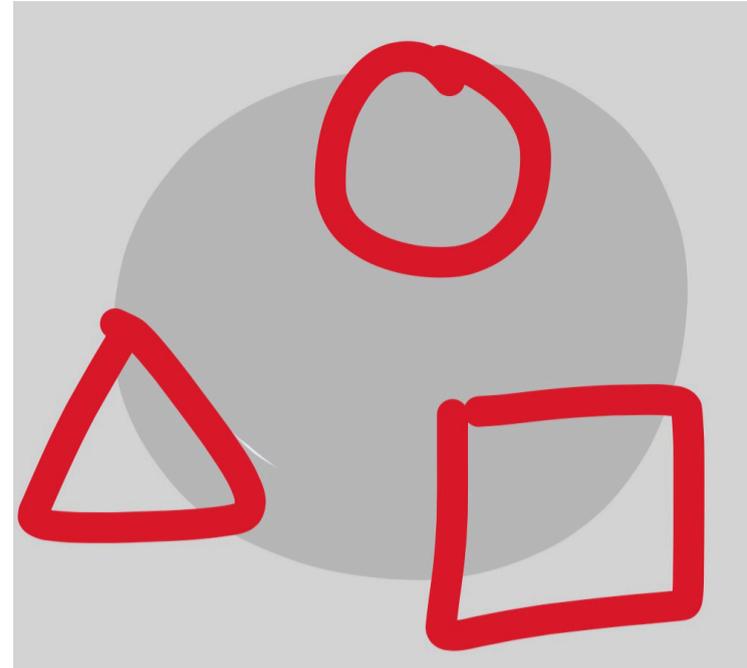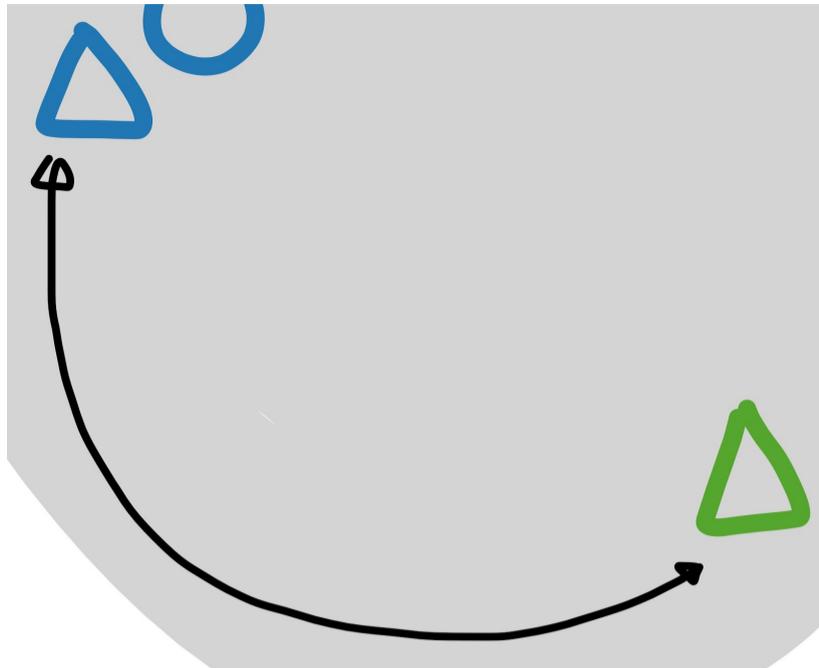
Transfer of practice through rotation of people

Locally surfaced knowledge made network effects possible as nodes become connected. Whether as an explicit attempt at this or happenstance, in addition to the one day off each week OS participants were expected to take, participants were also encouraged to spend one active day in another node - either of the same topic but in a different location, in the same location but different topic, or in the field to be reminded of actualities. This was a force function for cross pollination. Because participants were vested with responsibility in improving systems as well as being active in

response, seeing a good practice in one area would implicitly lead to better practices all over. This was implied, as well as being present in rhetoric ("be bold!" on Wikipedia is reminiscent of this[75]). It was assumed that any mis-steps, misspellings, or misrepresentations would be taken care of by others, who were equally entrusted to edit. Trust was constructed of transparency and self-correcting protocols. This remains a main interface block for the traditional response sector, which retains that trust is connected to the individual, rather than to the group - a useful concept for a trained medical professional, but not for delivering goods and services at scale.

