

Crowdsourcing in the Field: A Case Study Using Local Crowds for Event Reporting

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Abstract

While crowd work typically involves tasks that performed at any time and anywhere, some tasks inherently require the physical presence of workers at a specific time and location. This paper presents a case study of a hybrid crowdsourcing process that involves the collaborative production of event reports using a combination of local and remote workers. The process extends human computation into the physical world by using local workers to collect information in person at events and remote workers to curate the collected information and generate event reports. We deployed the process at 11 events, employing 84 workers, and identified the challenges local workers face as constraints in mobility, time available to perform tasks, unpredictability of events, and interaction with others. We discuss issues related to collaboration with remote workers and bias in field reporting, and conduct a qualitative analysis to make design recommendations for extending human computation into the physical environment.

Introduction

The vast majority of crowd work involves tasks that participants can perform anywhere and at any time. Having access to a networked computer is often the only requirement for remote crowd workers. However, some tasks inherently require physical presence at a specific time and location. Recent commercial, location-based crowdsourcing platforms have leveraged local workers' physicality to perform tasks with spatio-temporal constraints (Teodoro et al. 2014). For example, people use TaskRabbit for the delivery of goods, help with errands, and home repairs. Similarly, Gigwalk allows businesses to collect information about products on sale at specific locations.

In our study, we employ location-based crowdsourcing to address the dearth of local news that has resulted from the

decline of news organizations (Snyder & Strömberg 2008, Pew 2014). We do this by producing crowd-based news reports (see example snippet in Figure 1) for 11 small, local events across the United States, including neighborhood festivals, craft fairs, public lectures, and town hall meetings. We employed 84 local and remote on-demand workers from TaskRabbit, oDesk (now UpWork), and event attendees as volunteers. Applying a general-purpose crowdsourcing framework by Kittur et al. (2013), we introduce and examine a crowd work process for local event reporting. We explain how we map each of the framework's four components—workers, work design, workflow, and output—to our local, situated context.

Our findings reveal four primary insights regarding hybrid local-and-remote crowdsourcing environments. (1) Local workers must overcome challenges posed by the physical environment. These include mobility constraints, time constraints, and event unpredictability (e.g., rescheduling of an event). Each constraint affects the worker's preparation time, the number of completed tasks, and their adaptability to changes in tasks and event schedules. (2) Local workers have the opportunity to interact extensively with event attendees. This can lead to



Figure 1. Snippet of a crowdsourced report of a local event.

greater engagement but also result in distraction. (3) Local workers need to collaborate with a remote coordinator to ensure that the information collected represents all of the information needed for the final report. (4) Paid workers produce more authentic, fact-based reports, but volunteer community members can offer richer context. This paper provides insight into how to design location-inclusive crowd systems. Our findings inform the design of systems that extend human computation into the physical world.

Related Work

Our hybrid local-and-remote process of crowdsourcing builds on a growing body of research into local crowdsourcing and citizen journalism.

Local Crowdsourcing

Crowdsourcing now extends beyond the digital world, being used for physical tasks such as attending meetings (Cheng & Bernstein 2014), staffing vendor kiosks (Heimerl et al. 2012), monitoring environmental conditions (Stevens & D'Hondt 2010), and providing running support and data collection (Flintham et al. 2015, Curmi et al. 2015). The recent rise of on-demand mobile workforce, supported by companies like TaskRabbit and Gigwalk, has created new opportunities for requesters to hire flexible workers for tasks that require physical presence (Teodoro et al. 2014).

Prior research related to local crowdsourcing has focused on *mobile crowd work* and *ubiquitous crowdsourcing*. Mobile crowd work leverages workers' abilities to complete crowdsourcing tasks from their phones (Eagle 2009, Narula et al. 2011). However, most mobile crowd systems do not take advantage of workers' mobility or location. Instead, they use mobile phones to announce or access general crowdsourcing tasks. Crowdsourced public displays (Goncalves et al. 2013, Goncalves et al. 2014) sometimes rely on local workers' expertise about their current location, but the requested tasks tend to be similar to those performed online and do not take advantage of the workers' mobility.

Ubiquitous crowdsourcing leverages workers' device-sensing, networked capabilities (Vukovic et al. 2010, Vukovic et al. 2013) and do not necessarily require active involvement from participants. People passively contribute data via automatic sensing (e.g., sensor information about electrical events (Gupta et al. 2010)) or through explicit contributions about, for example, bike routes (Erickson) or noise pollution levels (Stevens & D'Hondt 2010).

Previous research has found that people are willing to answer questions (Nichols et al. 2013, Konomi et al. 2009) or capture information (Vääätäjä et al. 2011, Vääätäjä et al. 2012) while on a mobile. For example, Vääätäjä and colleagues used location-based crowdsourcing to enable news producers to announce tasks for anyone to accept

(Vääätäjä & Egglestone 2012). The tasks required crowd workers to gather information. After that point, the newsroom—not crowd workers—wrote and produced the news story. By contrast, our approach replaces the entire news creation process with a non-expert hybrid crowd.

In summary, local crowdsourcing research has focused on providing workers with simple tasks that make use of their location or mobility only. We extend this work to use the hybrid combination of local and remote crowds, and study what it means to integrate tasks that require mobility into a larger workflow. This enables us to build a rich picture of the unique aspects of local crowdsourcing.

