Towards an Appropriable CSCW Tool Ecology: Lessons from the Greatest International Scavenger Hunt the World Has Ever Seen

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ABSTRACT

If you could accomplish a complex, collaborative work task with one tool or many tools working together, which would you choose? In this paper, we present a case study of GISHWHES (the "Greatest International Scavenger Hunt the World Has Ever Seen"), an annual event in which teams spend one week completing complex, creative tasks. Building on the literature of IT ecosystems, we show how teams used different collections of tools to meet their communication needs. We interviewed team members, finding that most teams used multiple tools during GISHWHES. By analyzing which tools they chose over others for each function, we gain insight into the strengths and weaknesses of these tools, and the complexity surrounding work processes. In light of this complexity, this research highlights the importance of designing appropriable tools that can work with unanticipated workflows and mesh well with other tools in a communicative ecology.

Author Keywords
Collaboration, GISHWHES, Communicative Ecology, Appropriability, Pipeline, Facebook

ACM Classification Keywords
H.5.3 **[Information Interfaces and Presentation]**:
Group and Organization Interfaces --- *collaborative computing; computer-supported cooperative work; theory and models; web-based interaction.*

General Terms
Human Factors, Management, Theory

INTRODUCTION
As CSCW researchers and designers, we often handcraft tools and applications for specific environments. We meticulously gather requirements and analyze needs. We pour sweat equity into building these systems and then reach out to communities to adopt our software. Then we collect data in hopes of gaining insight into the efficacy of our creations.

In the wild, however, collaborators often use several tools. Lightweight tools like email or spreadsheets might complement special-purpose systems. In this study, we interviewed participants in a massive online scavenger hunt. In a thematic analysis of this data, we focus on how these groups coordinated and collaborated in order to accomplish tasks. All but one of our interview participants reported the use of multiple tools in the course of the scavenger hunt. These included familiar tools such as Facebook, Excel, email, and Google Docs, as well as Pipeline, a tool designed specifically to help teams manage online creative collaborations. We conclude that it is increasingly anachronistic to think of user needs as being supported by a single tool, and that key design challenges lie in understanding the complexity of these communicative ecologies.

This paper offers a detailed account of tool use for a complex, creative-collaboration environment. Additionally, we contribute a rich description of that environment, GISHWES (pronounced "GISH-wehz"[1]), as an intriguing example of Internet-supported, collaborative creativity. Using GISHWHES as an example, we demonstrate how to analyze sources of complexity within CSCW environments based on research from the information technology literature. Finally, we point out appropriation design principles in action, and suggest ways those principles can help improve support for complex collaboration.

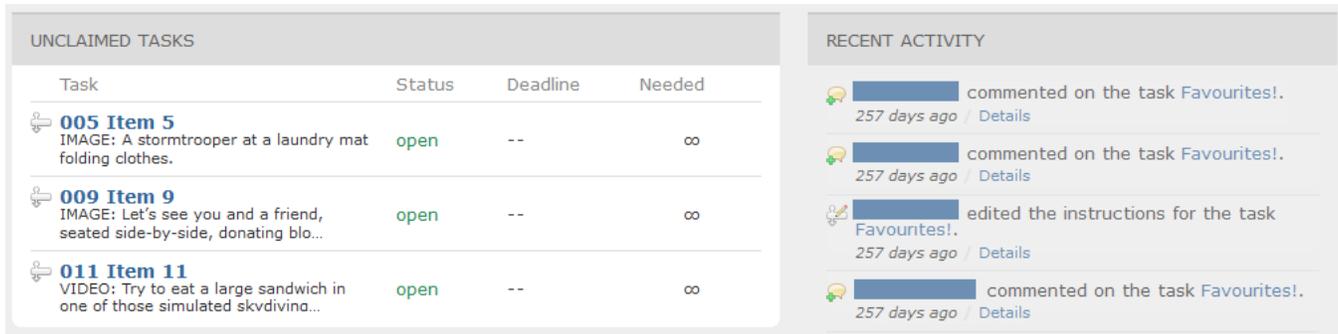[1] http://whatisgishwhes.wordpress.com/frequently-asked-questions/

UNCLAIMED TASKS			
Task	Status	Deadline	Needed
005 Item 5 IMAGE: A stormtrooper at a laundry mat folding clothes.	open	--	∞
009 Item 9 IMAGE: Let's see you and a friend, seated side-by-side, donating blo...	open	--	∞
011 Item 11 VIDEO: Try to eat a large sandwich in one of those simulated skydiving...	open	--	∞

RECENT ACTIVITY

_____ commented on the task Favourites!.
257 days ago / Details

_____ commented on the task Favourites!.
257 days ago / Details

_____ edited the instructions for the task Favourites!.
257 days ago / Details

_____ commented on the task Favourites!.
257 days ago / Details

Figure 1. In Pipeline, tasks are tracked on the left, while team member activity is shown on the right.

