

Expertise in the Wired Wild West

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ABSTRACT

This ethnographic study reveals how expertise was sought, articulated and actuated across online and offline worlds to enable the evacuation of 38 horses from an isolated ranch in the mountainous region of Northern Colorado following a series of devastating flash floods in September 2013. The shared expertise within a loosely connected community of practice bridged spatial-temporal limitations and afforded opportunities for practical assistance and response, both virtually and on the ground. Interaction via social media articulated the parameters of the emergent problem to be solved, and “cast a net” to find the expertise necessary to address different aspects of the perceived problem. Eventually, more than 60 people with equine expertise converged onto the ranch, bringing their materials to execute a single-day evacuation and relocation of the herd.

Author Keywords

Animals; expertise; crisis informatics; disaster; emergency; equine; livestock; social cognition; social computing.

ACM Classification Keywords

H.5.3. Groups & Organization Interfaces—collaborative computing, computer-supported cooperative work; K.4.2. Social Issues

INTRODUCTION

Disasters create myriad problems. Official responders are often so taxed that they cannot attend to every need in a community. Indeed, the very nature of disaster compels residents of an affected region to take charge in their recovery because the circumstances are dire and the resources are few. People self-organize to “get things done.” Many consider community members as the “true first responders” for activities that include rescue, evacuation assistance and medical care [20, 45].

Social Media in Crisis Response

Such arguments have been extended to the study of a new arena of social interaction, that of social media during

disaster response. By understanding that the online convergent crowd exhibits similar behaviors as the offline crowd, this body of research looks beyond the noisy online communications to see how subgroups of “digital volunteers” accomplish—or try to accomplish—work through that medium [31,33,36,42,43,47]. Though that research acknowledges that the work of the online effort must connect in some way to activities on the ground to fully assess its import, to date there has been little work that considers how online and offline work in the aftermath of disaster intersects (with exceptions including [41] and [49]). Additionally, we have little understanding about how spontaneous digital volunteers choose the tasks they could attack, and how the medium of social media might influence the topics around which groups organize, though we do see groups working across problem areas, such as crisis mapping [39], medical support [36,41], location information provision [43], situational awareness [33], and notably for this paper, animal welfare [47].

Animals in Disaster

This paper reports on a volunteer activity that responded to livestock concerns during a flooding disaster in Colorado. The matter of animal welfare in disaster is a major problem that community members often must tackle without official support. Over the last decade, the plight of animals in crisis events—both pets and livestock—and how that affects human decision-making about evacuation has been made increasingly clear [9,11,13,17,50]. Many people will not evacuate without their animals, or they may delay their decision to do so. Following Hurricanes Katrina and Rita where approximately 70,000 pets were separated from their families, with less than 3% of these reunited [16,47], the US passed the PETS Act (2006) for the inclusion of companion and service animals in evacuations and sheltering. However, the Act does not address the needs of those who own livestock, including equines and other large animals, even though their owners are often affected in the same way as small animal owners. Furthermore, large animal owners often depend on those animals for their livelihood; disasters can be devastating for these owners in both psychological and financial ways [9]. Naturally, it is difficult or even impossible to logistically evacuate large animals, and the lack of legislative support means that owners of livestock must take the lead on decision-making.

Growing interest among the online pet advocacy community in disaster response was described by White, Palen and Anderson [47], who studied the large-scale self-

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organizing activities of animal welfare advocates to suggest matches between lost and found pets over the months following the 2012 Hurricane Sandy. There was some connection between what was happening online and on the ground, but the extent of this was unclear, even to study participants [47].

Disconnection Between Offline & Online Response

Indeed, a major criticism of much current crisis social media research is that it does not consider the relationship between online work and offline or on-the-ground activities (Wulf, et al. [49] is a notable published location, and it is a discussion often brought up at conferences and in paper reviews). It is an important concern. Does the research fail because the online-to-offline connection is not happening, and therefore all the attention put to social media activity magnifies the role social media are playing (or could play) in disaster? Or is the behavior such that the research cannot tackle it because it is hindered by the logistical difficulties of deploying to a sometimes diffuse and hard-to-access disaster site at the right time to observe and study such activity? Probably some of each is occurring. The majority of online-offline connections that do exist are very subtle and difficult to capture empirically (especially under conditions of disaster).

This paper examines a case where the online work of information gathering was brought to bear on an offline or on-the-ground problem, the sensemaking of which demanded particular kinds of expertise. Where prior research failed because it could not place researchers on the ground in a far away site while simultaneously examining online behavior, we were able to study an event that was an outcome of devastating floods in our own geographical area. We still report on a single event, and the paper aims not to suggest without evidence that this happens frequently: It is rather aiming to learn from a situation that graduated from the online reporting of a problem (which was not a solicitation for help) to the mobilization of interested volunteers who devised and implemented an offline solution over an extended period for a time- and safety-critical situation. That it happened close to our home town where we could access all aspects of it over a protracted time period suggests that these kinds of ensembles of online and offline work in disaster settings are not rare, but that “being there” during the disaster creates the opportunity to witness them.

Research Objectives

This paper examines the case of a “self-assisted evacuation” of 38 marooned horses that were left isolated by extensive road damage on a high mountain ranch in the “wild west” of Colorado, by the devastating floods that occurred there. The account considers how online and offline work came together under conditions of specialized expertise sharing that drew upon people near and far, digitally and physically. In this paper, we examine how a problem with an uncertain solution under time-critical circumstances is solved across

people, time, place and materials. In addition to emotionally and financially supporting the ranch owners, the online activity served to “cast a net” to find expertise around the subject of horse-care and ranching. These experts then articulated the problem of the marooned horses and the geography of the mountains they were located in to develop a plan that would allow volunteer “horsepeople” who were connected primarily through social media to converge onto the ranch and evacuate the horses “down mountain” in the uncertain conditions of a post-flood environment without harm to the horses, themselves, or their equipment. Furthermore, the execution on the ground of their expertise was realized and shaped by the layout of the roads, the locations and temperaments of the horses, and the constraints and possibilities yielded by their materials and equipment.

In this online-meets-offline account of cooperative work, we see connections to the classic literature in CSCW around matters of mutual awareness in safety-critical systems [12] that is partially achieved online and only “satisficingly” [38] achieved offline. We see how performances around paperwork intended to connect the online to the offline are once again superficial [44], and that the offline work is refigured at the very end primarily to communicate its successful completion back to a waiting, online crowd. We see how problem definition, work articulation [37], and the materiality of work [27,35] come together to make the work happen in a socially-, spatially-, and temporally- distributed matter [14]. Finally, a main contribution of this research lies in the examination of the solicitation of expertise in a digitally-connected world, where widely distributed and diverse expertise must nevertheless be realized under highly localized conditions.