Individuals were encouraged to spend time in different nodes for ambient knowledge transfer and improvement of practices. Seeing how dispatch was sending out meals from the kitchen via distro might change the practice of those in any topical node. Expertise was expected to be embedded into the interactions and protocols themselves, rather than housed in any given individual's head.

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[75] https://en.wikipedia.org/wiki/Wikipedia:Contributing_to_Wikipedia

To make node statuses and needs visible to the network, the specifics of each group were boiled down into short announcements from the localized node set. Kitchen check-in at 520 Clinton happened in the same meeting as Clinton's dispatch check-in. Often transportation, timing issues, and possibilities were uncovered during these meetings. This sharing process could be time consuming, causing additional stress. Facilitation and concision were greatly valued at meetings, and glorification of these had to be balanced against any one person or persons becoming the de facto representative of a group[76]. Dedication to ideals of distributed power as well as pragmatism allowed this tension to be navigated, though not always easily, with urgency placed on increasing the capacity of all participants, rather than falling into specialization and subsequent siloing.

Knowledge Across the Network
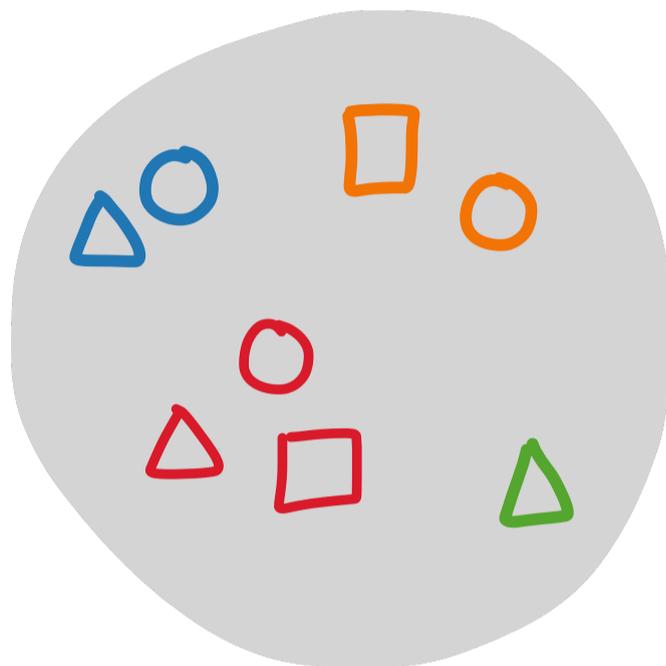
A website called InterOccupy[77] was launched as OWS spread beyond NYC for cross-location communication. This was used to house nascent Occupy websites (including OS) until they gained enough traction to merit their own domain. It is worth noting that initial OS efforts expected a few hundred volunteers and a few thousand dollars in donations, and instead worked with 60,000 volunteers and over a million in monetary donations, with another $700,000 in goods primarily sourced from local businesses donated through OS's infrastructure[78].

This incubation period within existing infrastructure designed for distributed, federated nodes laid a path to the smooth scaling and sharing associated with OS's success. Failed evolutions of OWS became the sound foundations of OS.

Whole-Network Communication

Taken from a long history of direct democracy and consensus, "General Assemblies" were important for cohesion and dissemination across the whole network. While OWS had held general assemblies in one main location in NYC,[79] OS's distributed locations throughout the Sandy-affected region meant these recurring meetings occurred via a conference call tool called Maestro Conference. Call facilitators would see a dashboard of who was on the line, potentially with their role or other identifying factor. Facilitators could also see indicators, which rather than being indicated by hand signals in a shared physical space, were made through individual callers using their dial pad (1 for technical difficulties, 2 hand raising, 3 for point of order, 4 for agree/"twinkle," 5 for disagree, 6-0 for specific questions/polls). This way, dozens to hundreds of people could be on a call together, and a team of

OCCUPY TOGETHER
HAND SIGNALS

SPEAKING

WANT TO TALK DIRECT RESPONSE CLARIFY POINT OF ORDER

FEELING

AGREE DONT AGREE OPPOSE BLOCK

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[76] *Intertwinkles* (DeTar)
[77] http://interoccupy.net
[78] "Occupy Sandy Relief NYC Fund," Occupy Sandy Recovery, accessed August 23, 2013 http://occupysandy.net/funds/
[79] http://www.nycga.net

facilitators/moderators were able to sense-make and include everyone. Facilitators could unmute people who signaled having questions, could put people into breakout rooms for specific discussion, and could take the "room's" vibe, etc. Maestro Conference is an example of social networks and networked technology being complimentary of one another.