BACKGROUND

GISHWHES

GISHWHES[2] (or The Greatest Scavenger Hunt the World Has Ever Seen) was created in 2011 by Misha Collins, a popular actor from the television show *Supernatural*. The scavenger hunt functions in part to raise money and awareness for Collins' non-profit organization Random Acts, which is dedicated to spreading "one random act of kindness at a time." Since it began in 2011 there have been three GISHWHES competitions. For this study, we focused on GISHWHES 2013, which included 155 scavenger hunt items (also referred to as *tasks*). Each item is a request for an image or a video with a focus on producing art and/or helping others. For example, item #19 was:

> IMAGE: Attend a ballet class or "spinning" cycling class wearing full scuba gear -flippers, mask, tanks and all. *(70 points)*

While item #21 was:

> VIDEO: Find an example of someone who engages in sustained generosity in your community and then do something nice for them. For example there is an 82-year-old Connecticut barber who always offers free haircuts to the homeless in exchange for hugs. You could find this barber and polish his shoes. Find someone similar in your own community and do something nice for them. In the video, you must describe what the person does for their community, and then show what your kind gesture toward them is. *(32 points)*

GISHWHES draws a global audience of individuals who want to have fun and help others. As explained on its 'What Is? ' page:

> Gishwhes believes that "normalcy" is overrated and that true "living" can be found hidden under the rocks of community artistic creation and in acts of artistic sublime public performances. More importantly, we are all artists and have gifts for society no matter what our capabilities or talents. And most importantly, cheese is not a good sewing material.[3]

GISHWHES is also a highly collaborative activity. Everyone who participates in GISHWHES does so on a team and in 2013 teams consisted of fifteen participants. Participants joined as groups or individuals, and the GISHWHES staff would combine these until each team had fifteen members. Teams had one week to complete as many items as possible. After GISHWHES ended, a panel of judges scored each submitted item for creativity and completeness. The first-place team for 2013 received "a trip to Vancouver, Canada for a chartered seaplane flight to a majestic island with Misha Collins for fish stew, a séance, and a Viking surprise."

At the end of the hunt photo submissions that impressed the judges were published in a coffee table book. While official participation numbers for the 2013 hunt have not been released, the previous year's hunt had 14,580 participants, and at the time of this writing is recognized by the Guinness Book of World Records as the world's largest media scavenger hunt.[4]

Pipeline

We became interested in GISHWHES in 2012 when participants adopted a tool called Pipeline[5] (see Figure 1). Pipeline was created to support collaboration by non-co-located groups in order to study teams of artists who created Flash animations for the website Newgrounds [13]. Pipeline helped meet the needs of Flash animators and was later released as free and open-source software so that it could benefit other communities that relied on creative collaboration.

One of the authors of this study participated in GISHWHES 2012, using Pipeline to coordinate with her team, and word of mouth resulted in four additional teams making at least

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[2] http://www.gishwhes.com

[3] http://www.gishwhes.com/g_blog/what-is-gishwhes/

[4] http://www.guinnessworldrecords.com/world-records/1000/largest-media-scavenger-hunt

[5] http://pipeline.cc.gatech.edu

some use of Pipeline. The Flash animators that Pipeline was designed to support typically work in a highly centralized fashion [12]. In contrast, GISHWHES teams are typically decentralized with individuals claiming particular items and working on them largely independently. Since one design goal of Pipeline was to enable a more decentralized process, we thought GISHWHES would provide insight into how online collaboration occurs in other contexts. We therefore did a needs analysis based on 2012 GISHWHES use, with an eye towards a more in depth study of a future GISHWHES.

As part of this needs analysis, we interviewed four of these scavenger hunt participants whose teams used Pipeline. Based on feedback about their use, we added features that we thought would better support their processes. For example, we noticed that some teams would use lightweight chat applications to keep in touch during GISHWHES, so we built in a minimalistic chat room. We also redesigned the way that tasks showed in the dashboard in order to provide clarity on tasks statuses, and we created a utility that would allow us to upload the GISHWHES task list for teams, saving them the trouble of having to create each task manually.

Following our feature additions to Pipeline, we decided to explore these issues further by studying GISHWHES 2013. Interested more broadly in the communicative ecology of each team, we did not limit our analysis to only participants who used Pipeline.

RELATED WORK

Scavenger Hunts

Arguably the most famous CSCW-related scavenger hunt was the 2009 DARPA Network Challenge. During this challenge teams had to locate ten red balloons, which were dispersed around the United States. Teams demonstrated that they could solve "impossible" problems [19] with the use of multiple online tools and strategies. Although financial incentives were used during this scavenger hunt [16], one of the key findings by DARPA was that "altruistic motives" were enough to initiate "successful recruitment and mobilization efforts" [19].

Besides tackling geo-location problems, scavenger hunts have furthered education efforts and provided entertainment. Universities have created initiatives to create interest in CS for K-12 students [24] and to address CS retention in undergraduate students [22]. Other schools like the University of Chicago and MIT have used scavenger hunts[6,7] to build light-hearted and beloved traditions. Computer-supported scavenger hunts are an interesting example of a complex, collaborative task. Hunts are often

performed by non-co-located individuals, and typically challenge participants to be resourceful in their use of CSCW tools.

Sources of Ecosystem Complexity

An important feature in computer-supported scavenger hunts is the complexity introduced by multiple tools and collaboration requirements. In a study of complexity in information technology environments, Lentz et al. studied how these environments evolved into complex ecosystems over time [11]. They found that four factors caused complexity in IT ecosystems. These factors inform our analysis of complexity in the GISHWHES environment.

(1) *Poorly interlocked job responsibilities.* Job responsibilities and degree of worker specialization differ within and across organizations, resulting in tool capabilities that rarely map well to actual practices.

(2) *Ad-hoc organizational procedures.* Similar to job responsibilities, processes and organizational structures can develop organically.

(3) *Environment diversity.* IT environments are a mixture of many tools published by different vendors. This introduces a challenge when designing a new tool to join the mix.