Crowdsourcing News Reporting

The specific process that we crowdsourced was news reporting. New media has enabled the public to play a more active role in reporting newsworthy events. Citizen journalists have covered a number of important events, including terrorist attacks (Cassa et al. 2013), revolutions (Lotan et al. 2011) and disasters (Starbird & Palen 2013). As news organizations reduce the resources devoted to reporting local events (Pew 2014), citizen journalists could be key to covering smaller events. Existing research suggests that non-experts can engage in information collection assignments (Vääätäjä & Egglestone 2012, Vääätäjä et al. 2012). The role of the public in generating news content is now common enough that even large news organizations, such as CNN (2014) and the Guardian (2014), invite the public to provide tips, photographs, and videos. However, citizen reporting tends to be undirected, and dependent on the work of volunteers who happen to be motivated to contribute at the right time and place.

News organizations typically use citizen contributions for major breaking events that their staff subsequently covers. Instead, our focus is on local events that do not currently receive news attention but are of interest to residents in small communities. We build on guidelines for citizen journalism (Knight 2014, CNN 2014) to manage crowd workers through information collection. Research has demonstrated that crowd workers have the ability to write journalistic articles given the necessary content (Bernstein et al. 2010, Kittur et al. 2011). This allows us to explore an end-to-end process for coordinating local workers (who collect the information) and remote workers (who transform the information into an article), with a focus on the unique aspects of using local workers to source the raw content.

Local Events Studied

To explore the use of crowdsourcing at under-reported local events, we deployed a hybrid crowdsourcing process at 11 local events using a case-study approach (Yin 2009). The set of deployments were designed to cover a range of events,

<i>Event</i>	<i>Name</i>	<i>Description</i>	<i>Access</i>	<i>Size</i>	<i>Duration</i>
NFEST	Neighborhood Fest	Neighborhood festival by local organizations; mayor attended	Open	Medium	Hours
ART	Art Show	Local tile makers showed and sold their work	Open	Medium	Day
NET	Town Hall Talk	Internet personality gave a talk on his/her book at town hall	Closed	Medium	Hours
TRAN	Transit Meeting	City members and transit organizations discussed changes	Open	Small	Hours
CRIM	Crime Prevention	Monthly crime prevention meeting at senior center	Open	Small	Hours
CSCW	Conference Talk	Two paper sessions from a computer science conference	Closed	Small	Hours
COLD	Midwest Cold	Cold weather in the Midwest caused unusual amounts of snow	Open	Large	Month
HACK	Hackathon	Three-day internal Hackathon at technology company	Closed	Small	Days
SHOP	Group Shopping	Neighbors shopped at local business to support local economy	Open	Small	Hours
SXSW	Music Festival	South-by-Southwest Music Festival prep prior to main event	Open	Large	Days
CLAS	Class Presentation	End-of-term student projects presentation day	Closed	Small	Hours

Table 1. Summary of the events covered in our study. Most events were open to the public, small (<100 participants) to medium (>100 participants) size, and lasted only a few hours.

each with different topics, audiences, sizes, and durations. The events are summarized in Table 1.

Most of the events we studied were selected from event lists publicly advertised by the city or suggested by neighborhood bloggers or journalists who participated in the study, including town hall meetings (NET, TRAN, CRIM) or festivals (NFEST, ART). Events lasted from a few hours (CRIM, NET) to a couple of days (HACK, SXSW). For some events we used only paid workers (NFEST, CRIM), while at others we sought community volunteers (SHOP) or a journalist evaluating the system (CLAS).

We focused primarily on community-based events that would have had limited or no news media coverage or local blogger attendance (CRIM, ART, TRAN, NFEST, SHOP). The events were public and represented activities of small bounded communities. This focused the tasks of the reporters to similar types of work across events and similar interactions with the environment.

Crowdsourcing Process Design

Throughout each deployment, we iterated on the details of the crowdsourcing process used to produce a news article about the event. While some of the tools used by the workers changed across events, the overall process remained the same. For example, workers had the same requirements of submitting photos or videos at each event, but used different tools to submit them. We made iterative changes to improve bottlenecks in submission of content or interaction with users. We defined the roles and tasks required of the workers based on a general-purpose crowdsourcing process (Kittur et al. 2013) with four components (see Figure 2):

Workers: Recruiting workers and evaluating their internal motivations to participate.

Work design: Dividing a complex task into smaller ones that crowds can complete.

Workflow: The process workers use to perform the crowdsourcing tasks that lead to the requested outcome, which involves collaboration, or quality assurance.

Output: Reports submitted by local workers and the resulting articles reporting on the events.

We now describe how we defined these components in our hybrid crowdsourcing process.

Workers

Recruitment: We recruited 84 crowd workers for the 11 events, at a cost ranging from \$0 (for volunteers) to \$938 per event (see Table 2). Depending on the event, we recruited workers from TaskRabbit, oDesk or the community associated with the event. The number of workers was a function of the event’s scale. With a day’s notice, we were able recruit up to three paid workers and 24 community volunteers. We selected crowd workers based on user ratings and the expertise indicated in their profile (specifically: taking photos, writing, and blogging).

Worker Motivation: While most workers were financially motivated, some volunteered to contribute to their community at certain events. Community volunteers reported on four events: the Hackathon (HACK), the Group Shopping event (SHOP), the Conference Talk (CSCW), and the Class Presentation (CLAS). We recruited community volunteers through Facebook posts, paper fliers, and mailing lists. Events involving community volunteers had significantly more reporters than those using paid workers.

