Homebrew Databases: Complexities of Everyday Information Management in Nonprofit Organizations

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ABSTRACT
Many people manage a complex assortment of digital information in their lives. Volunteer coordinators at nonprofit organizations are no exception; they collectively manage information about millions of volunteers every year. Yet current information management systems are insufficient for their needs. In this paper, we present results of a qualitative study of the information management practices of volunteer coordinators. We identify the resource constraints and the diverse and fluid information needs, stakeholders, and work contexts that motivate their information management strategies. We characterize the assemblages of information systems that volunteer coordinators have created to satisfice their needs as 'homebrew databases.' Finally, we identify additional information management challenges that result from the use of these 'homebrew databases,' highlighting deficiencies in the appropriateness and usability of databases and information management systems, more generally.

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Homebrew databases, information management, nonprofit, NPO, volunteer coordination, volunteer management.

ACM Classification Keywords
H.4.1 [Information Systems Applications]: Office Automation

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Design, Human Factors

INTRODUCTION

> This is where we get crazy. This is nuts. We actually—we don't have a database of our volunteers…. I shouldn't say that. We have probably seven databases for volunteers. All of them have different information. It took us three to four months to even figure out who had what databases (P1).

People manage a complex assortment of digital information in their lives. In the workplace, the volume and diversity of information to be managed poses a significant challenge for knowledge workers [4]. In the home, people manage ever-larger collections of digital information—media, in particular [20].

Some consumer applications provide databases tailored to support the management of specific types of data for individuals or small groups (e.g., iTunes). In contrast, enterprise applications (e.g., PeopleSoft) are designed to manage vast amounts of complex organizational data. Somewhere in between lie the information management needs of many people—people with information that is more complex than a music library but who are unable to confront the overhead involved in designing, learning and using enterprise database systems.

During our research with nonprofit organizations, we discovered one class of workers, volunteer coordinators, with compelling information management needs that fall in this middle ground. In the United States, where this research took place, approximately 63.4 million people (~27% of the population) volunteered for a nonprofit organization last year [6]. In order to manage this massive number of volunteers, 62% of charities and 37% of religious congregations have a paid staff member who coordinates volunteers [24]. Volunteer coordinators must manage a diversity of information associated with their volunteers, such as demographic, contact and scheduling information. Although volunteer coordinators work in an organizational context, there is typically little, if any, organizational information technology in place to support their information work. With little or no formal training in information systems, volunteer coordinators have created their own unique 'homebrew' information management systems, taking advantage of whatever media and technologies they have access to. However, the complexity of these homebrew solutions—for example, seven databases about volunteers with so many different owners that it took months to find them all (P1)—highlights deficiencies in the appropriateness and usability of databases and information management systems, in general.

In this paper, we present results of our qualitative, empirical study of the information management practices of volunteer coordinators. We describe their information needs and the context and constraints that motivate their choices about how to manage information. We characterize the resulting assemblage of resources, media, and technology they draw

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upon as 'homebrew databases.' A *homebrew database* denotes an assemblage of information management resources that people have pieced together to satisfice their information management needs. In our research, these assemblages sometimes included actual database software, but typically consisted of other resources such as spreadsheets, email clients, and paper records. Regardless of the systems used to manage this information, participants still referred to this assemblage as their "database" or "databases." We follow their lead, then, in calling these systems homebrew databases, although we emphasize that the media and technology they are composed of are not all technically databases, even though most of the types of data that our participants worked with would be well suited to being managed in a database system. To conclude, we unpack the challenges arising from the use of homebrew databases and discuss implications for the design of databases and information management tools.

RELATED WORK

Information Management in Knowledge Work

Studies of workplace information management have typically focused on how people manage particular types of information, such as files [1], email [2, 25], or schedules [19]. This application-centric research has highlighted the extent to which personal information management tools have been overloaded to accommodate other information management needs. For example, email was used for task management, calendaring, and reminding [2, 25]; calendars were used for task management, contact management, and accounting [19]. The use of multiple applications, each suited to a particular task or genre of information and each incurring its own information management overhead, has led to problems of fragmentation [3].