(4) *Specialized tool preferences.* Users often have strong preferences for particular types of tools— for example, GUI interfaces versus command-line versions. Two workers with the same responsibilities may accomplish their work in different ways.

Volunteers participating in a scavenger hunt are clearly different from IT workers; however, as we will see, similar issues describe the complexity within GISHWHES teams.

Communicative Ecology

One source of this complexity is that GISHWHES teams typically use many tools in accomplishing tasks. The field of communicative ecology [20] sheds light on how groups of people use multiple tools for their communication needs. Researchers like Turner et al. have used communication ecology to explain how tool use is shaped by other tools used in the workplace [23]. Additionally, Dittrich and Giuffrida have built off of Turner et al.'s work to show that instant messaging applications can act as a glue between communication channels [5], while Johri has shown that blogs and IRC can mostly replace email in a small technology firm [10]. An ecologies approach is not limited to the digital world but can also provide insights into interaction that bridges digital and embodied modes [14].

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[6] http://scavhunt.uchicago.edu/index.html
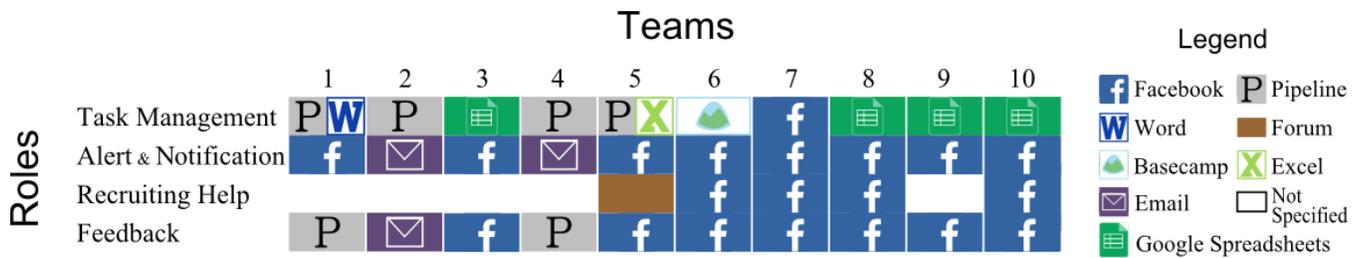
[7] http://www.mit.edu/~puzzle/

Figure 2. Matrix of tools used during GISHWHES.

While several of the studies above include all communication channels (including face-to-face and telephone use), for this study we focused on the software tools used within each GISHWHES group.

Appropriation

Designing software for complex, creative-collaboration environments is challenging. One promising approach is designing for *appropriation*. Appropriation is the study of how technology is often adapted or repurposed to solve problems it was never intended to address [6,7,21]. Appropriation is important because it acknowledges both the social and technical reasons that people adopt certain technologies [7,15]. There have been a number of studies of appropriation, such as Orlikowski's early work on Lotus Notes [15]. Quinones studied how workers adopted different tools, and observed that an individual taking on the role of a "shepherd" helped support tool adoption [17]. Additionally, Dix presented heuristics for supporting appropriation:

- Allow interpretation: Provide system elements without a fixed meaning.

- Provide visibility: Make how the system works clear to the user, so the user can devise his/her own uses.

- Expose intentions: Make the purpose of the system clear, to make it easier for users to subvert that purpose.

- Support not control: "Provide necessary functions so the user can achieve the task, but not drive the users through the steps."

- Plugability and configuration: Allow parts to be combined in different ways.

- Encourage sharing: Help users to share appropriation success stories.

- Learn from appropriation. [6]

Dix's ideas about appropriation shed light on user behavior we observed in GISHWHES, and also highlight ways we could better support this kind of collaborative practice in the future.

METHODS

For this study, we performed ten semi-structured interviews with fourteen individuals who participated in GISHWHES 2013. These individuals represented ten different teams. Interviews were one-on-one with the exception of one team for which five team members participated in a group interview. Initial interviews were conducted by phone/voice chat, and follow-up questions sent by email. Because GISHWHES is a creative activity and many of our participants view themselves as artists, it would be potentially unethical to deny them credit for this work [3]. Therefore, we used real names instead of pseudonyms if requested by our participants. Pseudonyms are denoted with an asterisk (*). We also analyzed their online activity and artifacts they created, where possible.

We recruited participants from Tumblr and other personal blogs if they showed evidence that they participated in GISHWHES 2013. We also emailed teams with an invitation to be interviewed if they used Pipeline during GISHWHES. Out of the seven teams who used Pipeline to participate in GISHWHES, representatives from four teams agreed to participate in an interview. Interview participants also came from six additional teams that did not use Pipeline, for a total of ten represented teams.

Our participants consisted of thirteen females and one male, between the ages of seventeen and forty-nine. According to our participants, the majority of GISHWHES participants found out about the scavenger hunt through Misha Collins because they or a friend were members of the fandom community for his television show. This gender breakdown is not unusual for these types of communities. Previous work has shown similar fandoms had female membership composition as high as ninety percent [1] , while other work has shown the predominant contribution by women to media fandom [18]. Although the Internet has caused these demographics to become more diverse over time [18], the demographics of our study reflects the target audience of *Supernatural's* parent network [4].

Our semi-structured interviews contained questions regarding the following topics: tasks, team composition, team dynamics, leadership, tool use, team workflows, conflict resolution, and public perceptions. Our goal was to gain a better understanding of how GISHWHES teams interact with tools, workflows, and each other during the

competition. After transcribing the interviews, the first part of our analysis was to break up tool use by team. Next, we conducted a thematic analysis [2] to determine the *software roles* that each tool provided for the teams. One researcher performed the coding, which underwent multiple iterations. All of the researchers discussed the codes during the thematic analysis. Although our sample size is small, Guest et al. have shown that saturation can occur with "high-level, overarching themes" in as few as six interviews [9].