Knowledge Transfer to Other Networks
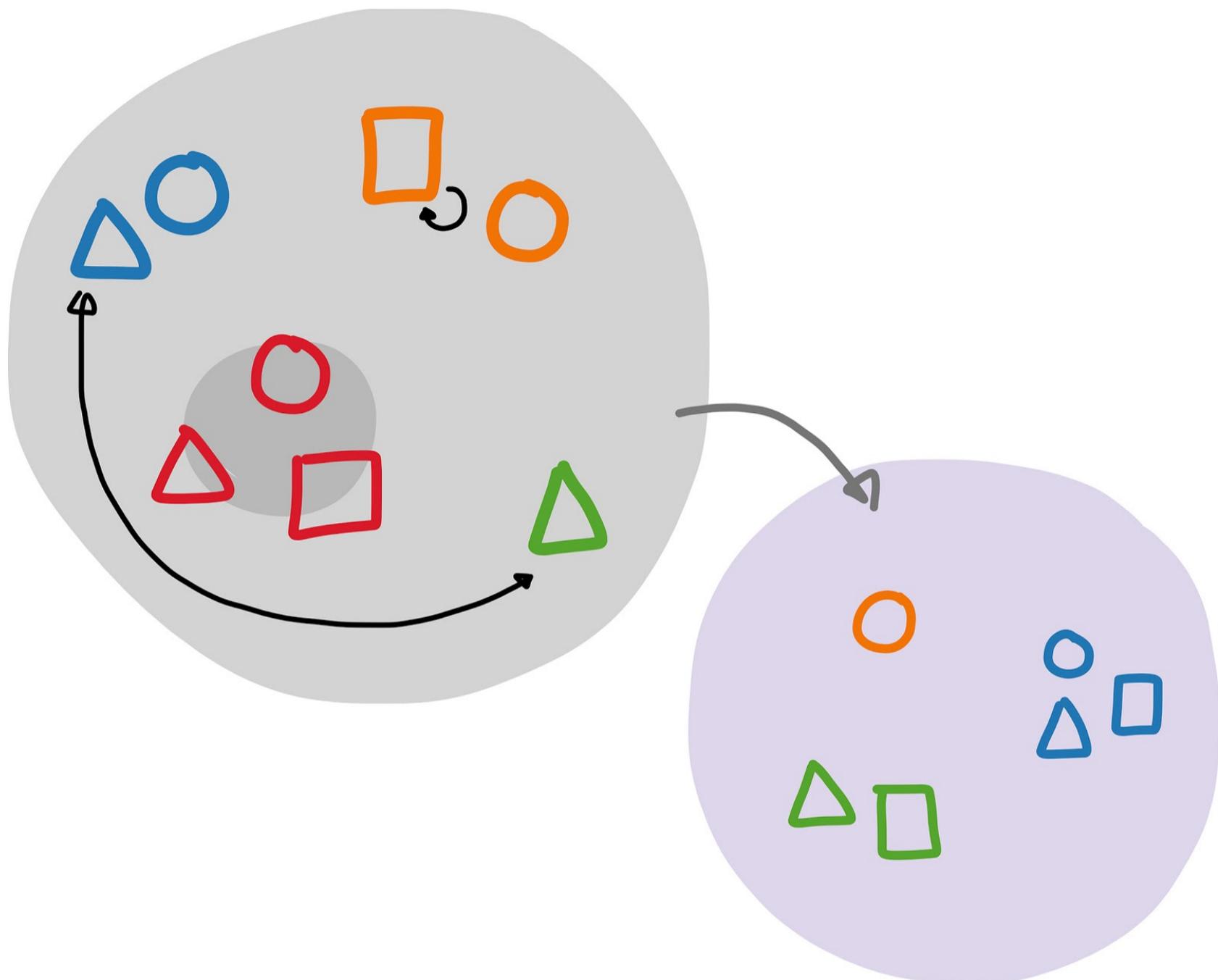
To a Different Network in Shared Event