Other research has examined information management at the intersection of various tools and media. Boardman and Sasse studied the use of three information management tools—files, email, and bookmarks; their findings suggest that individuals' information management strategies vary dramatically across these tools [4]. Researchers have also explored the complementary affordances and use of paper and digital media in information management [15, 21].

We extend this body of research by exploring the synergies and conflicts that arise when multiple tools are overloaded and used simultaneously for information management. In addition, we provide a complementary perspective on work practices; instead of setting our unit of analysis on a particular application or type of information, as most research in this area has done (see [15] for a notable exception), we examine the more holistic work practices of a particular class of knowledge worker, enabling us to better understand the relationships and movement among multiple systems used within the context of work.

The Usability of Database Systems

As early as 1978, human factors researchers suggested that attention be paid to the usability of database systems [22]. In the intervening years, SIGMOD, the ACM Special Interest Group on Management of Data invited two keynote speakers to address database usability [9, 11]. Jagadish et al. noted that database research has followed two main paths towards increased usability—exploring query interfaces and personalization. However, their assessment of the overall usability of databases is a clear call to action:

> ...when we see how information is created, accessed, and shared today, database technology remains only a bit player: much of the data in the world today remains outside database systems. Even worse, in the places where database systems are used extensively, we find an army of database administrators, consultants, and other technical experts all busily helping users get data into and out of a database…. Unfortunately, databases today are hard to design, hard to modify, and hard to query [11].

Our study of volunteer coordinators' homebrew databases reinforces this call to action. We provide a concrete context for understanding specific usability challenges that individuals face when in a position to incorporate the use of databases into their information management strategies.

Information Technology in Nonprofit Organizations

Studies of information technology use in nonprofit organizations (NPOs) have focused on diverse application areas, from use in fundraising [10] to inter-organizational coordination [13, 23] to IT management, more broadly [17]. More generally, this related work foregrounds the underlying context and constraints of technology use within NPOs—the significant resource and expertise constraints influencing technology use, the ways that volunteers change the dynamic of the organization and influence technology use, and the underutilization of technology when NPOs do not see a connection between technology use and their underlying mission or values (see, in particular [7, 14, 17]). Researchers have also observed instances in which the databases used by an NPO were augmented for "day-to-day operations," either by paper-based records [13] or by additional, partially redundant databases [16].

We extend this work by unpacking reasons why volunteer coordinators augment databases and explore the additional challenges that arise as a result of the use of multiple tools.

METHOD

Participants

We recruited 23 participants (22 female) who were responsible for managing volunteers in an NPO. For some participants, the work of volunteer coordination comprised their full-time jobs. Other participants undertook this coordination work alongside other responsibilities within the organization (e.g., fundraising, communications, or administration). Other participants were volunteers, themselves, and took on the work in retirement or in addition to another full-time, paying job.

We recruited participants in three different metropolitan areas in the western United States, primarily via snowball sampling. We also advertised the research at a volunteer recruitment fair on a university campus. We continued

recruiting participants until we had achieved data saturation and sampling breadth along two dimensions: the size of the volunteer program and the domain of the nonprofit. Participants represented volunteer programs along a continuum from those just starting to recruit volunteers to those managing established programs with ~2300 volunteers. Participants also represented seven of nine major classes of nonprofits, including arts, education, environment, health, human services, foreign affairs, and public benefit (e.g., community service clubs) [18].

Data Collection

We conducted semi-structured interviews using a protocol designed around the following areas of interest:

- The background of the organization, its mission, and the ways that the interviewee believed her work and the work of the volunteers contributed to this mission;
- The background of the interviewee, how she came to work in volunteer management, and whether she had received any formal training for her work;
- The nature of the work undertaken by the interviewee, with an emphasis on coordination work both within and outside of the organization; and
- The role of digital and analog technologies in her work.

During the interview, we also asked participants to sketch their social networks. We prompted participants to indicate specific information interdependencies with each colleague or group of colleagues as well as the technologies used to communicate or coordinate with each.