Work Design

We based the task decomposition on common journalistic specializations (photojournalist, editor, writer), which is similar to how other citizen journalism apps divide content requests into capturing photos, videos, or text (CNN 2014, Guardian 2014). We distinguished between the following roles: (1) reporter, (2) content curator, (3) writer, and (4)

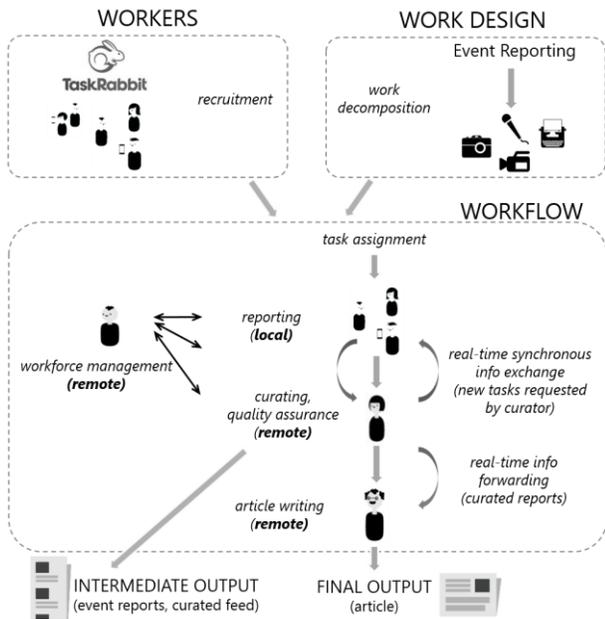


Figure 2. Hybrid crowd event-reporting process

workforce manager, described below. Workers performed their roles synchronously, with some workers (the reporters) physically attending the event and others (content curators, writers, and workforce managers) working remotely to write the article. The role separation was advantageous because it allowed for flexibility in the location of most workers, and all deployments involved some combination of local and remote workers.

(1) Reporter (local): Local reporters physically attended the event and completed a set of assigned reporting tasks. We decomposed tasks based on the content we wanted to capture in the resulting article. To explore the feasibility of such tasks, initial deployments provided the reporters with very little direction. At some events, we simply asked reporters to take pictures (NFEST-CSCW). However, as local event reporting is often intended to capture a specific aspect of an event, in later deployments we developed more

targeted tasks to aid workers in capturing specific information. For example, to develop an article about how locals prepared for the event (SXSX) workers were given targeted tasks like “How does SXSX effect locals’ daily lives? Ask for individual stories, take photos,” to develop an article about why the local community participated in the event (SHOP) they were given targeted tasks like, “Tell us something you learned about the business [that you support].” These tasks were defined with the help of article requesters: a journalist (CLAS), or an event organizer (SHOP). During each event, reporters submitted content as it was created. Workers received additional tasks throughout the event if their remote collaborators requested additional information.

(2) Content curator (remote): Curating consisted of assuring the quality of the reporters’ work and providing feedback through synchronous collaboration. For quality assurance, the curator signaled whether reporters were doing their job in submitting appropriate content in a timely manner and that was not plagiarized. Curators communicated with the reporter either by acknowledging receipt of the report or by asking the reporter to perform new tasks. The curator’s output comprised set of tasks for the report and a live feed of curated reports for the writer.

(3) Writer (remote): Writers produce the event articles based on the curated feed. The writing typically took place as reports were produced, in real time during the event, using the curated live feed. The curator and writer roles were combined in most deployments. The writer usually produced a *listicle*, a short-form article that uses a list structure (e.g., “5 things you missed at the town hall meeting”). We encouraged a listicle format because it was easy for non-experts to write and for audiences to understand, and intrinsically favored photos. The article often included a photo or video for each list item in addition to text.

(4) Workforce manager (remote): Every event required a worker who was available on demand to perform

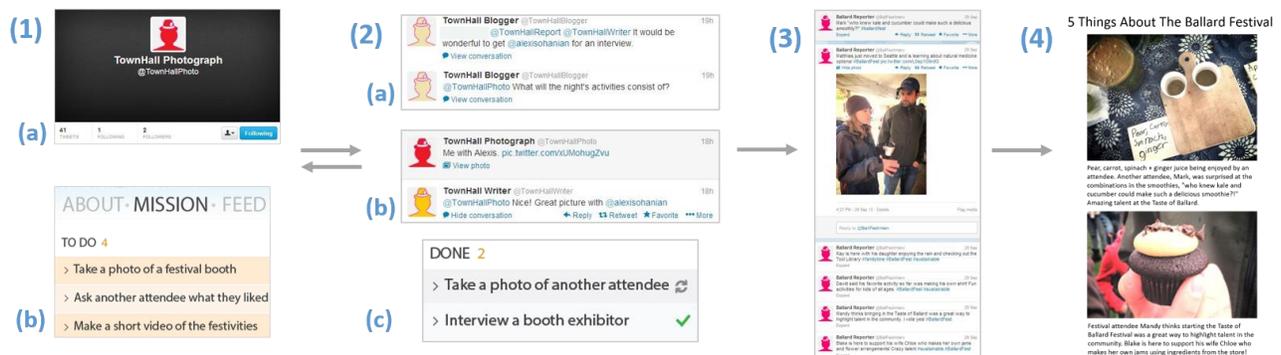


Figure 3. Examples of content produced as part of the crowdsourcing process. (1) Tools that workers use in the field: (a) Twitter profile, (b) Eventful app. (2) Information exchange with remote worker: (a) Curator asks for details, (b) Curator gives feedback, (c) Eventful tasks confirmed as submitted in the interface. (3) Curated feed of content. (4) Final article

workforce management. The workforce manager was familiar with the entire process and recruited the workers. During the initial deployments the research team typically played this role, while a workforce manager was hired (or volunteered) to communicate with the other workers at some of the later events. These workforce managers were given a template to follow describing the role.