METHODOLOGICAL APPROACH

Sites of Study

The fieldwork of this ethnographic study first began with online observation of Facebook activity in a group set up specifically during the Colorado Flood event, named *Colorado Equine Evacuation and Disaster Response Network/Fleet of Angels* from September 11 to October 25, 2013. On October 2, a member crossposted a link to the Back Country Horsemen’s website calling for volunteers to assist with the needs of a ranch in a mountainous remote area of Northern Colorado at 8500 feet (2600m) above sea level. The ranch, set on 600 acres and the physical site of study, operates as a breeding facility for competitive show horses, each valued in the tens of thousands of dollars.

The ranch owners were evacuated during the 2013 Colorado floods that began on September 11, following days of heavy rain. The region experienced a year’s worth of rainfall over a four-day period. The ranchers had to leave what were originally 39 horses behind. Parts of county road access to the ranch eventually washed away and became impassable during the storms and the resulting flash floods. Because of the road status, the horses were “marooned”—

this was the official status of people who were isolated in the mountains for the same reason and had to be airlifted in what the National Guard called the largest air rescue since Katrina [32]. Though domesticated animals were airlifted out with their owners, operating on the directives of the PETS Act, livestock were not.

The threat of the conditions at the ranch was serious: rain and flood waters could mold existing feed and damage or limit access to the little remaining seasonal pasture grass. Horses could be standing in sodden pasture, which could then lead to hoof damage. With the owners so far away with limited access to their property as well as a lack of assurance from officials, it was hard to know how dire the flooding and food situations were, or how quickly they might get worse. What is more, the winter season strikes hard and early at that elevation in Colorado, and, as time passed during the month of September, it was unclear whether the horses could survive for long without proper care. Eventually, a group of volunteer “horsepeople”—experienced owners and caretakers who were loosely connected online but describe themselves as “united by a ... common bond and passion” for horses—came to the ranch to move the horses “down mountain” to a temporary ranch location. The “self-assisted evacuation” happened on Sunday, October 6 over the course of 13 hours with more than 60 people—some using their own horses—and approximately 20 trailers participating.

As an important point of clarification early in this story, the number of horses to be evacuated decreased from 39 to 38, which is why both numbers appear in this account. Between the flooding and the evacuation, one of two stallions was killed by the other after they were turned out from their pens into a paddock by a would-be helper long before the expert horsepeople arrived. The stallion’s death was a catalyst for a concentrated mobilization of response from horsepeople, both online and offline.

Ethnographic Investigation

Prior to the October evacuation, the first author had been collecting data on other livestock welfare issues in Colorado in the wake of the floods. She had been conducting interviews with ranchers, feed providers, the emergency hay bank and emergency responders. On October 2 she learned of this ranch’s situation through a Facebook group she was monitoring. From that point on she collected all prior and current Facebook data related to the ranch. She responded to the call for volunteers for the evacuation as a researcher, and became a participant observer who was in direct contact with those coordinating the evacuation.

She assisted with the evacuation of the horses on October 6, shadowing the ranch owner, Trudy, throughout the day as she traversed her large ranch and engaged with horses and helpers. The morning after the evacuation she drove to the temporary, rented ranch where the horses and owners would spend the winter season. There she spent four hours

following up with the ranch owner, employees and two volunteers who had come from Texas to assist. The first author was the only person present at the ranch during the evacuation day who was unfamiliar with horses, a point that delighted Trudy because she knew that the research would not be tainted by the “strong views” that horsepeople often held. We see this research as a multi-sited ethnography [24], with such an approach providing the necessary mobile lens to this particular research environment [2].

We audio-recorded many conversations with Trudy and took nearly 200 photographs of the evacuation. The week following the evacuation, we interviewed seven participants who had volunteered that day plus two officials, a ranch employee, and the owners once again. These interviews were conducted in person and by phone as circumstances allowed. We used photographs taken on the evacuation day in the interviews as probes [1]. In addition we collected personal email correspondence between the evacuation organizers, neighbors and officials. Follow-up questions and interviews by email and telephone clarified points over an even longer duration of time. The interviews were transcribed and then analytically combined with other documents, field notes, and visual data to produce a complete picture of the evacuation’s coordination activities. (We note that all names of people and the ranch used in this account are pseudonyms.)

ANALYTICAL DESCRIPTION

This ethnographic reporting focuses on how loosely-connected members of a community of practice with equine specialization mobilized online and offline, and worked with the ranch owners to organize and implement an evacuation. They recruited help from this community to move the horses down-mountain to a temporary ranch over three hours’ drive away. We document how a larger distributed group of interested observers articulated the full extent of the problem that Trudy faced through remote, mostly online interaction on Facebook, by email, and telephone, which eventually led a subset of them—who did not otherwise know each other, and with some coming from outside the State—to converge on the mountainous ranch location and evacuate 38 horses on a single day.

We identify times of conflict and challenges that were overcome through the flexibility of experts in circumstances that were unusual and emergent. It reviews matters of coordination between stakeholders who had not worked together before over multiple media before and after, and across physical places; and with respect to the “living” inventory of livestock, which imposes a level of urgency and degree of expertise necessary for such an evacuation.

The next section relays an overview of the features of the evacuation planning and implementation. Some portions of the evacuation are highlighted to convey the “telling” examples [5] of the nature of the coordination.

Flooding & Human Evacuation of the Ranch

The owners of Palisades Ranch were subject to a mandatory human evacuation order on September 12, the second and heaviest day of rainfall during the Colorado floods. Trudy, one of two ranch owners and the prominent figure here, made their situation public by posting on her personal Facebook Timeline. They were able to evacuate with their dogs, but left their 39 equines behind. In the flurry of activity in the hours following the human evacuation, a neighbor of the ranch, Alexander, who owned a small plane and so could evacuate but still fly back and forth when the weather cleared, offered to watch Trudy's herd and fly in grain. Due to the weight of the grain, however, Alexander found he was only able to transport three bags per trip—not enough to feed 39 horses. It became clear this was not a viable long-term plan.

Unfortunately, nearly a week after the human evacuation, an unidentified person entered the property and let loose the two stallions who had been penned. It is likely that the person thought the stallions did not have access to food, not realizing that they must be penned for their own and the other horses' safety. When checking the horses on September 18, six days after the mandatory human evacuation, Alexander found that one stallion had killed the other. He suspected a National Guardsman had been responsible for their release, as they were in the area to check on conditions. When she was told of the death, Trudy was deeply saddened but decided against reporting it to officials, saying, "I would not take someone's joy. He doesn't know horses. He thought he was protecting them."