Interviews lasted 60 minutes, on average. We conducted all interviews singly or in teams of two, and all researchers used the same interview protocol. Researchers met weekly while collecting data to discuss the interview data and to revisit the protocol, where necessary, in light of each new interview. We interleaved data collection and data analysis.

Data Analysis

The research team collaboratively analyzed each interview transcript. The most prevalent topic discussed was the "databases" that were variously used, worked-around, and/or abandoned by the participants. In this analysis, then, we focused on the interview data that related in some way to what participants referred to as their "databases" and to information management, more broadly. Using inductive qualitative methods [8], we iteratively developed a coding scheme related to participants' information management practices. Our initial set of codes typically related either to specific kinds of information management challenges or to rationales for using particular systems. Subsequent iterations of the coding scheme helped to differentiate between challenges rooted in the work context and challenges created (or exacerbated) by the participants' choice of systems. In addition, we identified clusters of systems that shared similar motivations for adoption and resultant challenges for information work. Our final iteration of the coding scheme helped us focus on the cyclic nature of information management strategies.

VOLUNTEER COORDINATION: AN OVERVIEW

The volunteer coordinator manages an organization's volunteer program, which is "a vehicle for facilitating and coordinating the work efforts of volunteers and paid staff toward the attainment of organizational goals" [5]. Additionally, our results suggest that from a public-facing perspective, the volunteer coordinator is "the port of entry for volunteers to get engaged in [an] organization" (L2[1]). The volunteer coordinator recruits, trains, places, follows up with, and recognizes volunteers, while continually working to keep them engaged within the organization. However, the work of the volunteer coordinator is not wholly outward facing; much of the work involves coordination within the organization, as well. Volunteer coordinators work with other staff members to help identify volunteer opportunities throughout the organization. They maintain an acute awareness of all programs and activities carried out across the organization, "…stick[ing] your nose into everything that's going on in the rest of the organization because you have volunteers everywhere" (D2). Both for herself and for others, the volunteer coordinator generates numerous reports about volunteers and about the state of volunteerism within the organization.

HOMEBREW DATABASES: CASE STUDIES

Managing information about an organization's volunteer base—such as names, contact information, and schedules—is central to the work of volunteer coordination. Here, we describe two different case studies of homebrew databases in order to exemplify the most common information management strategies used by participants in this research.

A Youth Development Nonprofit's Homebrew Database

O1 is one of two volunteer coordinators at a local affiliate of a national youth development NPO. She works half-time and manages a new group of 60–120 volunteers per quarter.

O1 collects information about potential volunteers via email. Once a potential volunteer RSVPs for an orientation and training session, O1 transfers his or her name and contact information to an Excel spreadsheet associated with the given month's training session. O1 maintains separate spreadsheets for the RSVP lists to different events as well as separate spreadsheets for current and past volunteers:

> I have this very massive, detailed RSVP to the training list for every month that I update pretty much every day and there's – it's color coordinated, it's all fancy (O1).

O1 collects information from confirmed volunteers via several paper-based forms: a signed volunteer contract; questionnaires about their skills, interests, schedules and availability; and a background check provided by the local police department. O1 then copies selected information from these forms by hand onto index cards, one per

[1] We refer to each of our participants based on the domain of work undertaken by their NPO [18]. For example, NPOs working in the area of housing and shelter have a domain code that begins with the letter "L." Multiple participants within the same domain are differentiated numerically (e.g., L1 and L2).

volunteer, and staples the index card to the front of each volunteer's packet of information as a quick reference. She uses these cards to help in placement and scheduling:

> You should see me…. I collect their packet and I staple it all and I have their…index card with their name, I highlight their name, their availability and their email address. It's like I see it all there because it's on a couple different pieces of paper and I sit there…with my chart and I figure out, you know, where I'm going to put who…. (O1).

After O1 places and schedules volunteers, these packets of information are filed alphabetically in a three-ring binder for the current quarter. O1 is in the process of entering volunteer contact information into a database used by the rest of the organization but has not yet caught up with the data entry backlog. As a result, she noted that when the NPO's "emails go out, our volunteers don't get those…."