Workflow

The workers involved in the process exchanged information with each other to create the final event article. The article requester, researcher, or event organizer interacted with the workforce manager to provide the event information necessary to get the process going. However, the requester did not need to be aware of the details involved in event reporting, as the workforce manager interacted with all of the workers to provide task instructions, and if needed, answer last minute questions from field workers.

Reporters communicated with the curator through the information they submitted. For example, one curator (serving as both writer and curator) asked: “*Could you ask Paul a question for me? Ask him what is his favorite thing to draw on his tiles,*” and “*Did he [the speaker] specify which Y! executive that was?*” He then received a report containing the specifically requested information. These requests and replies, as well as confirmation to the reporter that their submissions were received, were transmitted through the technology used for reporting

We used various different technologies to support work assignment and communication (see Figure 3). Participants used one or more of these to submit content:

- (1) To communicate instructions to workers, the researchers and the workforce manager used email.
- (2) To submit textual reports, post new tasks, and share content with writers, local workers used Twitter or Eventful (Agapie & Monroy-Hernández 2014). We selected these apps because they allow for easy submission of text and photos, while also allowing for the receipt of prompts for new tasks from the curator. They also facilitated the writers’ access to curated content. We used Twitter in the early deployments (NFEST-CRIM). We switched to Eventful because workers were not familiar with notification features of Twitter, thus missed the curator feedback. Eventful uses only email and a web browser for communicating content.
- (3) To facilitate the recording of audio and video, local workers used Soundcloud and YouTube for uploading content (CRIM, NET, and TRAN events).

Output

The output of the process consisted of the workers’ reports and the writers’ articles. The articles were typically written within a few hours of the event, with a standard word processor (e.g., Microsoft Word) and a blogging platform

Event	Local		Remote		Incentive	Total Cost
	#	Roles	#	Roles		
NFEST	1	Reporter	1	Writer	Paid	\$122
ART	1	Photographer	1	Writer	Paid	\$107
NET	2	Photographer Interviewer	2	2 Writers	Paid	\$147
TRAN	1	Reporter	3	Writer, Manager,	Paid	\$98
CRIM	1	Interviewer	3	2 Writer, Manager	Paid	\$60
CSCW	10	Reporter	1	Writer	Paid, Community	\$214
COLD	2	Photographer	3	Writer, Manager Curator	Paid	\$54
HACK	24	Reporter	2	Writer Curator	Community	\$31
SHOP	6	Reporter	3	1 Writer, 2 Curator	Community	\$43
SXSW	4	Reporter	1	Writer	Paid	\$975
CLAS	11	Reporter	1	Writer	Community	\$0

Table 2. 84 workers created articles about the 11 events. Workers served in local or remote roles and were either paid or community members. When the curator role was not assigned to an individual, the writer performed it.

(e.g., WordPress or NewsPad (Matias & Monroy-Hernandez 2014)). All of the articles were published on a blog and shared with the organizers.

Analysis Procedure

Evaluation of Output: We analyzed the reports and the final articles for quantity and quality, across different types of users and types of media. We ranked articles compared to similar news and blog posts based on subjective ratings from oDesk workers.

Worker Feedback: We shared the articles with the event organizers, and four organizers responded with brief feedback. We collected qualitative feedback from workers using two prompts after each event (16 people responded):

- (1) *Tell us four things that you liked about the job,* and
- (2) *Tell us four things that you did not like about the job.*

We asked two experts to evaluate the output and process. A local blogger commissioned and evaluated the report feed and blog post produced (CRIM). A professional journalist performed the remote roles (CLAS), and gave feedback on the entire process.

We used a grounded approach (Charmaz 2014) to do thematic analysis on the worker feedback. Two of the researchers used open coding to analyze the data. We performed two rounds of coding, with researchers coding independently overlapping subset of the data. We generated 104 codes in the first round. In a second round of coding, we

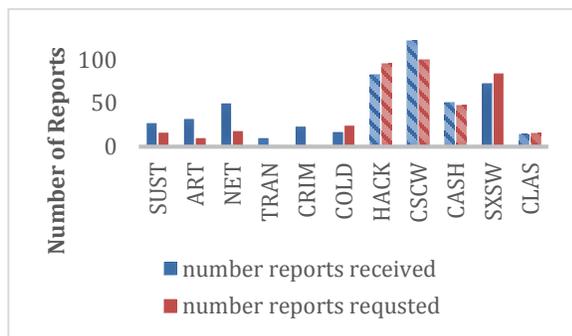


Figure 4. More reports were received than were requested from paid reporters. Community reporters produced a larger number of reports per event (hashed bars) than paid reporters (there were more community reporters in any given event than paid reporters)

re-coded the data into 74 codes to eliminate redundancies and into 13 categories. The top categories related to worker: communication, enjoyment, initiative, instructions, and motivation. We present the data in the categories informed the findings.

Evaluation of Output

Report quantity: Reporters were asked to perform a fixed number of tasks at each event, including taking notes and photographs and conducting interviews. Each event generated between 10 and 122 reports, for a total of 503 (Table 3). Of those, 228 (45%) items were text. For example, a reporter at the CRIM event submitted: *“Officers are talking about using motorcycle dispatch to solve localized speeding and traffic violations, as opposed to relying on intersection cameras.”*

An additional 250 (50%) items were photographs and another 25 (5%) contained video or audio content. As expected from previous work with mobile assignments (Vääätäjä et al. 2012, Alt et al. 2010, Konomi et al. 2009), photos were particularly abundant, perhaps because they are easy to take and share via mobile devices. Videos were less common, perhaps due to technical and social complexities—noisy environments, cumbersome use of a mobile phone for video recording, or the social awkwardness of approaching people for recordings. Overall, more reports were received than were requested (Figure 4).