One common issue in response is that of fragmented attention[80], often due to conflicting or disparate sources of information[81]. While RSS[82] and APIs[83] resolve this is digital spaces, few response organizations have explored these possibilities (a main exception being UN OCHA's Humanitarian Exchange Language[84]). One place many civilians go to gain situational awareness during crises is Google Crisis Maps (GCM). The tech-savvy crew at OS saw how useful the GCM was for people who were self-mobilizing to respond and

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[80] https://civic.mit.edu/blog/mstem/5-ways-you-can-give-attention-as-aid
[81] The Attention Economy: Understanding the New Currency of Business, Davenport and Beck, 2002

[82] http://www.rssboard.org/rss-specification March 30, 2009
[83] http://www.webopedia.com/TERM/A/API.html
[84] http://hxl.humanitarianresponse.info

support in an informed way. OS also saw how limited the map was - only hosting the few "verified" sources which were also available to the public (in contrast to the "common operating picture" created by various formal response organizations, which are often not available to all responding organizations, let alone to the public). Expedited through one author's personal connections to people at GCM and OS, the OS data feed of needs and offers from nodes was added to the available map layers in this widely viewed forum. This in no way disrupted the OS maps -- in fact, it added attention and contextual detail. A well-known place (Google) amplified the voices of people who knew what they needed (OS)[85]. This sort of collaboration should be explored more in the future.

To Similar Networks with Same Purpose at Different Times

When the 2013 tornados in Oklahoma started, the OS crew spun up much of the technical infrastructure which had been useful during OS response, again displaying an evolutionary approach. These included, but were not limited to, a mapping instance, a registry, a website, copies of instructional documents, forms for information input, and a Twitter account. Using generalized Occupy Response social media channels, an activation call was organized and publicized, with a focus on working with Oklahoma residents, especially those who were Occupiers. After two organizing calls for response, smaller peripheral organizational calls were set up to hand off the technical infrastructure and facilitation to Oklahoma locals. Anything infrastructure not taken up by #OpOk was closed down. Support for the response was ongoing - both remotely through facilitation until local facilitators came on, as well as people showing up physically with shovels, water, food, shelter, and emergent need fulfillment. This was again replicated for the Boulder Floods, and Occupy Boulder.[86] This offering of a technical suite, and then shutting down unused parts is another difference between distributed and centralized deployments. Centralized systems predictably implement according to existing plans, whereas distributed systems are adaptive. Evolutionary adaptation occurs within the bounds of mutual aid, with the affected population determining what ideas and practices "survive" and which do not, with an emphasis on the coextensive.[87]

Benefits of a Mixed-Mode System

Those affected by Sandy, the institutions tasked with serving those populations, and other response groups agree that OS was effective. We've explained the geography of effort, decision making, task assignment, knowledge transfer, and technical infrastructure. In order to gain the benefits of joining distributed and centralized systems, an interface needed to be created,[88] which was in part made up of FIT. This interface took work, and its success is independent of OS's functionality.

In any system, including disaster response, there are different scales of action needed, and therefore actions are suited to a spectrum of organizational structures from pure centralization to pure distribution. In many cases it is effective to use a combination[89] - distributed decisions based upon local information are often best for prioritizing which homes to visit in order to clean out to prevent mold and to check for trapped persons, while centralized deployment of large scale debris pickup vehicles or for intensive medical treatment is likely more effective. Given the differences in organizational structure and function it may not be surprising to find that, rather than optimizing for each others' strengths, members of "both sides" were often angry and confused by the other[90]. OS mocked hierarchies such as FEMA and the Red Cross for lack of

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[85] http://tech.nycga.net/2012/11/29/occupysandy-technology-and-relief/
[86] http://boulderfloodrelief.org
[87] *Black Flags and Windmills* (scott crow) p 57
[88] *Connecting Grassroots to Government Report* Crowley Oct 14 13
[89] Making Things Work, p 104
[90] either cite someone else or personal experience

fine-detail response, while members of the staff of the Office of Emergency Management appeared to have discomfort for unauthorized efforts which risked harm for OS participants. While many mutually beneficial partnerships might be forgone due to barriers to interaction, the increased transactional cost between the network and hierarchy was here nearly too high. Despite the complementary capabilities, a strong partnership barely managed to function, due to distrust by activists about the inability of established institutions to deliver appropriate support in and outside of disaster scenarios, and from those institutions towards activists for disruptive protests during OWS.