Instead, O1 sends her own e-newsletter to the volunteers. O1 was originally cutting and pasting email addresses from her Excel spreadsheets into Outlook, but because it took too long, she had an intern help her re-enter all the volunteer information into Outlook. Unfortunately, the distribution lists are too long to use within Outlook, so she has returned to cutting and pasting from her Excel spreadsheets.

O1 uses another quarterly set of three-ring binders to log volunteer hours. All volunteers have a separate page in the binders where they are responsible for signing in and out and logging their hours worked each time they volunteer.

A Human Services Nonprofit's Homebrew Database

P1 is the volunteer coordinator at a local affiliate of national human services NPO. The national organization has a suite of web-enabled databases for tracking volunteers, donors, and clients, but these tools do not fully meet the needs of the local NPO. Because of this, the local NPO maintains their own homebrew database for ~2300 volunteers.

P1 first collects information about potential volunteers from a website when they register for orientation and later via a set of paper applications filled out at that orientation. P1 tracks the application process on paper until the prospective volunteer passes a background check. Then, the documents are scanned onto a shared network drive, and some data are manually entered into the homebrew database.

The foundation of this homebrew database is a shared Microsoft Outlook address book. Information about each volunteer, including his or her name and contact information, is managed in an address book entry. Extra fields are repurposed to store additional information such as race, ethnicity and job title. When volunteers attend training sessions or receive certifications, this information is tracked in the free-form notes section of their address book entries. The volunteers, themselves, are also given paper certificates as a record of their training, which can be used as a backup for the NPO's data: "we ask everybody to hold onto them just in case, because of us and our crazy databases" (P1).

Although the Outlook address book is set up to be shared throughout the organization, many of P1's colleagues prefer to maintain their own copies of the information. In fact, most departments maintain separate, somewhat-duplicate rosters of volunteers:

> Yes. It's on our server. But, again, some people don't use it. They want to create their own. That's what had happened, there are probably about eight different Outlooks that were out there…. So when I got here I was, like, "You are kidding me." So when they would say, like, "Can you do an hourly report, how many hours our volunteers have done in the last…" I was, like, "What? Can I even get a roster of our volunteers?" (P1)

P1 and her colleagues also maintain a "massive Excel spreadsheet" for tracking the hours of ~1500 adult volunteers. (Hours of ~800 youth volunteers are kept in a separate spreadsheet.) The spreadsheet-based system has recently evolved from one-file-per-month-per-department to a single shared file used for an entire year. This file has been enhanced to include formulas for calculating things like volunteer hours across departments and months. To keep the formulas working, anyone doing data entry has to add new volunteers at the bottom of the first page of the spreadsheet, out of alphabetical order. Each department is responsible for collecting their volunteers' hours and entering them in this shared spreadsheet.

P1 maintains contact with volunteers via a bi-monthly e-newsletter. She sends newsletters in batches using Outlook, "four separate e-mails because it will drag our server down so quickly." Volunteers also receive NPO-wide e-newsletters from the marketing department. As such, P1 is also responsible for entering volunteer contact information into the separate system used by marketing.

P1 is currently in the process of trying to streamline her information management practices. She is working with a software engineer who has volunteered his services full-time to the organization (a short-term arrangement). The volunteer is building a Microsoft Access database that they hope will be used throughout the organization to manage volunteer data:

> Without [this volunteer], I don't know where we'd be right now, frankly. Because he spends all of his time building [the database] while we are running the department…. So I don't know how we would do [it], because it's a full-time job in and of itself (P1).

HOMEBREW DATABASES: THE CONTEXT OF INFORMATION MANAGEMENT

Our results suggest that volunteer coordinators' choices and configurations of homebrew databases are motivated by a number of salient features of their work contexts.

The Diversity and Fluidity of Information Needs

Volunteer coordinators manage a diversity of information:

- *Individual volunteers*: names, contact and demographic information, schedule and availability, photos, program areas, skills/certifications, experience, dates and times of volunteer service, valuation of the volunteer's time (for calculating in-kind donations), background check, and liability waivers or other signed contracts.