Online Connection

As Trudy relayed information about her situation to her Facebook friends—many of whom were also horsepeople—they started making suggestions and asking questions to grasp the situation. For example, some did not understand how expansive and rugged the Rocky Mountains are, and that the horses could not be "ponied" or led down to the plains. The online followers of her story became more knowledgeable about the situation as their questions and her answers unfolded. The death of the stallion was a particularly important moment in communicating the gravity of the situation. As in any protracted disaster situation and certainly during the recovery phase, uncertainty rules the day while people wait for changing situational assessments and directions about permissible returns to homes. By the time Trudy realized that a "self-assisted evacuation" was the only practical possibility, in large part due to the information gathering conducted by her growing set of online contacts, 13 days had passed from her own evacuation. It then took only another five days to lease a temporary ranch and evacuate the animals.

Trudy's initial Facebook post provoked an unintended but positive response. Thinking that she was sharing only her frustration and distress, she said that she had "50 mares stuck on the mountain" (Figure 1). Having no expectation

that people would come to her aid, what was meant to be an approximate number was transformed into the target that others organized around, and it propagated for the entire time up through the evacuation—and even after the evacuation when there was still uncertainty about the scope of the on-the-ground work that was ultimately conducted.

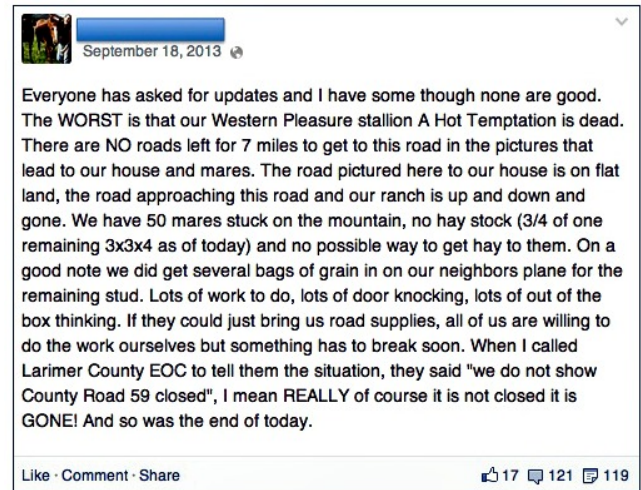


Figure 1. Trudy's Facebook update.

On the same day that Trudy posted news about the death of the stallion, a horseperson in Missouri saw the post and sent a Facebook message to Jane, a ranch owner she knew in Pueblo, Colorado to solicit in-State help. Jane in turn contacted Frank of the Back Country Horsemen of Northern Colorado (BCHA) by email. Though Jane was located in Colorado and could better leverage the equine social networks there, we note that Pueblo is still over two hours' driving time away from Boulder, Colorado (the nearest city to the ranch, which itself was still a distance away). Jane and Frank together began collecting information about the ranch, including its accessibility. Frank contacted Trudy and over the next few days, the three of them pooled information from their conversations with officials. Together, they brainstormed solutions that could help the horses of Palisades Ranch.

Trudy was initially reluctant to accept help. In a follow-up interview she said,

It made me squirm a little bit. I was embarrassed at first ... I'm not used to getting. I'm used to giving. I don't like attention on me.

This confirms our observation that the mobilization was a ground-swelling, and that though Trudy was involved in supplying information about the situation, significant action was being staged by others on her behalf in preparation for the massive undertaking of a 38-horse evacuation. Trudy had never met Jane or Frank, but understood the motivation of the volunteer response was altruistic, and decided to accept and encourage their help.

Conflicting Official Information

As they conducted their planning for a possible herd evacuation, the volunteers did not act independently of officials. Since the horses were not in immediate danger, officials understandably considered the situation low in priority as they were still locating people on the missing persons register. When Frank shared the initial thoughts for an evacuation of the Palisades horses with the Boulder County Sheriff's Office, he was summarily told there was a roadblock along the planned route, and that those who breached it would be arrested.

Frank, whose career had included 25 years' experience in law enforcement, did not give up. He had better luck with Larimer County Sheriff's Office, where he once worked as a mounted officer with the Sheriff's Posse. A "Posse" is a legal entity of non-paid workers who respond to a sheriff's request, and has its origins in the 1800's American West. In response, deputies from Larimer County Sheriff's Office went up to the ranch themselves, checked road conditions, and relayed that there was in fact no roadblock. The disparity of information between the two agencies reveals the kind of information gaps that frequently occur during mass emergencies and are a source of motivation for people taking problems "into their own hands."

In addition, on September 24, Trudy's husband was told that no hay would be slung in by officials, and that they would need to source and fund the feed and its transport themselves. On September 25, the prohibitively high cost of helicopter rental compounded with imminent winter weather brought Trudy into agreement with Frank and Jane, who had been making evacuation contingency plans the entire time. Trudy began to search for a temporary location for her horses.

Online Support: Raising Money through an Auction

While the remotely distributed volunteers and ranch owners made contingency plans for the evacuation, other online helpers sought complementary ways to support the effort. One person created a Facebook group for support, where people began to donate money along with goods or services to be auctioned, with proceeds going towards the needs of the ranch. The donated items were mostly horse-related (clothing, equipment and even stud fees). Participants used the comment threads to bid. Good-natured bidding and conversations ensued across the auction threads. The group celebrated updates by Trudy. Because the first auction attracted a great deal of support, they held a second.

The auctions were set up unbeknownst to the grief-stricken Trudy who was mourning the loss of the stallion and distressed about the rest of the herd. The two auctions raised an astonishing US\$22,000. Trudy discovered the auction's existence after a few days through a reporter who had called her for comment about her "really good friends." Ultimately, the proceeds helped Trudy pay the lease on a temporary ranch and buy hay, which had become expensive due to the water damage of Colorado's hay supply.

Trudy's work led to securing a temporary ranch and the lease was signed on October 1. Trudy, Frank and Jane agreed to set the evacuation to happen five days later—24 days after the rainstorms and flooding began. On October 4, Trudy began to prepare the ranch. Mary, a friend from Texas, came to help, and in turn brought one of *her* Facebook friends, Audrey. Frank continued to make the logistical arrangements for the evacuation, updating Trudy and Jane as he went. Note that this core trio had yet to meet in person.