RESULTS

The ten teams we studied made use of various combinations of eight different tools (see Figure 2). These included three productivity tools (Microsoft Word, Microsoft Excel, Google Spreadsheets), three communication tools (Facebook, neighborhood online forum, email), and two more comprehensive collaboration tools: Basecamp, which is a web-based project management tool, and Pipeline.

Pipeline was designed specifically to help leaders in online collaborative groups by redistributing some of their responsibilities among the group [13]. Its major functionality is as a task management and feedback system. Every team that used Pipeline for GISHWHES created a new project for their team. The projects were all private, which meant that only invited members would be able to participate in the project. Team members would create *tasks*, which mirrored the GISHWHES item list. Within a task, team members could claim a task, and upload an image or a video as a *contribution.* While they could leave feedback at the contribution level, several teams used the chat room to leave feedback for their team. Statuses such as *open* or *closed* could be specified at the task level. Each project also came with a discussion forum to facilitate communication.

In the overall GISHWHES task completion workflow we observed, first teams must determine which team member will complete a given task. Next, one or more team members must actually perform the task, leading to the generation of either images or video. Task performers may then solicit feedback. In some cases, this step is skipped—particularly towards the end of the GISHWHES window as time runs short. Finally, someone must upload the task to Imgur (for images) or YouTube (for videos), and then officially submit to the GISHWHES webpage.

In analyzing this workflow, we observed four primary software roles:

- Task management

- Alert and notification

- Soliciting help

- Feedback

We will now look at these roles in detail and describe how teams incorporated each.

Task Management

Since teams were managing a list of 155 items, shared by fifteen individuals, every team mentioned a need to keep track of which tasks were claimed by whom and the status of each task (e.g., in progress, submitted, etc.). Interestingly, this software role experienced a shift in tools for some of our teams. Figure 3 illustrates tool use at the beginning of GISHWHES compared to the tools being used by the end of GISHWHES.
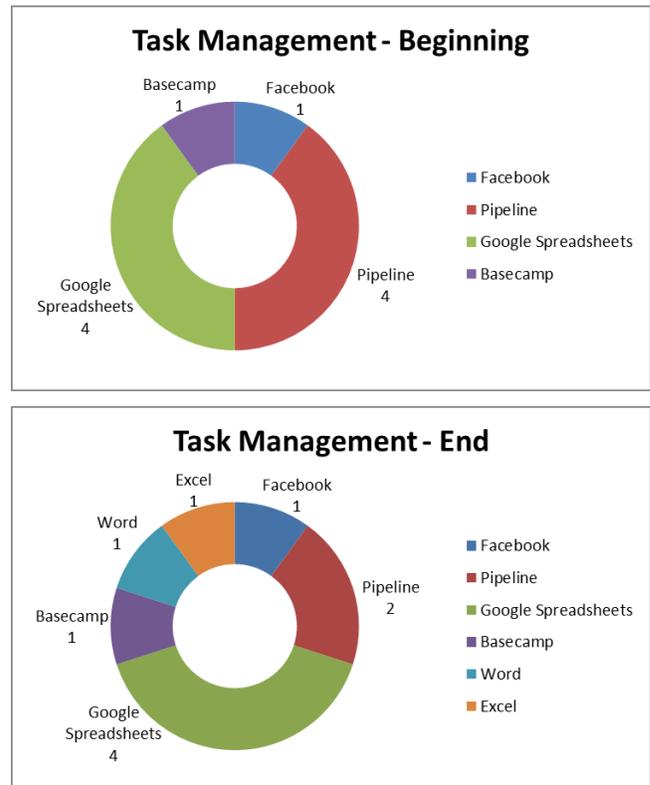
Figure 3. Task Management Tools Throughout GISHWHES.

The teams that we interviewed who used Pipeline to track task management reported a positive experience. For example, when Amy (Team 2) was asked to describe her experience with Pipeline, she responded:

I felt that it was really cool, because otherwise, I don't know how we would have kept track of who was doing what tasks because it was such a long list. This way, it was separated out. So, it told me what I had said I would do and it told me what had already been claimed. So, it was just very easy. ~ Amy (Team 2)

However, even though participants reported a good experience with Pipeline, we noticed that use of the tool broke down over the course of GISHWHES. Team 1, for example, eventually reduced their use of Pipeline because as the deadline for GISHWHES loomed near they shifted focus to submitting images and videos—completely omitting the step where they would request feedback before submitting their tasks:

Pipeline was fantastic. It was nice to see them [pictures] all there and everything. I think towards the end, we were so busy that we stopped using it. We ended up sending them [pictures] directly to Imgur. I'd say like maybe after the last third of the week, those last couple of days, because tasks stopped getting closed on Pipeline. We ended up just skipping straight to where the submission was, because people weren't having the time to go on there and look at photos anymore. ...So, unfortunately, we ran out of time to be reviewing each other, and we just trusted each other's judgment. ...On Facebook we'd say, "I got this item done," and, "I got this item done," and Sarah* would be updating every single time on the Word document. ~ Rae (Team 1)

Team 1 originally used Pipeline for two different software roles (task management and feedback), but because they stopped using Pipeline for one of these roles (feedback), the cost of maintaining use for the one remaining role was too great. Consequently, Team 1 switched to a more lightweight tool (Microsoft Word) to handle task management.