- *Groups of volunteers* (e.g., corporate employees or church youth groups): name of the organization sending the volunteers, group leader name and contact information, group size, skills or physical abilities of the group, number of staff needed to supervise the group, total people-hours volunteered, and photos of the group.
- *Volunteer opportunities*: description of the opportunity, number of volunteers needed, schedule (dates and times), location, experience or training required, program area or department, and name of the supervisor.
- *Volunteer events* (e.g., orientations, training sessions, feedback roundtables, and recognition ceremonies): names and contact information for individuals who have RSVPed and often what informational resources the individual has already been sent.

This diversity of information needs is due, in part, to the complexity of the volunteer coordinator's job. In many cases, one individual manages the equivalent of an entire human resources department. The diversity is also due to the different kinds of stakeholders that must be supported; volunteers, nonprofit staff members, and representatives of other organizations all have information needs that the volunteer coordinator has to fulfill.

Volunteer management is also characterized by a fluidity of information needs. Volunteer coordinators reported frequently changing information management strategies to respond to new information needs from internal and external stakeholders, for example, as a result of new funding opportunities. In addition, many of the volunteer coordinators we interviewed had been working at their job for less than a year and/or were part of a new volunteer coordination department. As such, information needs were still evolving as the individuals and departments came to better understand their job or role within the organization.

The diversity and fluidity of information needs manifests in system requirements for *supporting diverse types of data*, from photos to scheduling information to legal documentation. Further, *underlying schemas and reports need to change as information needs change*.

The Diversity and Fluidity of Stakeholders

Volunteer coordinators work with a diversity of stakeholders, both internal and external to the organization:

- *Volunteers* typically approach the volunteer coordinator via email with inquiries about opportunities to volunteer. They send information about themselves, their interests and schedules. They RSVP for orientation and training sessions. In some instances, particularly when working with children, they are responsible for obtaining a background check and ensuring that the resulting paperwork is on file with the nonprofit. Volunteers sign in at the nonprofit and log their hours when volunteering. Some volunteers request reports about how many hours they have worked so that they can add that information to their résumé or provide verification for a community service requirement (e.g., at school). Many volunteer coordinators also reported continually reaching out to new demographics of volunteers; their efforts helped ensure a continued diversity of volunteers.
- *Group leaders* represent volunteers from other organizations, such as religious institutions or corporations. Group coordinators sign up to volunteer on behalf of their groups and negotiate terms of service with the volunteer coordinator (e.g., what service activities would be done as well as who would provide supplies for the project). Most commonly, group coordinators maintain their own rosters of volunteers, reporting to the nonprofit volunteer coordinator information about the number of volunteers who should be expected.
- *Institutions* such as schools or the criminal justice system send volunteers to the NPO to fulfill a specific number of service hours. These institutions have additional information needs including volunteer contracts with expectations for both the volunteer and the nonprofit, timesheets to be signed, and evaluations to be written.
- *Other Staff Members within the Nonprofit* (e.g., program and event coordinators) work with the volunteer coordinator to identify volunteer opportunities, create job descriptions, identify required training or expertise, provide scheduling information, and estimate the number of volunteers needed. The volunteer coordinator matches volunteers with these opportunities.
- *Accounting and development departments* within the NPO also have specific information needs. Some accountants maintain records about volunteer service hours to track in-kind donations. Data about hours volunteered are also frequently used by colleagues working on grant writing and development.

Volunteer coordinators also manage a fluid group of stakeholders. Some are working to provide a greater number of episodic—short term or one-time—volunteer opportunities to bring in new volunteers; others are constantly reaching out to new demographics of volunteers.

The diversity and fluidity of stakeholders manifests in requirements that systems can *scale gracefully*, both in terms of the amount and kind of data within the system as well as the number of users of the system.

The Diversity and Fluidity of Work Contexts

Many volunteer opportunities happen in the community—at schools, building sites, urban shelters or food pantries, settings without consistent or predictable information systems infrastructures. Some NPOs offer volunteers the opportunity to respond in crisis situations, as well. In these situations, the timing of volunteer work, the location of the service opportunity, and the quality of the infrastructure (information technology or otherwise) cannot be predicted in advance. These contexts for volunteer work and, therefore, the contexts for the work of the volunteer coordinator are diverse and changing. This diversity and fluidity manifests in requirements that systems be *accessible from multiple locations*, whether that access is mobile, web-based or otherwise.