Information Sharing Built Network of Online Experts

Trudy continued to post online. The posts were shared across the network of horsepeople and organizations, and received many likes and comments, all with messages of support and occasional suggestions of evacuation locations for the horses. The attention of the online community of equine-specialists had clearly been engaged.

When Trudy was securing and preparing a new ranch, she did not have time to post updates on evacuation plans. Instead, Jane and Audrey tagged Trudy in their Facebook posts about the evacuation plans, effectively posting on her behalf since the posts then appeared on Trudy's Timeline.

Date	Event
Sept 12	Ranch owners evacuated.
Sept 18	One of 2 stallions discovered dead.
Sept 19	Jane contacts Frank. Both contact Trudy. Planning begins.
Sept 24	News that there will be no hay drops by FEMA or the State.
Sept 25	Focus turns entirely to a herd evacuation. Trudy begins looking for a ranch to lease.
Oct 1	Temporary ranch lease signed. Evacuation day set. Frank sends email and posts web announcement searching for volunteers, which propagates across social media.
Oct 3	Snow conditions predicted for evacuation day, but team proceeds, with contingency plans.
Oct 4	Trudy moves into temporary ranch. Local reconnaissance on ranch and road network performed.
Oct 6	Evacuation day (with clear weather).

Table 1. Timeline of events.

Expanding the Reach for Help

With the full impact of the planning to move the horses upon them and with time-critical decisions to be made, Frank took on the lead role of soliciting the help of experienced horsepeople through his online networks. Frank asked his partner, Louise, also a horseperson, to take on the role of managing the paper-based administration of the evacuation day, while Frank focused on organizing the volunteers and physical logistics.

On October 1, Frank used his standing and connections as president of the Boulder County Horsemen's Association to

attract appropriate volunteers for the evacuation. Addressed to his “fellow equestrians,” Frank sent an email outlining his plan, stating that he was looking for:

Ten to 12 riders (wranglers), up to 25 4WD three- or four-horse slant load or stock trailers for transport.

To lend authority, Frank explained his recent history with Palisades Ranch and that he was supervising the effort, but that the owners and their employees would have the final say on how the day went. Frank made it clear that “complete cooperation is necessary by all who sign up.” The email was shared throughout the equine community by email, websites and Facebook pages.

Between October 1 and October 6 (evacuation day), Frank received about 100 email messages expressing interest. Not all interested people were appropriate for the task. Frank sometimes needed to correct assumptions and use his experience as a horseperson and former Posse lead to select qualified candidates. As Frank explains:

I had people telling me ... I don't know how to rope or anything, but I'll come with my horse – and I said, rope? What? What are you going to rope? ... I said no, we don't want a rodeo, we want everything calm and quiet.

The selected volunteers were emailed an information sheet that included directions to the property, contingencies in case of poor weather, and cell phone numbers of eight people from the Northern Colorado Back Country Horsemen organization whom Frank trusted. He booked more volunteers to come than he thought were required for what he thought were 50 horses. As he anticipated what faced him, including the uncertainty about the numbers of volunteers who would show as well as the psychological state of the horses, he remained flexible. Frank says:

Working with volunteers is different to when I worked with the Sheriff's Department and we had an operation. You were deputized and by golly, you were coming. We asked you to come, we're going to order you to come and you come. When you have volunteers you can't hardly hold them to that.

After seeing a Facebook post, the Weld County Posse also decided to assist with some of their members in an *official* call-out, even though, remarkably, the originating and the destination ranches were not a part of Weld County. On the evacuation day, the Posse members came in uniform, adding visible authority and underscoring their expertise. However, they did not seek to take control. Instead, they saw themselves as supporting the efforts of Frank and his team. As an existing volunteer group, the Posse was able to mobilize more easily than new, episodic volunteers (something we see in other volunteer situations, eg., [46]). Barb, the Weld Posse coordinator explained that she was not flummoxed that Weld participated when the Larimer and Boulder County Posses did not:

One of the advantages that Weld County has is that we don't have to carry a weapon or be post-certified, so our numbers are much bigger. They only have seven or eight on the Larimer County Posse, so they don't have a big group to draw from.

Note again that Frank and Louise were not local to the area, and were working remotely until the evacuation day. Weather remained poor and work demands meant Frank and Louise could not travel to the ranch to check access. Instead of personally surveying the location to establish best routes, they had a friend who lived locally travel the planned route and identify on a map any unrepaired road damage, and suitable places for parking and loading of horse trailers. This happened on Friday October 4, two days prior to the Sunday evacuation.

We also note that, somehow, the actual number of horses—38 after the stallion died—was never accurately figured or communicated by Trudy. Frank was basing his evacuation logistical preparations on the original 50 that Trudy rather casually communicated in her very first post, which had propagated online. It was even reported over time to be as many as 60 horses, and as few as 45 in the digital tracings we reviewed. This was one piece of information that never got corrected, even on the day of the evacuation, though Frank was not worried about this disparity. This suggests that the tracking of the horses was done based on their “presence” in the pasture rather than matched against an inventory. We will return to this issue.

Evacuation Day

Psychologically Ready the Horses

Evacuation day was the first time the ranch owner had seen her horses since she evacuated 24 days before. The reunions were emotional and took some time, as Trudy welcomed each. Some horses approached her directly while others remained dispersed across the ranch pasture, which was now very low on edible grass.

This time spent was critical to successfully herding the horses. Trudy needed to gain the cooperation of the lead mare, which would indicate to the other horses that the activities and new people were acceptable. Most of these horses were not used to being “ponied,” (that is, being led with a lead rope by a rider on another horse) and as herding animals, equines prefer to stay with those they know. Frank relied on Trudy's personal knowledge of the horses to determine how best to gather and load them in trailers, but when the *in situ* practicalities of timely decision-making and next-in-line trailer capacities presented themselves, he also used those constraints as his guides. Here we see the applied expert management of the inventory as a skillful interplay between a real-life, time-critical “packing problem” [eg. 22] and the psychological needs of sentient creatures.



Figure 2. Riders pony horses out of the pasture.

Summoning of Expertise Trumps Pro Forma Paperwork

On the day of the evacuation, 44 volunteers signed in on a form prepared by Louise, the volunteer in charge of evacuation-day administration. When Louise and Frank reviewed the sign-in forms after the evacuation, they found that because volunteers filled in the form themselves, only a third were legible and many were incomplete. As researchers, we had thought the form was to be part of a security or tracking effort, but interestingly, in follow-up interviews, the organizers said they were more concerned about thanking volunteers afterwards. In addition, Louise brought waivers for volunteers to sign, but with the focus on the practical aspects of the evacuation, they found it too difficult to manage, so none were completed.