Team 5 also decreased their use of Pipeline during GISHWHES when half of their team experienced issues using Pipeline. Team 5 was composed of two sub-teams—one located in the U.S. and one located in Canada. The Canadian sub-team expressed difficulty with uploading images/videos to Pipeline, as well as with performing workflows like assigning a task. As a result, both sub-teams shared an Excel spreadsheet stored on a Google Drive to handle task management, using color coding to denote sub-teams.

It is worth noting that the Excel spreadsheet assigned each task to one of the sub-teams instead of individuals. This is something that is not currently supported by Pipeline (all tasks must be assigned to an individual). It is also interesting to note that the U.S. sub-team did not completely abandon Pipeline, as they still were using it up until the completion of GISHWHES.

Besides Excel, other teams chose to use spreadsheets for task management. Four teams used Google Spreadsheets, largely because of the ability to co-edit. Similar to Team 5, multiple teams reported using color coding in their spreadsheets:

It [task list] was a document that we could edit. Carol* [team leader] was real organized. She had it all color-coded. So, when you chose it, you typed it in red and put your name. Then when you accomplished it, you changed it to green and put the date. ~ Deborah (Team 10)

Team 9 displayed an amazing amount of effort in constructing a Google spreadsheet for task management:

It took us two months of work into the Google Doc, because we wanted to know how the layout is and how easy it is to read. We also did a test run with a few of our friends here. If they couldn't get it, then we fixed it and, you know, asked

their opinions. It was like color coordinated. ... If you wanted to do an item, you would like claim it by putting your name beside it and changing the color of the item on the Google Doc. So, the color code was like red/yellow/green, and they all meant something different. Then you just have your name with it. If more than one person was doing it, there were multiple names. Whoever got it done, we would look at it and we would choose which one was best if there were multiples of one. ~ Team 9

The other project management tool that was used to help teams keep track of assignment and progression was Basecamp. The only team to use Basecamp was Team 6, and they reported a positive experience:

... the Basecamp worked fantastically. I actually found that I did start a Pipeline account before GISHWHES started because I had intended on using it. Then somebody brought up Basecamp and they had used it before. So we wound up using it. ~ Ashley (Team 6)

The interesting difference between Pipeline use and Basecamp use was that the team who used Basecamp only created one account for the entire team, instead of individual accounts for each team member:

We used the same email or password for our YouTube channel, for our Imgur account, and for the Basecamp and anything else just so it was easier for everybody to say, 'Okay. Well, we can log on and have all of the same information.' ~ Ashley (Team 6)

Team 6 was able to use Basecamp effectively as a productivity tool even though they could not rely on automatically tracking each user's unique activity. Sharing login credentials was common for other teams when creating Imgur, YouTube and Google accounts.

Team 7 was the only team that used Facebook to handle task management. They accomplished this by creating a Facebook document on their private group page. The Facebook document was a simple list of every GISHWHES task. Facebook documents do not allow co-editing like Google Spreadsheets; however, this was not a problem because most of the members were in different time zones and were not online at the same time. While Team 7 had a positive experience using Facebook for task management, Team 9 reported trying to use Facebook for task management with suboptimal results. This was due to information that would get "buried" over the duration of GISHWHES. This caused Team 9 to adopt Google Spreadsheets, which offered more functionality and reportedly a better experience.

Alert and Notification
Besides tracking the progress of every task, team members also need a way to communicate status changes with the group. They have to communicate when tasks are claimed, or when a team member will not be able to complete a task that they had previously claimed.

Figure 4. Alert and Notification Tools.

Eight out of ten teams reported using Facebook (see Figure 4) for alerts and notifications, making it the most popular tool for teams to communicate.

We used it [Facebook] to communicate with people because with the time difference, and sometimes people just don't get emails or just don't check their email. I'm pretty diligent about checking all my email, but I don't trust everyone else to be as diligent as I am. But everyone checks their Facebook, especially if you get the little notification saying something's been posted. So, we used that just to keep everyone updated on what we had done and remind people to update the excel spreadsheet as we were going. ~ Sandra* (Team 5)

One factor that may be able to account for Facebook's popularity involves the convenience of receiving Facebook updates on mobile phones:

And with the Facebook page, I have Facebook connected to my phone. So, whenever somebody would post something, it would go off, and I could check it. If it was important, I could get back. If not, whenever I get a chance. ~ Ashley (Team 6)

So, there's a lot of time where someone's sleeping and someone's up. People on my team really like to communicate. There's a lot of communication happening. So, my phone was going off all the time where people were communicating across Facebook. ~ Amy S. (Team 3)

It was mostly through posts, but everybody had Facebook on their phone. We were able to keep in almost instant contact like chat through doing posts, because we were all carrying our phones around and doing Facebook on our phone while we were doing items. ~ Deborah (Team 10)

The remaining two teams who participated in our interviews mentioned using emails for alerts and notifications. Team 2, for example, explained how staying connected through email was helpful for sending updates, as well as receiving feedback:

She [team leader] kind of made sure from the beginning when the team list came out, she was the first person to email everybody. When the list itself actually came up, she was like trying to get everybody to be organized and see who was going to take what task. Let's see. Then like throughout the day, she would just like send out updates of what she was doing, like email us, and show us what she had done, and ask if we liked it. ~ Amy (Team 2)