Constraints in Time, Funding, and Expertise

The work of volunteer coordinators is characterized by pragmatic constraints in time, funding, and expertise. Many volunteer coordinators work only part-time in that capacity. In addition, many volunteer coordinators reported that interactions with volunteers and clients were the "real" work; the related information management responsibilities, although important, were less of a priority to them.

The work of volunteer coordinators is also constrained by funding. In particular, organizational information system infrastructure seemed to be more commonly allocated to support engagement with donors than with volunteers.

Finally, the work of volunteer coordinators is constrained by a general lack of expertise in information systems. Many volunteer coordinators were trained in the domain of the nonprofit (e.g., biology or education) or otherwise had received little training in information systems designed for organizational contexts. Many of the volunteer coordinators were relatively new to the organization or their departments were new. Thus, there was also frequently a lack of expertise in the organization's information systems (if they existed at all). Finally, some volunteer coordinators rely on volunteers to help with their information management; because of the fluidity of volunteers, there can also be a general lack of expertise within the volunteer pool, as well.

These constraints mean that *learnability* is a key factor in the adoption (or abandonment) of information systems. In lieu of time and funding for extensive training, participants believed that they and their volunteers should ideally be able to 'walk-up-and-use' information systems.

HOMEBREW DATABASES: THE MULTIPLICITY OF SYSTEMS

The diversity and fluidity of information needs, stakeholders, and contexts as well as time, funding, and expertise constraints all factor into decisions about which information systems to use. As these factors change, so do the assemblages of systems that are used to manage that information.

The volunteer coordinator's homebrew database is often distributed across numerous different systems. As such, the vast majority of volunteer coordinators have to manually enter information about volunteers into multiple information systems, including calendar systems, spreadsheets, address books, and other databases. Each application enables the data to be used in different but equally important ways. When NPOs collaborate with other organizations or are local affiliates of a national NPO, they often have to enter and maintain information in databases owned and managed by these other groups, as well.

When a volunteer coordinator matches a volunteer with an opportunity, the management of information about that volunteer often transfers to another staff member within the organization—typically either a program or event manager. These individuals often have more specific information needs driven by the particularities of their programs or events. For example, the volunteer coordinator at an animal welfare NPO recruited volunteers to foster animals in their homes. The foster program manager maintained information about these volunteers in her database—the animal database; the volunteer coordinator had to manually move those data over to her own volunteer database to consolidate volunteer information in one place:

> They enter foster hours when a foster kiddo [animal] is returned. Then their database, which was our animal database, which is not our volunteer database, generates the number of hours that were put in, averaged at about two hours a day. And then we take those and put those into ours… (D2).

In some instances, volunteer coordinators reported that even when they had a shared infrastructure for maintaining volunteer information, other staff members frequently duplicated information to customize it for their own needs. Practices of syncing back to the shared "database" were tenuous at best: "[A co-worker] would take my information, copy it and drag it into hers. I didn't know, always, if she was making changes" (P1).

This multiplicity of systems and duplication of data leads to (1) overhead for entering data into multiple systems, (2) version control issues in which information falls out of sync among "databases" and, (3) the abandonment of certain "databases" and the relinquishing of the functionality afforded by that particular "database." Indeed, L2 reported that her biggest frustration was that…

> …nothing syncs. You have to do multiple entries for everything. And at the point when you have to do multiple entries is when you don't do entries. You know, it just is so time-consuming and redundant that you have so many other things to do, that you just don't have the time to enter it (L2).

Volunteer coordinators typically create their homebrew databases by drawing from three classes of systems: *personal office applications*, *paper*, and *enterprise or custom databases*. In addition to the overall challenges resulting from the use of multiple systems, each class of systems creates its own challenges for information management. Each volunteer coordinator created her own unique assemblage of systems and typically experienced a subset of these challenges related to the particular classes of systems present in her homebrew database.