Rather, as the hauling trailers left, a volunteer recorded the license plate and number of horses in the trailers. That was on yet another separate piece of paper—which, once again, was never used. The paper and the data it held were not shared with the destination ranch probably in part due to the lack of phone or data connectivity in the mountainous terrain, though the unworried neglect of all of the paperwork brings into question the very value that this particular system of coordinated work attributed to the paperwork in the first place. Furthermore, even though participants afterward stated intention to connect what had been online relationship development to offline interaction, paper tracking turned out to be largely pro forma for both that purpose as well as for inventory management. It suggests instead that management of the inventory was based on the mere presence of that inventory (the shared understanding that if there's a horse, and Trudy says it is hers, we will move it until there are no more horses). The imagined work during the planning processes involved paperwork, and therefore was once again the rationalized version of work as Suchman's contributions continue to remind us [44].

Furthermore, the *expertise* of the horsepeople was what was being summoned—along with patient cooperation—and the

demonstration of their craft to mobilize a heavy and sometimes opinionated inventory was sufficient for granting what resulted in almost unconditional trust. The destination ranch counted the horses as they arrived, but that was primarily to post the information to a waiting audience on Facebook. As Frank said:

We didn't know who was going to be there and what their phone number was. I knew somebody was there, but I didn't know who.

Communication Via Passing By on Set Route

Despite their extensive preparation, new information about the road was discovered on the day of the evacuation. As the first volunteers drove along the seven miles of dirt road towards Palisades Ranch from the highway, they found that in many sections it would be impossible to have two trailers pass each other. The organizers had planned to have trailers coming in and out from the loading area, but they realized that would not work. Instead they staged the trailers further away along the highway at its junction with the dirt road. Two volunteers stayed on the highway with the drivers/trailers and directed them to the “Trailer Loading” area sequentially as it became available. Communication between the two people giving directions and those working in the “Parking & Admin” and “Trailer Loading” areas happened via verbal messages that were passed along between the drivers coming in and out. This worked well, as the two helpers had to only come down twice over the 13 hours to clarify issues.

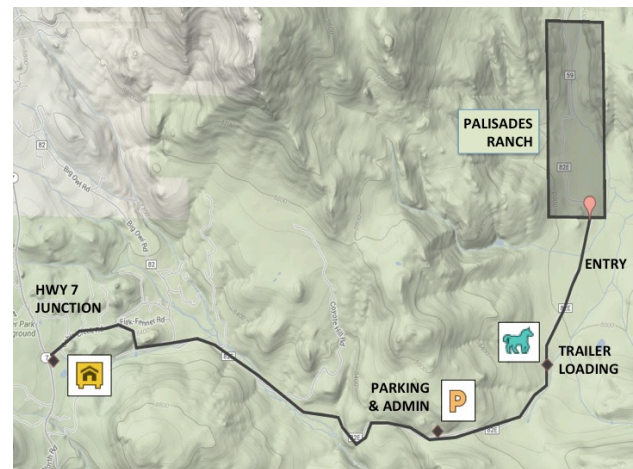


Figure 3. Map of the ranch and the approach.

Indeed, Frank had intended to use radios to communicate across the four staging areas, but their radios relied on line-of-sight and did not work in the woodland terrain. Like the trailer train, riders verbally passed on information at the Trailer Loading Point when horses were loaded and before they headed back into the ranch.

A Distributed Work Environment Enabled by Expertise

The expertise of the volunteers was important to supporting the distributed work arrangements, such that a micro task—for example, ponying a horse—could be performed

within the confines of a person's expertise, equipment and tools, while still working as part of the larger coordinated activity of many horses, people and trailers. Their shared familiarity with equines, tools for managing the animals, and a common equine-specific terminology used smoothed the work which was especially important because they did not know each other. Trudy recognized the importance and value of this expertise:

These people have given more than money. They have given time and talent. That's worth so much more...



Figure 4. Posse members in uniform talking with ranch owner.

Conflict with Officials and Neighbors

The property line at the entrance of Palisades Ranch runs directly along the junction of Boulder and Larimer Counties. Frank had different experiences working with the two counties. One county knew of the evacuation plans and provided information to aid in the planning stages, but communications with the other county stopped with the inaccurate instruction about a non-existent roadblock.

On the afternoon before the evacuation, Jason, a second neighbor whose ranch is located directly adjacent to Palisades Ranch on the Boulder County side, heard second-hand about the planned operation and complained to the county. Jason had concerns about the plan to herd the horses through his property, which was necessary because the county road was washed out through both Palisades Ranch and his own. Not knowing the people involved and having only a civil relationship with Trudy, he was worried that the evacuation would be dangerous, and that some of his horses may be collected along the way. There had been no direct communication between Jason and the organizers until late on the day prior to the evacuation, when Jason emailed Frank, questioning the plans. Frank replied that Jason should speak directly with Trudy, and that if Jason also needed ranch assistance, they would be happy to help. At 2:30am on the day of the evacuation, the Boulder County deputy sent an email to Frank, strongly suggesting rescheduling the evacuation, and at minimum recommending the engagement of Animal Control to:

...assess the condition of the horses... and if there is a legitimate need to immediately 'rescue' some or all of them, then maybe we can make something happen.

Up until this point, the effort had internally been called a "rescue," perhaps in part to mobilize interest. Frank had not thought of the external and legal implications of using this term. In addition, the sudden re-engagement of the sheriff at this late stage of planning exposed a critical failure to coordinate with neighbors. Frank assumed Trudy had shared the plan with her neighbors—indeed, Trudy had written on Facebook about her supportive neighbors—but the relationship between her and this particular neighbor had been tense. In fact, Trudy felt direct communication with Jason was unneeded as there was no intention to involve his animals. On the morning of the evacuation, Frank arrived and reached a just-in-time compromise—the plan to herd the horses out got changed to ponying and leading them out—but not before heated words were exchanged between Trudy and Jason. Frank then renamed the effort to be a "self-assisted evacuation," to clarify intent and plans to those outside the effort.

Keeping Track of Horses & Trailers

The ranch owner, her spouse, and their two staff were the only people who knew the horses' names. They were distributed across the ranch and Trailer Loading area, attending to different needs through the day. They did not have consistent contact with the volunteers at the three key sites—Trailer Loading area, Parking & Admin, and the Highway—and therefore could not name and count all the horses as they were loaded.



Figure 5. Loading horses into trailers.