We analyzed the impact of having external workers versus community members report on the events. Community members produced more reports overall but fewer reports per individual than did paid external workers. Figure 4 shows the number of reports received, categorized by whether they came from community members (hash marked) or external workers (solid). As Figure 4 illustrates, events with community member reporters generated more reports. These reporters were individually less likely to submit many reports, but because events with community

Event	Title
CSCW	CSCW, Issues Raised and Key Findings
external	Seattle Maritime Festival swells to 2 days, adds location
external	Council Organizational Meeting Recap
SXSX	Six Ways Austin Locals Prepare For SXSX
CLAS	Students’ passion shines in class projects
external	Sustainable Ballard Festival on Sunday
NFEST	8 Things You Missed At the 10th Annual Sustainable Ballard Festival

Table 3. Examples of top-rated articles based on how informative they were. Ranking included articles on similar topics retrieved from external media sources

members tended to have many local reporters, the aggregate number of reports submitted was high.

Articles produced: Submitted reports were used to create a single article for each event. Table 4 shows, in black the title generated for each article. The articles varied in length and style. The longest article was 942 words (or about as long as a page of this paper), while the shortest was only 123 words (or about the length of this paper’s abstract). Length was directly associated with the number of reports received. For example, the longest article was the result of curating 73 reports, whereas the shortest was from only 17 reports. The style was open ended when reporters had open-ended tasks: *“Everything you need to know about the South Seattle Crime Prevention Council meeting,”* and narrower when the tasks were focused: *“Six ways locals prepare for SXSX.”* Most articles included several photos and interviews. A report’s content was often used verbatim in the final article, such as: *“Streetscars along Broadway and Jackson will work with light rail to improve transit around the greater Seattle area.”*

At the end of the study, we posted the articles on the research project’s website and shared them with stakeholders, some of whom reshared them through their own channels. For example, the blogger who prompted the creation of the CRIM article republished it in a neighborhood blog in several posts: *“it ended up being extremely timely ... I [later] learned that that officer that ... your person interviewed on tape is being promoted to homicide... I realized that I could use that video in a new post... that would give me an excuse to refer back to the earlier post ...That all creates more attraction and more feeling and more interest in sort of a series of issues”.*

Article quality: We evaluated the articles through comparison with articles from news sources or blogs in the same local area (e.g., the *Seattle Times*). The comparison articles covered the same event in a previous year, or a similar event. Seven raters from oDesk performed pairwise comparisons between the 11 articles produced and 9 comparison articles. We did this because when rating each article individually with an absolute value, we found low inter-rater reliability. The analysis resulted in 190 pairwise

comparisons from which we extracted an absolute ranking. Table 4 shows the external comparison articles labeled “external.” Overall, the crowdsourced and non-crowdsourced articles had comparable ratings, which suggests that our process produces reasonable content. For articles on similar topics but from different sources (e.g., CSCW and comparison post from a CHI blogger), the crowdsourced articles ranked higher.

When we shared the articles with event organizers, they provided positive feedback. One of the neighborhood festival (NFEST) organizers posted a Twitter message: “Wow! Awesome pics and writing!!” Similarly, one of the art show (ART) organizers said: “Thank you for the wonderful article! It's so great to see the...artists featured in such a personal way!”

Worker Feedback

The feedback we received from workers had between 6 words and 3998 words (interview), with a median of 208 words. We present the themes that emerged in the analysis.

Reports and Article Quality

The content workers submitted reflected their contextual knowledge, or lack of, regarding the community. This was visible to the experts.

Reporter Stance: The reporter stance affected the type of reports workers produced. We did not provide workers with overall context about the event or the community, just as other crowdsourcing systems provide only micro-tasks without expressing the overall goal (Ahn et al. 2008). When we sent outsiders to report on sensitive issues, such as a community crime discussion (CRIM), they presented information factually—presenting what they saw with no interpretation. The local blogger evaluator, who wrote local stories regularly, commented on the lack of context as a potential problem with the article: “*I think somebody with a little bit of context or understanding...would feel less like an outsider shining the light on*” (blogger, CRIM). The blogger did not think an external reporter was the right choice and expressed the need to have someone from the community, with the community’s bias, doing the reporting: “*This is just a person on the street...reporting about the community....It needs to be somebody who has a stake in the community and cares about that community*” (blogger, CRIM). The journalist, who evaluated the process, supported the need for context, in particular for making sense of the reports and creating an article: “*Curator’s knowledge of the event and the community is crucial*” (journalist, CLAS).

Community members were more likely to submit subjective content. At the SHOP event, reporters submitted emotional reports about the community: “*I love supporting local business!*” and “*I love P’s sweet little downtown and*

I want it to thrive!” (reporter, SHOP). At the CSCW talks, general audience members, paper co-authors, and paid workers were all asked to report on the sessions. It was the co-authors, invested members in the event, who volunteered. Some co-authors focused on reporting on their own papers, not on the entire session, showing their bias.

Content Fragmentation: Breaking down the task into component pieces, as well as distributing it to several people, created fragmentation that led to context loss. The journalist who evaluated the process for the CLAS event criticized the lack of connection among the 15 reporting tasks received during the event: “*There was no common thread running through all the things....It would have been easier if each person contributed several paragraphs....It's hard to piece things together*” (journalist, CLAS).