Personal Office Applications as "Databases"

Despite the quantity and complexity of the information managed, most volunteer coordinators use personal office applications such as Microsoft Excel and Outlook for managing volunteer data. These tools are not merely part of a larger information workflow. Rather, nearly all of the volunteer coordinators in our study use one of these tools as a primary repository for some form of information, even at organizations managing over 1,000 volunteers.

Most volunteer coordinators use multiple spreadsheets to track different but often overlapping kinds of information—for example, corporate, regular, and prospective volunteers; volunteers by department; and hours by department.

Volunteer coordinators also track volunteer information in email address books and in email messages, themselves. Some volunteer coordinators use email as the primary "database" for storing all volunteer information. Others use multiple address books, shared address books, user-customizable fields, and hierarchical distribution lists.

The problems that arise from the use of personal office applications as "databases" center on issues of scale and inaccessibility. Personal office applications fail to scale along three dimensions: number of users, number of records, and dimensions of data. First, although these applications allow for some collaboration, granting access to a large number of users means that shared files are often locked for editing. Second, the increase in the number of records stored in individual spreadsheet files, for example, leads to situations in which a file grows too large to open in a reasonable amount of time. Limitations of personal e-mail clients means that e-mails intended for wide distribution cannot be sent to hundreds (or thousands) of individuals:

> We were crashing the system for a year and a half and no one told us. {Laughter} Our network would go down every time we sent an email out to all the volunteers, but there was never the connection made. And one day I was pulled over to the data room and, "Do you recognize these email addresses?" I'm like, "Yes, those are our volunteers!" (D2)

Working around these issues requires the adoption of additional systems (e.g. email marketing services) or the additional effort of separating recipient lists into multiple smaller sets and manually sending out emails in batches. Third, personal office applications do not scale well for tracking information along multiple dimensions. For example, when tracking volunteer hours, some coordinators found it difficult to maintain data both from an individual perspective (e.g., for recognizing service) and from a departmental perspective (e.g., for documenting the total monetary value of volunteer work for a particular program).

Another problem with using personal office applications as "databases" is the inaccessibility of the data. Volunteer coordinators frequently create reports about volunteers' service. Although the Outlook address book, for example, is easily adapted to store additional information, it does not provide tools to generate these kinds of reports. Volunteer coordinators struggle to access and aggregate data siloed in multiple files, or worse, multiple programs:

> I guess what's tricky for me is I don't really have one database or one list of everyone. They're in these different spots. So if I wanted to, like, do a mass email to everyone, I don't have that capability (C2).

Additionally, information stored in personal office applications is difficult to access from off-site locations, where a significant amount of volunteering takes place.

Although these problems related to scale and inaccessibility are significant, it is also important to understand why something like Outlook may be a *good* choice for managing human resources information in the first place. Tools like Outlook and Excel satisfy many of the constraints within which volunteer coordinators work: they are already available on NPO computers and do not require additional expense or training. The fluidity of stakeholders—volunteers, in particular—means that technologies need to be familiar and accessible to many people. In addition, personal office applications can be appropriated flexibly and generally provide basic multi-user functionality.

Paper-Based "Databases"

Perhaps more surprising than the pervasive use of personal information management tools is the extent to which volunteer coordinators, even in large organizations, use paper as a substantive part of their information management workflow. This was the case for half of our participants, who often noted the seeming absurdity of the situation:

> We give anniversary pins, you know, for every year and then every subsequent five years. From what I understand somebody went through our paper files and figured [it] out, looked at the orientation date. And we have over 1,000 volunteers! (P1)

Many volunteer coordinators collect applications and contracts on paper-based forms. Volunteers frequently report hours on paper sign-in sheets. Liability waivers and emergency contact forms are almost always kept on paper; these records are typically maintained at a worksite and only later archived at the organization's primary office. Sometimes a subset of information from these forms is entered into a computer-based information management system. In one NPO, paper forms are scanned into the computer, although the data stored on them is not translated from handwriting to queryable digital text. In many cases, forms remain paper-based and destined for filing cabinets.

Paper "databases" suffer from similar issues of scalability and inaccessibility as personal office applications, only magnified. Searching, sorting, and aggregation require that information either be processed manually or duplicated in the computer, both of which are time consuming tasks.