The highway-based volunteers rotated trailers between the two staging areas in batches of five. When each of the loaded trailers reached the highway, the drivers spoke with the volunteers who confirmed directions to the destination ranch 51 miles away at a 4400ft drop in elevation. The drive was three hours long because of road impasses. The remaining roads were in compromised condition in

numerous areas, and required a high level of skill to navigate with a fully loaded horse trailer. The drivers discussed the best way to make the trip with the aid of printed maps, but they did not have the benefit of feedback from those who had already made the trip. Happily, as the afternoon progressed, a Boulder County Sheriff's deputy (who came to see the progress) relayed that a major canyon road closed since the floods would reopen late that day. This reduced the trip by one hour, allowing the last few trailers to travel the steepest part during daylight.

Errors that Disrupted the System

Late in the afternoon, coordination around the horse trailers, which had been going well, went awry. A series of miscommunications about the number of horses awaiting evacuation had propagated through the system. A local rider, Angela, who had been ponying horses and was leaving the site on her own horse, passed through each of the staging areas—the Trailer Loading area, and Parking & Admin—and finally she saw five trailers moving toward the Parking & Admin area from the highway. Angela performed a personal calculation of horses that still needed to be evacuated, the trailers she had observed in the parking area as she left, and then those waiting on the highway, and thought some would not be needed. What she did not realize, however, was that Frank had planned that the riders would not do the additional, tiring task of transporting the evacuated horses, given that there were less than the planned 50 horses. In other words, Angela did not have a view of the distribution of labor, and though she had performed a calculation on the material evidence (marooned horses and trailers) and presumed that to be evidence enough (and indeed, that had been how they had been working), the immaterial aspects of work were beyond her ken, and meant that she could not assign proper meaning to the material evidence. With this (observed but incomplete) information as her rationale, she told the five drivers they would not be needed.

Upon hearing this erroneous news, the trailer drivers turned around and returned to the highway where one of the highway volunteers assured them that they *were* needed, emphatically asking Angela where she had gotten her information. Angela was confused but apologetic. In a follow-up email, one of the affected trailer drivers said,

I felt confident that [highway volunteer] had been down where the loading was and had the updated information. The person on the horse was riding out so I questioned (in my mind) how she could know how many were left.

Another problem came up later in the afternoon when a man named Harry who knew the ranch owner personally arrived to help. Trudy and Harry had agreed privately that he would take the single remaining stallion and another equine to the new ranch, but neither had shared this plan with the organizers. When Harry arrived at Palisades in the early afternoon, for some reason he thought the evacuation process was not a good one, and simply informed the

volunteers at the Parking & Admin area he would “go down and check it out.” The volunteers deferred because he said he was affiliated with the owner—they thought he was an employee. Harry loaded five horses at the Trailer Loading area and brought them up to Parking & Admin where trailers were waiting to go down to the Loading area. Instead he unloaded the horses from his trailer, and reloaded them on the trailers at this higher point in the loading sequence. This reordering of the process disrupted what had been a smooth system. It upset the horses, and disrupted the pattern of coordinated work the volunteers had become accustomed to. After Louise complained, Harry acknowledged her authority and that his adjustments were not helping. They reverted to the original process, and Harry moved only the two animals to the temporary ranch, as originally planned.

We see these disruptions as insights about how much the group grew to depend on repeatable, clear actions taken by others, which was the basis for quick development of intersubjective knowledge between people and horses they did not know, and for a task that they had never done before, but which had to be completed before dark. First, we see how Angela became so dependent on the direct mapping of available-horse-to-available-trailer method that she did not realize that other plans, which were invisible to her, were in place for managing the apparent excess of trailers. Second, we can see how the distributed group used stations in the landscape to mark the stages of work that were repeated for every horse. The breaking of the coordinated patterns of work as they were mapped to the landscape disrupted a system that worked without a great deal of immediate communication between people at the different stations.

Home on the Range: Arrival at the Destination Ranch

There were three volunteers at the destination ranch to receive the trailers as they arrived: Jane, Mary and Audrey, introduced earlier in this narrative. Nobody at the new ranch knew how many trailers to expect, nor when they were likely to arrive because of the spotty cell phone reception. As the trailers began to arrive, it was clear some organization was going to be needed to prevent bottlenecks on the driveway. A fourth volunteer was found in Jodie, an employee from the telephone company who had earlier set up the phone service and wanted to help despite a lack of horse experience. She stationed herself at the driveway entrance, and as trailers arrived, she held them back until Jane and the others were ready to receive a new trailer.

In contrast to the loading at the evacuation site, where attention was paid to putting horses that got along in trailers together, these volunteers had no personal knowledge of how best to paddock the horses together. Rather, Jane, Mary and Audrey, as experienced horsepeople, observed the horses' behavior. Audrey said:

I knew to watch them. If there was a problem in the paddock I was ready to go in and remove a mare and put her in the other one.

Happily, apart from a few scratches and rubs from the side of the trailers, the horses were not injured, and were successfully penned in the new paddock. By 8pm the evacuation was complete. Trudy arrived at the new ranch just after the last trailer had left. Trudy was told the horses were all well, and the evacuation was deemed a success.

DISCUSSION

There are many lessons from this account. We will discuss: first, the *improvisational nature of emergency response*; second, *expertise in safety-critical work*; and third, how these matters play out in *ensembles of online and offline work* where the expanse of digital connection as well as the situated, co-located and collaborative expression of expertise intersect.

Threaded throughout these arguments is the idea of distributed cognition particularly as it materializes in the on-the-ground work, but also through prior online preparation. Through this lens, we see how ideation of solutions sprung from uncertain expressions of problem statements which were quickly forwarded to the local (or local enough) domain experts—horsepeople in Colorado. We see how expertise interacted with the material conditions of work in a way that suspended the need for having prior working relationships with one's colleagues-of-the-day. Much like other specializations—air traffic control [10,23], subway control centers [12], and snow sweeping [18]—the actors do not necessarily know each other, but they trust their own expertise, others' expertise, and common features of the material environment to allow coordinated work. The interesting matter here is that such a large-scale evacuation in an environment impacted by flooding was something that no one had prior experience with; this is where a number of psycho-social phenomena came into play, such as the human tendency to “make do” and improvise with tools at hand, as well as the idea of reciprocal trust springing from mutual liability. From a distributed cognition perspective, we see how Frank as the “expertise concierge” (in the words of McDonald and Ackerman [25]) reduced the macro goal of herd evacuation into a horse-by-horse evacuation, leveraging the constraints of trailers and making use of the road network as a structure to enforce ordering through queuing and sequenced communication. We discuss these aspects in greater detail.