Challenges of the Physical Environment

Workers had to perform tasks in the physical environment, which posed challenges of mobility, time constraints and unpredictability of situations.

Mobility: While at events, participants were faced with a continuously changing environment that affected how they could do their job. At events like festivals (SXSW, NFEST), participants travelled and drove around the city, which limited how much content they could capture. They received between four and six tasks during an hour. But depending on travel times this proved to be difficult to accomplish: “*I found that with the time it took to drive/park/walk around town, talk to people and store owners etc, gather stories, write them and send them in, that sending in a story every 5 to 15 minutes wasn't feasible.*” (reporter, SXSW). However, the workers were resilient to doing tasks, even when additional requests were made. A community member mentioned, “*There were too many assigned tasks. I know I didn't have to complete them all, but it was like a double-dog dare to do that. :-)*” (community reporter, SHOP).

At seated events (CRIM, NET) participants were constrained by the location and could only capture content while being seated during the talks. Further, events involved large groups of people. It was hard to access who were hard to access with one or two reporters – at the NET event all attendees left at the same time, so it was hard to perform interviews. The worker feedback reflected disappointment when this happened: “*I was disappointed; I really was hoping to speak to him for a minute. Everyone was exiting quickly afterward which made trying to do more interviews difficult.*” (reporter, NET).

Preparation Time: The physical environment and having to travel to different locations, sometimes as far as an hour away, meant that workers needed additional preparation time. Local paid workers were resilient to last minute planning (NET, TRAN). One reporter stated, “*I received the instructions about 1 hour and 30 minutes*

before the event. That made me anxious, and I almost bailed on the task” (reporter, TRAN). Despite finding it inconvenient to accommodate a change or receive late instructions, they would still take on the task. Workers were also willing to spend additional time at an event if necessary. Some workers spent up to an hour extra at the event, especially due to the unpredictability of the events that would sometimes start late (TRAN, NET).

Quality assurance: We encountered cheating when workers submitted content they did not capture, by downloading images from the internet (COLD). This form of cheating can be characteristic to the large audience of the event, and thus the thousands of online photos available. Smaller events were more specific, and, it was harder for workers to submit fake photos. We came up with a method to resolve such situations, of not being present in the physical space: we required local workers to take a “selfie”, a photo of themselves attending the event.

Interacting with Others at Events

Workers performed tasks that predominantly required them to interact with other people at the event. While this was enjoyable for some of the workers, it was distracting for others, especially members of the community. To facilitate interactions, workers required knowledge of reporting norms on how to introduce themselves to others.

Enjoyable: Workers reported finding interaction with others as a very enjoyable part of the task. Workers mentioned enjoying being part of the type of event itself (TRAN, CRIM, SXSX): *“I liked the choice of event, it was a very tight-knit intimate community experience you wouldn’t otherwise hear about”* (reporter, CRIM). They liked helping other workers get their tasks done (TRAN). Several workers mentioned liking the interaction with other people itself (NFEST, NET, SXSX): *“I enjoy talking with and meeting people”* (reporter, SXSX). The field reporters seem to consider the tasks as a good fit with their interests.

Distracting: Unlike paid workers, event attendees who were part of the community and volunteered to take on tasks later reported feeling too distracted by the tasks and thus enjoyed the event less: *“I did not enjoy it. It distracted me from engaging with my friends”, “...seemed to diminish the conversation as people were fiddling with their phones”* (community reporter, SHOP).

Reporting Norms: We did not provide the workers with more content than the name of blog where the content was posted. Workers were outsiders to the event and expressed the need for background knowledge about the tasks they were doing to inform the interactions with the people at the event. Event attendees requested to know who the reporter is representing, or where the content is posted (NET, SXSX, ART, CRIM), information that a professional reporter would share as part of their working norms.

Situations in which workers were not prepared to provide such information made the interaction uncomfortable: *“The Town Hall staff was understanding, but they weren’t informed of [our reporting] presence there”* (reporter, NET). *“Not knowing exactly what to tell people about my project was a bit difficult to communicate”* (reporter, SXSX). When challenged to provide information about their context, workers sometimes provided inaccurate responses: *“I told the officer I was ‘with’ a company called...”* (reporter, CRIM).

Collaboration with Remote Workers

The events participants attended were sometimes unpredictable: they would start late or run longer. Workers were always moving and searching for photo opportunities, reporting what they hear, or finding people to interview. This required any interaction with remote workers to be as simple as possible and helpful to their task.

Instructions vs Initiative: Participants expressed the need for feedback on receipt of the content they had submitted. When a curator was not available to provide this feedback, participants would complain, *“I wasn’t provided with any direction on how the content was being received. I didn’t know if my stories were too long or too short, or needed to change in any way”* (reporter, SXSX).

Participants needed clear instructions, especially with regard to traveling and preparing for the event (CRIM, ART). Some workers wanted detailed instructions on how to perform the task (ART, SXSX): *“I often felt like I was going in blind without much direction. I’d like more clarity on length, style, tone of the stories I’d be submitting”* (reporter2, SXSX). Other workers were independent and took initiative on how to perform tasks (NET, ART, TRAN, SHOP, SXSX): *“I liked the ability to make decisions about where to go and who to talk to myself ... What motivated me most about this job was the openness of it, getting to walk around and talk to people, it was a lot of fun.”* (reporter2, SXSX). Workers also had many suggestions for future redesigns of the applications they used and how to perform reporting tasks (NFEST, NET, CRIM).