Soliciting Help

Another key software role is soliciting help. Many of the GISHWHES tasks required access to unusual items or places (for example, item #14 was a photograph of someone dressed as The Flash inside the large hadron collider tunnel), and could not be accomplished without a geographically diverse group. Therefore, participants leveraged their networks of strong and weak ties [8] to provide information, loan items, and solicit participation from others. To support this process, the most popular tool was Facebook, which four teams reported using (see Figure 5). One team mentioned that they created a post on a neighborhood online forum, but did not receive any responses. Five of the teams did not specify the act of recruiting help online, but we do not believe this omission is conclusive that another team member did not solicit help.
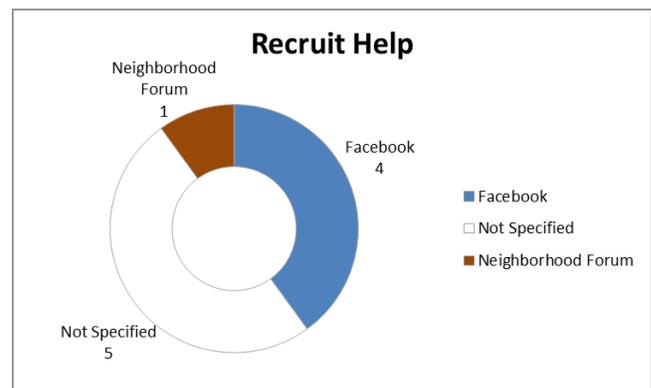

Figure 5. Recruitment Tools.

Soliciting help for a GISHWHES task from your social network can offer the additional benefit of strengthening existing relationships. As an example, item #119 requires access to an old typewriter:

Item #119 - *IMAGE: Type out your team's one-page manifesto on an old, mechanical typewriter. The page must be legible and the bottom of it must be partially fed into the typewriter. (16 POINTS)*

Jenna(Team 7) described how she completed this challenge:

I use Facebook for a lot of stuff. So, one of them was writing your team's manifesto on an old typewriter, a manual typewriter. So, I got on Facebook and just said… Actually, it happened multiple times that I needed something. I'd be like, "Hey, I'm asking for more help with GISHWHES. Who has an old typewriter that you can bring

over to my house? I'll make you coffee in payment." ~ Jenna (Team 7)
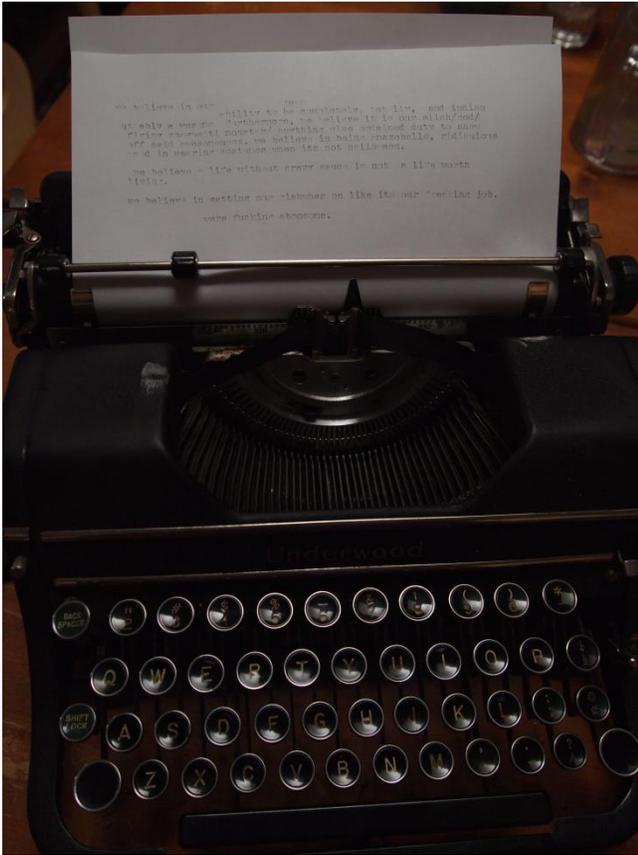
Figure 6. Submission by Team 7 for Item #119 – Type out your team's one page manifesto on an old, mechanical typewriter. *(16 points)* ©**Jenna**

After soliciting help on Facebook, it did not take long before one of her friends volunteered to help out:

… first my mother-in-law said she had one. But then she couldn't find it. Then another friend of mine who's pretty hipster (she's into the old stuff and we hadn't seen each other for a long time), she's like, "I'll bring it over if you make lunch and we can hang out for a little. (Laughter)" ~ Jenna (Team 7)

By reconnecting with her friend, she was able to nurture a weak tie [8] that had remained inactive for a while. Other teams also mentioned using Facebook to gather support from both their strong and weak ties:

I would go on Facebook and I'd say, "Okay, everybody. I desperately need a trench coat" or whatever I needed. Then people could… I mean, there were some things that people just didn't have and we weren't able to use. But a lot of things, somebody in my Facebook family and local friends were able to help me find. ~ Deborah (Team 10)

In another example, Ashley (Team 6) recounted how she was able to convince her Facebook connections to follow

the account of an imaginary alarm clock that she created on Twitter, for completion of a task:

My favorite thing that we did with social media was we had to do the Twitter alarm clock. So, I was the Twitter alarm clock. So, I went on Facebook and I posted it, because I had warned everybody, like all my friends and family like, "Listen. Things are going to get crazy and I'm going to demand that you do things, and you need to do them." (Laughter) So, I went on Facebook and I was like, "Listen. I need you to go follow me at Misha, the Alarm Clock." They're like, "What?" I was like, "I'm an alarm clock. Just go with it." (Laughter) Like I had teachers from when I was in high school, family, everybody. They went to Twitter and they followed me for all my crazy tweets as an alarm clock just so I could get to my 200 followers that I needed. I wound up with like 400. I still have 415 followers. (Laughter) ~ Ashley (Team 6)

Notice that even though the participant was soliciting participation on Twitter, she used Facebook to recruit those participants.