Improvisation

In this account, from the perspective of emergency management we learn how intentional a self-organized response can be. Mass emergencies call for on-the-fly flexibility to adapt to changing circumstances and available resources over large numbers of people. Mendonça, et al. [26] and Kendra and Wachtendorf [20] have characterized this as *improvisation*, which has strong parallels to the conversations in CSCW about the nature of situated

cognition or situated work [14,44], as well as the relationship between informal as well as formal aspects of work [30,44]. The difference in the discussions around improvisation is that it is often attached to large-scale endeavors of work. As such, in discussions around mass emergency, a focus is on how members of the public converge onto disaster sites to help physically [7,21,45]—and now digitally as well [42,47].

They interact with formal aspects of the response to use whatever resources they can access to perform even critical tasks like rescue, transportation to hospitals, and debris removal [20,26,45]. Notable is the stunning waterborne evacuation of a reported 500,000 people off Lower Manhattan in the wake of the 9/11 attacks as insightfully told by Kendra and Wachtendorf [19] where a “motley” array of personal and commercial vessels converged onto Battery Park in an orderly though clearly unplanned affair. Though this is a point that social scientists of disasters have been making for years [21,40], it is one that somehow fails to significantly permeate federal policies and even simple everyday conceptualizations about the nature of mass emergency work [30].

As accounts of similar phenomena in the online space are reaching the research world, other doubts ensue about exactly how the online work “matters”—about how it connects to the “real work” on-the-ground. We presented this debate at the opening of this paper, and why it might be justified, but also why it is a problematic question. It is probably being asked too soon and of a world in which it is difficult to have both a watchful eye on the online response and be staged to be in-place to observe the connected activity on the ground, assuming it happens at all.

Here we see that it does happen, though how much is not something we can answer. But a rare disaster put us in the right place at the right time for such behavior to become apparent. This horse evacuation case teaches how the improvisational work of domain experts produces sustained commitments to work (over a month long) with the open-ended parts of the problem being staged online until it could culminate in the execution of offline work, also requiring domain expertise.

Expertise in Time- and Safety-Critical Work

Expertise is a type of embedded knowledge developed within a cultural, social and cognitive environment [6]. Expertise is the ability to apply knowledge in different contexts [6], including in emergent situations that require experts to improvise, as Normark and Randall note [29].

In the horse evacuation, we see how relevant domain expertise made this event come to life, with all the initial ideation arising out of a demonstrable online interplay between statements of distress, problem articulation through public questioning and suggestions, and the alerting of a community of practice around horse care. Indeed, effectively all of the evacuation planning—except for the

securing of a temporary ranch—was done by people who were unaffiliated with Palisades Ranch or the owner, Trudy. The volunteers connected through their expertise and mutually witnessed the gradual scaffolding of the problem articulation and solution for a situation that, as fellow horsepeople, alarmed them. We note that as horse lovers, they may have been acting to benefit the horses even moreso than their owner Trudy, as we have seen demonstrated in other studies of pet advocacy mobilization [47]. Some who did not assist with evacuation planning instead participated in auctions online that raised significant funds, but notably around items all related to equestrian matters—reinforcement of this being a community of practice at work.

At the site of the evacuation, participants arrived mostly knowing what roles they would play—riders, drivers, and administrative roles, with those assignments reinforced by the type of equipment and helper-horses they were asked to bring. However, uncertainty was still of course present. This uncertainty was mitigated by intersubjective knowledge that specialized experts share, in this case about the business of equines. Work in flight deck operations [15] articulates how intersubjectivity enables overlays of even incomplete gesture or speech upon artifacts to constitute meaning between only the people who have interacted with such socio-material environments before, even when they have never worked with each other, and we see similar behavior here in the loading and transporting of livestock.

Further, calling upon Fitzpatrick's ideas, this was an environment where expertise was deferred to and leveraged rather than seen as a commodity to be managed in such a way that it strangles innovation [6]. In fact, the pride of specialization enabled professionalism and mutual respect of people because of their craft. In addition, their expertise is *about living creatures* and the uncertainty that comes with horses as social individuals further highlights the respect for equine expertise across a very large and distributed community of practice—the horses were also actors in this ensemble.

We have noted how trustful Trudy had to be of people she did not know—indeed, they are people she cannot even personally thank because the paperwork system “failed.” In this event, she knew she would need to relinquish control (which might have been a reason she delayed her decision). But in turn we must also recognize that the volunteers were voluntarily assuming liability in driving in terrain and roads that had been damaged in recent floods, where the connection to the official response was unclear (though earnestly pursued), and in carrying horses on their equipment after a taxing day. We see this as “reciprocity of liability” but critically, it was based on *the implied consent that only experts can give*, and this is what made the arrangements work.

Ensembles of Online and Offline Work

We therefore see features of expertise being leveraged to different advantage in online and offline settings, and that had corresponding temporal qualities.

Digitally Casting a Wide Net to Help with Rare Problems

In the initial weeks, long before Trudy had even imagined a herd evacuation, her distress unintentionally brought experts to the fold who asked her questions and made suggestions that more precisely identified and articulated the problem. They sought details about her ranch, the horses, the terrain, and the post-flood conditions. The digital world allows the casting of a wide net to gather expertise, which can be very useful when the problem is rare or uncertain, as it was in this case.

Expertise In Situ to Execute Solutions

Studies of work practice in co-located safety-critical environments, many of which we named earlier, examine how people employ not only intersubjectivity, but also mutual awareness of action that arises from being co-located [3,12]. This was certainly at play on the ranch in both macro and micro ways. The evacuation of the horses depended on the presence of the horses being in the pasture rather than any kind of starting or even exiting inventory. In micro ways, the riders, loaders, and unloaders “read” the horses’ temperaments and relationships to other horses to best lead and load them. They took their cues from where they were in the chain of four staging areas to know what to do next, and from their spatial relationship to each other and the horses. Notably, while these smaller tasks included long stretches of waiting, therefore requiring a great deal of patience over a long and tiring day, these workers remained dedicated and were sustained by a persistent commitment to the larger, shared goal of evacuation. The calm that blanketed the group was a result of their shared expertise, even in an untested situation. Certainly, in the aftermath of disaster, calm operatives are a highly valuable commodity.