Multitasking Technology: Participants preferred using as few technologies as possible. Switching apps came as an inconvenience. For example, one of the workers said: *“I don’t like having to switch between email and the app [Eventful]; I ended up with a bunch of draft emails and I had a hard time switching between when I was talking to people or the internet wasn’t working”* (reporter, SXSX). Someone else said, *“It is difficult for me to concentrate on the Sound Cloud part & stay aware of Twitter feedback. It would be great if the two were linked so the comments floated on top of Sound Cloud like those landing pages that are showing up everywhere online does”* (reporter, NET).

Real-time assistance: Workers appreciated communication with a manager (NET, TRAN, ART, NFEST). *“Having a way to contact a ‘live’ person if needed & communication via Twitter made the whole experience more satisfying”* (reporter, ART). When they had questions, participants wanted to reach the manager even by calling, but event constraints were not always allowing of that: *“So, I realize I could have called you with these issues as they occurred. I didn’t want to stand up and leave the hall during the presentation”* (reporter, NET).

Discussion

The hybrid process we developed to support event reporting reveals opportunities for online crowdsourcing to extend to the local, physical space. Hybrid crowd work can have applications beyond news reporting, especially in situations like crisis informatics, where there are needs for people who are online to coordinate information for people in the field (Starbird & Palen 2013). In this section, we discuss how one could leverage our findings to build systems that extend human computation into the physical world.

Recruiting: Platforms like TaskRabbit create a market for field worker availability. Although availability was limited in our studies, markets will grow; local workers will become easier to recruit. Our findings show that local crowdsourcing processes can leverage local channels for recruitment, like blogs posts or live Twitter feeds of those attending. Events with existing community base can leverage attendees to broaden worker availability.

Worker experience: Crowd workers find it challenging to experience events they are attending in the field when also doing tasks (Flintham et al. 2015). Designing for local workers should accommodate for offering a good experience, through fostering tasks that encourage engagement with the event and low technological demand.

Autonomy in the field: Context awareness is important in local crowdsourcing. This is consistent with findings on platforms like TaskRabbit (Teodoro et al. 2014) and crowdsourcing more generally (Dow et al. 2012), that show that workers value knowledge of results and motivation for their work. Online crowdsourcing tasks tend to be as small as possible (e.g., “type a word” (Ahn et al. 2008)). For creating news reports, a mix of task types might be ideal. Many small tasks can target many non-expert reporters for diverse content, while the more experienced workers can receive larger tasks with higher autonomy.

Communication between local and remote workers: Crowdsourced reporting systems have focused on allowing submission of photos, text, or videos (Väätäjä et al. 2011, Guardian 2014, CNN 2014). However, these systems do not support the workers’ need to communicate with others. In our hybrid process, we identified the need for real-time

communication between the local worker and a curator. Due to the dynamic environment, the need to interact with others in the field and remote, we recommend that technology support this communication by aggregating actions in a simple, structured, and non-disruptive manner. Traveling to an event is a large investment for a worker. For short, one-hour events, travel time can equal the time spent at the event. Due to the travel preparation costs, systems should target primarily hyper-local workers. If that is not possible, systems should account for flexibility in the job design to accommodate distant workers.

Reporter norms: To produce articles that serve the goals of the community, workers need to follow reporting norms that facilitate interaction with others and creating the desired article. Tasks should be designed such that workers are informed about the context of their work and of the community. This can help them create content that is a better fit to the community needs and create a fluid interaction with those at events.

System Design: The design of the system involved fixed roles (reporter, photographer, curator, writer) separated to make tasks easier for unexperienced workers. Such roles can lead to information fragmentation. Alternative system designs can support roles assigned primarily to one person, to prioritize more consistency and focused reporting for an event. The tasks can also be designed to support a reporter’s interests: local bloggers or reporters could request information specific to their own needs and direct members of the community to capture the needed content.

Limitations: We designed our system to support basic reporting tasks. We kept tasks simple, with brief instructions, to fit needs of the workers in the field. This limits the reporting being performed to basic information that the worker observes, and without instruction in reporting techniques (such as: interviewing diverse participants or asking for permission to capture content). This results in the quality of reporting being closer to a blogger’s post than a professional article.

Conclusion

We presented a hybrid crowdsourcing process for event reporting using a combination of remote and local crowd workers that builds on existing crowdsourcing workflows (Kittur et al. 2013). Our findings revealed a number of benefits and challenges to using such a hybrid approach and its impact on different aspects of a crowdsourcing workflow. These include challenges posed by situating workers in the physical space, with mobility constraints, the challenges of interacting with others face to face, communicating with remote workers while constrained by the attention necessitate by the physical space, bias of the non-expert crowd workers in doing reporting.

Future research should address these challenges through a deeper understanding of how to design systems so that they support the needs of workers in the field, while providing workers with reporting guidelines.