Response at Scale

Many problems in response are last-mile problems. While formal response might get resources into an area, it can be infinitely more difficult for those resources to get to recipients within the time needed. In contrast, OS's structure was exceptional at needs assessment and last-mile delivery, among other things[91]. This combining of methods will continue to prove difficult so long as critique of past and current failings of government and infrastructure remains dangerous and criminalized - distributed response depends upon participation of communities, many of which have been historically marginalized and with whom trust must be earned. To similar effect, the private sector is only aware of those needs which it has the capacity to fulfill, capping its ability to be adaptive and holistic.

Response is not limited to distribution of resources, it also involved handling incoming attention, funds, and volunteers[92]. Formal, hierarchical institutions tend to train for extreme events which press the capacity of a team, their tools, and their knowledge without exceeding those capacities. Planning for the mess of crisis situations often falls outside process and moral, and so surges in both need and offered resources are often left to the wayside[93]. In contrast, OS *was* primarily surge capacity[94], with difficulties in predictability and long term resource allocation.

Combining the formal and the informal
"We Want a World Where Many Worlds Fit"

Attempts from centralized response to interact with networks often bounded networks as informational inputs, rather than merging into a true mixed model. It would be all too easy, from the perspective of a network native, to blame these issues of mistrust and ineptitude on the State. However, the authors would generally attribute the fragility of communities to wider social process of late capitalism, such as including increased mobility of populations to find work; larger communities beyond the scale where people have strong associational ties; consumer cultures displacing civic cultures; growing inequalities and gaps between local elites, middle-classes, and wider populations. Placing of burdens on the state should instead be seen as a particular mode of claim-making about the universal right of people to certain goods. The history of mutual aid has not always been an inclusive one, and should not be seen as a fix-all. Certain communities get left out, and without a claim on the state to help redistribute (in the absence of a strong moral claim on non-marginalized populations, which institutions like the church may formerly have mediated), they often systematically continue to be left out. In this, the mixed model can be used to uphold human rights. If the state is an equal and just democratic state, then choosing to coordinate through it **is** about communities engaging in a degree of mutual aid. That said, our modern states rarely represent the democratic ideal - and

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[91] http://www.thenation.com/blog/171020/occupy-sandy-efforts-highlight-need-solidarity-not-charity
[92] *Participatory Marketplace* (Stempeck, June 2013)
[93] *An Introduction for System Developers to Volunteer Roles in Crisis Response and Recovery* (Rogstadius, Karapanos, Teixeira, Kostakos, 2013)
[94] *Diagram of Occupy Sandy* (Greenfield, 2013)

are far from people - and so the critique that placing coordination with the state can undermine citizen efficacy does hold. The consequence of this line of argument is that we should, as a result, think about trying to make the state more responsive and integrated with community action, rather than solely routing around it.

Conclusion

Last-mile complications and situational awareness are long standing issues in disaster response, and ones which centralized institutions are exceptionally ill-equipped to deliver if operating exclusively. Distributed structures the ideal coupling to these issues. Networks as yet lack the capacity to store large-scale resources, for which institutions are fit. To gain the benefits of both, take a reflective path to merging, as facilitated by technology.

While the premise of hierarchical institutions are well known, the understanding of knowledge transfer in networks must not be seen as some fanciful nor impossible-to-understand notion. Networks are functional, real, and scalable. Nodes surface knowledge to themselves, transfer knowledge to other nodes in same location as well as shared-topic nodes from other locations, share knowledge across the network, and transfer knowledge to other networks sharing a task in time as well as to other networks in different places and time through iteration and stigmergy. While this might seem complicated or overwhelming from a centralized system angle, these setups actually allow for the whole to be greater than the sum of the parts.

In disaster response we find a visceral, immediate, and pressing need to shift to a mixed model through the application of complexity science. This discipline also allows discussions to be had about efficacy outside of politics, but we still must remember history, and continue to advocate for the inclusion of the frontline population, both for moral and functional reasons.

Something something we think it is possible to do this with purpose, and commend FEMA and OS for taking a chance on each other. We are eager to explore ways of doing this intentionally more in future.

Acknowledgements