The Magnifiers of Uncertainty and Social Media

However, the awareness of the work in the large was imperfect, and based on sometimes hastily written posts by Trudy that said, for example, that her many neighbors were supportive—but no one directly consulted the *adjacent* neighbor whose land they had to traverse to get around road damage. This became a problem during the evacuation and indeed someone affiliated with the recalcitrant neighbor referred online to the event as a “manufactured crisis” and “fiasco.” It is not the goal of this paper to judge whether the evacuation was ultimately necessary, but we do highlight the tensions around this issue, which shed light on the function of expertise, the uncertainty of disaster, and social media as a mechanism for participation in disaster response.

We note that there are many indications that suggest that the evacuation was important to the ongoing welfare of the animals and ranchers: One horse had already died, and our direct on-site observations witnessed the surprising and extensive damage of mountain roads. In addition, Trudy

remains in her temporary ranch because county road repairs are incomplete at the time of this writing, 10 months after the flooding.

Some participants called the experience “life changing” in that it offered a new view of what they themselves could do and what could be done in community-based disaster response. In an interview a week after the evacuation, Frank, the lead organizer noted how remarkable the effort was, though he also said that once he got up to the ranch he observed that “in my mind, [the situation] was worse than it was.” Jason (the recalcitrant neighbor) and some emergency managers also questioned the action. We may believe that in their general unwillingness to support the effort, officials were simply unaware of the needs of livestock in this event. However, Jason, who felt the effort was extreme, is also an expert horseperson who resides directly next to the ranch.

Some may conclude with the benefit especially of Frank’s hindsight that the situation was exaggerated, but this is a dangerous place to land, because by doing so we miss many finer points about the nature of collaboration and emergent problems. Note that Frank does not regret the actions he took, only that the actions might not have had as drastic a benefit as perceived *a priori*. Such is the situation with disaster. We easily dismiss how *uncertain* situations of disaster are or can become, and how a goal in safety-critical work is to avert situations *before* they become problems. Much of the work in safety- and time-critical matters in CSCW appreciates the implications of this goal on vigilance, mutual awareness, and, of course, error, especially propagated error. It is all too easy to blame “pilot error” when a sequence of preceding systemic conditions took place to set a pilot up for perceiving the problem as he or she did [34,48], including one that warns of hazard. Indeed, disaster can *magnify* problems, not necessarily out of proportion, though that can happen, but rather too so that we focus on specific details when many things are happening. Both meanings of magnification are at play in emergent disaster situations that require rapid action as problems are gradually articulated.

We note that neither the officials nor Jason were engaged in the social media attention on the ranch as the evacuation was being planned. Calling upon media theory, which considers how mass media frames and focuses the kind of attention an event receives, e.g., [4,8], social media can do the same. Recall that the event was initially called a “rescue” suggesting immediacy and danger. The death of the stallion was dramatic and unusual. The public display of questions and answers about the situation not only scaffolded understanding of the parameters of the problem, they engaged and compelled a watchful audience. Finally, the Colorado floods achieved international press: it was a significant disaster event. We might see the plight of Palisades Ranch as a “way in” to grapple with the largeness of the event that engaged the hearts and minds of a community of practice. The focusing comes from the razor-sharp

understanding of the possible problems that can occur in ranching, if not in disaster.

So, notable in this case was that the starting conditions were not known to anyone involved in the earliest planning. Coordination happened “in the dark,” that is, without environmental feedback of what they were facing. Even Trudy could not access her ranch—the weather on the Colorado Front Range had been terrible for days, even weeks. Exposed “burn areas” from prior years’ wildfires in the mountains created unsafe conditions for traversal by cars at risk from mudslides. Indeed, emergency personnel discouraged passage so that they could continue with missing person recovery and airlifting, which happened for days after the rains stopped. Ranchers were immediately worried about the viability and pricing of the Colorado hay supply. They had concerns about getting supplies up before winter snow storms set in, which weather forecasters said were imminent. The surprising turn of what amounted to glorious weather on the day of the evacuation was seen not as evidence for miscalculation about the severity of the situation, but rather as a stroke of luck by the volunteers who had brought snow chains and cold-weather clothing.

So disaster—that is, uncertainty and threat—combined with the delivery by social media to a very particular audience attenuated the need for action—highly crafted action.

Materiality of On-Site Expertise

Finally, work in CSCW and distributed cognition has long considered how artifacts mediate and enable work. As we have described in this account, physical presence and properties of equipment—specifically trailers in our telling here—played a role in supporting coordination, or even in the failing of it (citing the mistaken rider who told drivers to leave).

The visual traversal of trailers across a shared route, even though there were four different staging areas some miles apart where trailers waited and horses were loaded, meant that over time the coordinated work was made visible as each trailer passed on their way in and out. Riders and drivers also passed on information to the volunteers staged at each site, which ensured a mostly common sense of the state of the work. The presence of breakdowns show that the system was otherwise going smoothly, and the team worked quickly to revert back to a functional state.

Furthermore, to link this back to the matter of expertise, we see that expertise was displayed through material objects: people wore clothing that was consistent with their identification as equine experts (such as boots and cowboy hats), and the Posse members wore their uniforms. At the ranch, one job was to hand out halters and lead ropes to riders. If riders’ preferred materials were not available, their expertise allowed them to adapt to what was at hand. As Rosner [35] explains, this goes beyond the “affordances” of objects [28] and instead goes to what the tools represent to their craft and their expert execution of work. Recalling an

earlier quote, even the misuse of ropes as a tool when stated only as an *idea*—“*I don’t know how to rope or anything*”—is a sign of a novice.

Conclusion

In this study we describe how the problems incurred by the 2013 Colorado Floods on Palisades Ranch saw the convergence and blending of online and offline expertise. Social media enabled the problem that the Palisades Ranch faced—the marooning of 38 horses—to be made visible, which had the consequence of casting a wide net to locate, engage and mobilize appropriately skilled people throughout a community of practice. These volunteer responders brought their expertise to this unusual context, and improvised throughout the planning and execution of a livestock evacuation. The ever-present information gaps and challenges inherent in disaster response were overcome through the pursuit of coordinated work, which came about through the blending of grassroots and managerial activity; intersubjective knowledge that comes from expertise; and in the physical display of the movements of the horses and equipment across the geographical landscape. Activities conducted on- and offline frequently though discontinuously connected the two spaces across the long span of the event. However, we must recognize that there were also marked breaks of connection between the offline sites too (the two ranches and roads in between), and that those disconnections arose due to the terrain, conditions and distance. In other words, the imagining of work that can be conducted online and offline should not be reduced to simply to a matter of nominality (that is, “online work” versus “offline work”), but rather understood with respect to the disaster conditions that temporally- and spatially distributed collaborative work must accommodate.

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