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References

- Agapie E, Monroy-Hernández A. *Eventful: Crowdsourcing Local News Reporting*. *Collective Intelligence* 2014.
- Ahn L, Maurer B, McMillen C, Abraham D, Blum M. *reCAPTCHA: Human-Based Character Recognition via Web Security Measures*. *Science* 321 (5895): 1465–68
- Alt F, Shirazi AS, Schmidt A, Kramer U, Zahid N. *Location-Based Crowdsourcing: Extending Crowdsourcing to the Real World*. *NordiCHI 2010*
- Bernstein MS, Little G, Miller RC, Hartmann B, Ackerman MS, Karger DR, Crowell D, Panovich K. *Soylent: A Word Processor with a Crowd Inside*. *UIST* 2010
- Cassa C, Chunara R, Mandl K, Brownstein JS. *Twitter as a Sentinel in Emergency Situations: Lessons from the Boston Marathon Explosions*. *PLoS Currents* 2013
- Charmaz, Kathy. 2014. *Constructing Grounded Theory*. SAGE.
- Cheng J, Bernstein M. *Catalyst: Triggering Collective Action with Thresholds*. *CSCW* 2013
- CNN iReport Accessed June 4, 2014. <http://ireport.cnn.com/>
- Curmi F, Ferrario MA, Whittle J, Mueller F. *Crowdsourcing Synchronous Spectator Support: (go On, Go On, You're the Best) N*. *CHI* 2015
- Dow S, Kulkarni A, Klemmer S, Hartmann B. *Shepherding the Crowd Yields Better Work*. *CSCW* 2012
- Eagle N. *Txteagle: Mobile Crowdsourcing*. *Internationalization Design and Global Development* 2009
- Erickson T. *Geocentric Crowdsourcing and Smarter Cities: Enabling Urban Intelligence in Cities and Regions*. *International Workshop on Ubiquitous Crowdsourcing* 2011
- Flintham MD, Velt R, Wilson ML, Anstead EJ, Benford S, Brown A, Pearce T, Price D, Sprinks J. *Run Spot Run: Capturing and Tagging Footage of a Race by Crowds of Spectators* *CHI* 2015
- Goncalves J, Ferreira D, Hosio S, Liu Y, Rogstadius J, Kukka H, Kostakos V. *Crowdsourcing on the Spot: Altruistic Use of Public Displays, Feasibility, Performance, and Behaviours*. *UbiComp* 2013
- Goncalves J, Hosio S, Ferreira D, Kostakos V. *Game of Words: Tagging Places through Crowdsourcing on Public Displays*. *DIS* 2014
- Guardian Witness Accessed June 4 2014. <https://witness.theguardian.com/>
- Gupta S, Reynolds MS, Patel SN. *ElectriSense: Single-Point Sensing Using EMI for Electrical Event Detection and Classification in the Home*. *Ubicomp* 2010
- Heimerl K, Gawalt B, Chen K, Parikh T, Hartmann B. *CommunitySourcing: Engaging Local Crowds to Perform Expert Work via Physical Kiosks*. *CHI* 2012
- Pew Research Center's Journalism Project. *How News Happens*. 2014 Accessed June 4. <http://www.journalism.org/2010/01/11/how-news-happens/>
- Snyder JM Jr, Strömberg D. *Press Coverage and Political Accountability*. Working Paper 2008. National Bureau of Economic Research
- Kittur A, Nickerson JV, Bernstein M, Gerber E, Shaw A, Zimmerman J, Lease M, Horton J. *The Future of Crowd Work*. *CSCW* 2013
- Kittur A, Smus B, Khamkar S, Kraut RE. *CrowdForge: Crowdsourcing Complex Work*. *UIST* 2011
- Konomi S, Thepvilajanapong N, Suzuki R, Pirttikangas S, Sezaki K, Tobe Y. *Askus: Amplifying Mobile Actions Pervasive Computing* 2009
- Lotan G, Graeff E, Ananny M, Gaffney D, Pearce I, Boyd D. *The Arab Spring/ The Revolutions Were Tweeted: Information Flows during the 2011 Tunisian and Egyptian Revolutions*. 2011. *International Journal of Communication* 5 (0): 31.
- Matias JN, Monroy-Hernandez A. *NewsPad: Designing for Collaborative Storytelling in Neighborhoods*. *Ext Abstracts CHI* 2014
- Narula P, Gutheim P, Rolnitzky D, Kulkarni A, Hartmann B. *MobileWorks: A Mobile Crowdsourcing Platform for Workers at the Bottom of the Pyramid*. *HCOMP* 2011
- Nichols J, Zhou M, Yang H, Kang J-H, Sun XH. *Analyzing the Quality of Information Solicited from Targeted Strangers on Social Media*. *CSCW* 2013
- Starbird K, Palen L. *Working and Sustaining the Virtual 'Disaster Desk*. *CSCW* 2013
- Stevens M, D'Hondt E. *Crowdsourcing of Pollution Data Using Smartphones*. *Ubicomp* 2010
- Teodoro R, Ozturk P, Naaman M, Mason W, Lindqvist J *The Motivations and Experiences of the On-Demand Mobile Workforce*. *CSCW* 2014
- Väätäjä H, Egglestone P. *Briefing News Reporting with Mobile Assignments: Perceptions, Needs and Challenges*. *CSCW* 2012
- Väätäjä H, Vainio T, Sirkkunen E. *Location-Based Crowdsourcing of Hyperlocal News: Dimensions of Participation Preferences*. *GROUP* 2012
- Väätäjä H, Vainio T, Sirkkunen E, Salo K. *Crowdsourced News Reporting: Supporting News Content Creation with Mobile Phones*. *MobileHCI* 2011
- Vukovic M, Das R, Kumara S. *From Sensing to Controlling: The State of the Art in Ubiquitous Crowdsourcing Int. J. Commun. Netw. Distrib. Syst.* 2013 11 (1): 11–25
- Vukovic M, Kumara S, Greenshpan O. *Ubiquitous Crowdsourcing*. *Ubicomp* 2010 _
- Working With Citizen Reporters, Knight Digital Media Center 2014. Accessed June 4. <http://www.knightdigitalmediacenter.org/learning-module/working-citizen-reporters>
- Yin RK. *Case Study Research: Design and Methods*. SAGE 2009