Besides using Facebook to reach friends and family, some teams also used Facebook to identify completely new social networks to ask for help. Item #5 required teams to take a picture of a member at a Laundromat wearing a *Star Wars* Stormtrooper costume. When Deborah (Team 10) reached out in person to a local game store, they were pointed back to social media instead:

So, I went to our local gamer store. I said, "Hey, any of you guys have a Stormtrooper costume?" I think was actually how I approached it. They were like, "No, but you want to check out…" And they told me the name of the group, which I guess is an international group, or Star Wars costume enthusiasts or whatever. So, I put that on the Facebook group while I was still out and about at stores for a different thing. By the time I got home, someone was like, "Yeah! So, I got in touch with the local group, and they're going to call me back." So, we went on with other things and we were accomplishing other tasks while that one waited on a call back that didn't arrive. ~ Lauren (Team 8)

These are just a couple of the ways in which Facebook was utilized to complete tasks. In the next section we will discuss how Facebook was used as a way for teams to share feedback about GISHWHES submissions.

Feedback
Finally, all teams reported using a process that allowed an individual to receive feedback from the rest of the team before an image or video was submitted. Seven out of the ten teams reported using Facebook in order to give feedback to other members (see Figure 7).
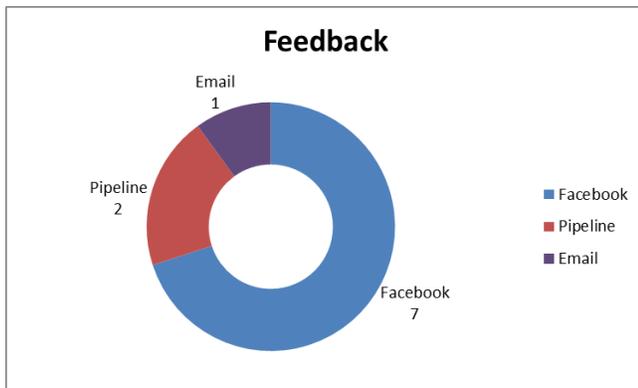
Figure 7. Feedback Tools

Two teams mentioned using Pipeline in order to leave feedback for other team members. However, those who used Pipeline did not always use the features that were specifically designed for giving and receiving feedback. Instead, they repurposed the team chat room for this function:

So, it was really easy for them to leave their feedback in that chat box. ...We rarely ever actually left feedback where it suggests you leave feedback, perhaps like in the actual threads that you can create. We never used those hardly ever. I know that there's a checkbox where you can select that you would like feedback on that photo. I think people would select it, but actual comments were rarely left. It was more of everyone would just leave a chat note on the item they had reviewed. ~ Rae (Team 1)

Team 2 was the only team that reported using email in order to give feedback. In the first version of their feedback workflow, team members who completed a task emailed their team to request that everyone approve their contribution before it was submitted to GISHWHES. This workflow proved inefficient and team members did not know how many approvals to wait for before submitting a task. The team leader of Team 2 quickly adjusted the workflow to allow team members to turn in submissions as soon as they received three approvals from fellow team members. This welcomed change had a positive impact for Team 2.

DISCUSSION

Our interviews revealed how teams used multiple tools to serve different software roles. Looking at the bigger picture, Lentz et al.'s model of complexity can extend our understanding of these particular tool ecosystems. We will use these categories to identify successful examples of appropriation, and to point out where appropriation inspired design could benefit the collaborative process.

Poorly Interlocked Job Responsibilities

Similar to IT environments, participant roles in GISHWHES are ambiguous and dynamic. Some teams had explicit leaders, and others did not. Job responsibilities also differed between teams. For example, some teams required that the person who completed an item perform any necessary modifications and then submit the image to GISHWHES, while other teams had team members who only acquired images/videos with the expectation that other members would handle post-processing and submission. Tool choice was shaped by work patterns, and those patterns differed across teams. Even within a single team, the patterns were not static over the course of the week.

Tools to support this activity need to adapt to this complexity. As a result, a software design process that began with analyzing user roles and developing software to match a given set of roles would be unlikely to function as planned, because actual roles will be different in practice. Instead, it would be preferable to design appropriable software that assumes dynamic roles. In Dix's terms, we need to allow interpretation, and support but not control the process [6].

Ad-Hoc Organizational Procedures

The concept of ad-hoc organizational procedures is relevant to both the policies or procedures mandated by GISHWHES organizers, and those constructed by individual teams. One example of a GISHWHES mandated policy was that participants were not allowed to post any of their items to any "social media platform" (special rules were written for posting videos to YouTube, which was a requirement).[8] Many of our interview participants interpreted the spirit of this law as allowing them to post images to private Facebook groups so that they could collaborate during GISHWHES. However, Team 5 interpreted this rule explicitly and did their best to enforce the rule among their team. In this case, tool choice was shaped by rule interpretation.

An example of a team procedure naturally evolving was the feedback workflow that Team 2 instituted. During GISHWHES they realized that it took too long to wait for every team member's feedback, and instead they set up an approval process that required only three team members to approve. A software solution that tried to codify the idea of "approval" would not be able to adapt to this change in what approval meant. Software that in Dix's terms supports the process without controlling it can allow for this change easily.

Finally, a creative procedure that evolved over time was Team 9's mandate that all submitted photos receive a team watermark, and all videos start with an intro screen displaying their team name. Team 9 created this procedure after realizing that submissions (from a previous GISHWHES) that were distributed via the GISHWHES coffee-table book, or shared online, did not credit the originating teams. As a result, one team member was

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[8] http://www.gishwhes.com/g_blog/updates/

responsible for applying these identifying marks before submitting anything to GISHWHES.

In each of these three examples, Dix's principle to support the process but not control it is key. The way the process was implemented changed across teams and for individual teams across time. A software solution that tried to control the process could not meet this challenge.

IT Environment Diversity

We presented an overview of all the tools used to fulfill the software roles in Figure 7. Besides these tools, teams also used Imgur and YouTube for storing images and videos, tools like Photoshop or Kdenlive for editing images and videos, and services like Google Drive and Dropbox for storing team materials. With respect to hardware, cell phones were used by some participants to capture photos or as a way to stay connected with the team while they were away from a computer. Altogether, a communicative ecology of software and hardware was used to help teams navigate GISHWHES. The plugability and configurability of tools used are key features to make them appropriable in this context.

Specialized Tool Preference

We found several examples of specialized tool preference within the GISHWHES teams. Team 4, for example developed a workflow where Jake* would download all of the video files from Pipeline to a Dropbox folder. This was because he would often work in a Windows environment, but when he edited the teams' videos, he liked to use a free and open-source video called Kdenlive, which was only available on Linux.

Another example of tool specialization was the Google spreadsheet Team 9 lovingly referred to as "their baby". This Google spreadsheet took two months to build. It was color coordinated and its purpose was to optimize the "layout" in order to make it "easy to read". Through iterative rounds of testing, they ran friends not associated with GISHWHES through so they could iron out the areas that people found confusing. The amount of effort reportedly put into their task management tool was more than any other team reported. Unsurprisingly, they considered this spreadsheet to be a secret asset, and chose not to share it during the interviews.

The Google Spreadsheet is an excellent example of an appropriable tool. Being highly configurable and open to interpretation, it allowed Team 9 to build a tool that met the level of sophistication they were looking for. Software to support complex collaboration should look into providing tools that (to paraphrase Dix) allow the user to do more for themselves.

Designing for Complexity

A professional IT organization is a different setting from a wacky, volunteer scavenger hunt. This makes it perhaps more striking that we found similar sources of complexity in interacting software platforms and user roles. Lentz et. al. conclude that "Simplistic design approaches centered on point problems or averaged concepts of static user roles are ill suited to tackling these complexity issues. Simplification will require sophisticated design approaches that consider the role of design elements in the larger context of multiple ecosystems of interacting subsystems.[11]" An appropriability perspective takes this further to suggest that rather than trying to understand/model/anticipate features of such a dynamic system, it makes sense to design appropriable solutions that will be used in diverse ways. By embracing an appropriation-inspired approach to software development, we will create more robust solutions for complex, communicative ecologies.

CONCLUSION

Would you be able to dress a rooster in a GISHWHES tank top? What about borrow a nun's habit, and wear it down a water slide? How would you make your country's flag out of food or food packaging (Figure 8)? Could you get your grandfather (or other elderly gentleman) to dress like a teenage girl from Jersey Shore? These were all tasks from the 2013 GISHWHES. How would you accomplish 155 of these tasks in one week? This paper, first, provides a detailed description of GISHWHES and how its participants attempted a complex, creative, time-limited collaborative task.

Figure 8. Submission by Team 7 for Item # 127. Make your country's flag from food or food packaging. *(49 points)* **©Jenna**

As CSCW designers, we often think in terms of creating a new tool or platform for a task. In our fieldwork on tool use in GISHWHES, we found that a communicative ecologies approach better captured key features of user activity. All teams used multiple tools, and tool choice shifted as the pace of work accelerated over the course of the week.

This phenomenon is not unique to GISHWHES. For example, in ongoing work we are studying tool use in our institution's online degree program. We have observed that

faculty supporting online classes are using not one tool but several. Those tools include our institute's official grading software, a vendor's content delivery system, our standard course support software designed for on-campus classes, a third-party site that supports class discussion, and email. The challenge is in making all these tools work together, and planning appropriable new tools as a harmonious part of a dynamic communicative ecology.

In our analysis of GISHWHES, we found four primary software roles: task management, alert and notification, soliciting help, and feedback. We were surprised at the extent to which teams used Facebook. While one might be tempted to view Facebook as a social platform, it has notable affordances for group work. In particular, it offers the ability to reach out to social networks for help, instant notification on mobile platforms, and smooth desktop/mobile integration. Additionally, it proved to be a key advantage that participants all already had Facebook accounts and were familiar with the platform. Team members were often reluctant to try a new tool like Basecamp or Pipeline. However, even the groups most dedicated to Facebook found that information "got buried" in a single-threaded Facebook group, and needed to rely on tools like email and spreadsheets to track complex information.

Moving forward, we must look for opportunities to increase the appropriability of the new technologies we create. Users will invent creative ways to use our tools, and our technology will rarely exist in isolation. While the environments that will arise will be complex, designing for appropriation can provide the flexibility needed for meeting the needs of these communicative ecologies.

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