Yet, paper fills many information management needs of volunteer coordinators. For many participants, paper plays a key role in supporting collaborations:

> We have it that way in a physical book because myself, [my supervisor, and a co-worker from another department] all look at the book from time to time and see what's open, so it's getting kind of toted everywhere (L1).

With multiple users, a single copy of a paper-based "database" does not lead to version control problems. In a number of instances, when computer-based "databases" were duplicated and drifted out of sync, a common strategy was to revert to the use of paper-based systems to have one, easily identifiable, master copy of the data. Paper-based "databases" also serve as a functional lowest-common denominator in organizations where not all employees have access to the same technological infrastructure or the skills to use it. A volunteer coordinator at one NPO schedules volunteers on a print out given to her by the project coordinator because she does not have access to the application that he uses to plan the work (L2). A volunteer

coordinator at another NPO tracks volunteer hours on paper because the volunteers work in a kitchen without a computer (K1). The portability of paper, then, is also an asset, particularly for NPOs that work at off-site locations.

Finally, paper is also useful for maintaining a shared awareness of processes. For example, P1 uses checklists and a series of trays to track the state of volunteer applications, not only for herself, but also for the office volunteers who come in and out throughout the day. By having information sorted based on applicants' standings, someone can immediately see what task to start on next.

Enterprise and Custom Databases

Roughly one-third of participants use some form of enterprise-level or custom database software. These range from full-featured database systems designed specifically for NPOs, like The Raiser's Edge[2], to more general business-oriented tools, such as ConstantContact[3]. One volunteer coordinator at a youth services NPO, for example, has appropriated VolunteerMatch[4] for managing many of her volunteer information needs:

> All of our short-term opportunities are directly linked to VolunteerMatch. So, anyone who looks for that short-term opportunity will show up in that reporting system. So, we have a way of capturing all of their data and their information and pulling – downloading reports (O2).

This one service allows her to manage sign-ups and scheduling, access information about each volunteer, and run reports to target new opportunities to individuals who had volunteered for similar activities in the past.

However, none of the volunteer coordinators have been successful in transitioning entirely to a single database, even one designed specifically for NPOs. Those who use an enterprise-level database do so alongside other tools. Many volunteer coordinators who expressed interest in enterprise or custom databases also expressed concerns that using a new piece of software—especially database software—would require dedicating time and money to develop the system and train people to use it:

> I know everything that we've looked at, I think you feel like you still kind of have to build a lot and that it's not as easy to set up as you kinda hope it would be (P1).

In addition to setup time, volunteer coordinators who were currently using databases experienced them as introducing new data entry and data management overhead: "The problem is it's a full-time job. Literally, I could sit at a computer nine hours a day and enter in those volunteer applications" (O2). Thus, even organizations that had functional databases are not able to fully utilize them:

> So, I guess that's part of the daily [work], too, is the input of the night before's volunteer hours, which is a little backed up right now… My volunteer who does that has been sick for a while…. We try to keep up with it and it just gets away from you. We could use extra hands, but that means extra computers and extra spots to sit (K1).

Additionally, data in databases are often perceived as not being accessible or in a usable format. Because different stakeholders often have different information needs, even when a volunteer coordinator uses a database to manage the majority of her information, she often reported exporting data to an Excel spreadsheet for herself or other collaborators, recreating the challenges of data redundancy that the database is intended to mitigate: "Once they're all there [the information is in the database], I can make this beautiful Excel sheet of all their information…" (O1).

Furthermore, information management is not the real work of volunteer coordination; it is overhead. While a few participants had volunteers who were willing to help them manage data, many felt that data management is the most undesirable task that could be given to a volunteer:

> It's like [my volunteer here]. He could be playing golf right now. The weather is perfect. And yet he's here, you know, sitting doing the most boring task there is (P2).

Issues of scale were the primary motivators for volunteer coordinators to transition to enterprise-level software. Coupled with this, ongoing difficulties managing duplicate and inconsistent data drove the vast majority of volunteer coordinators to seek out more centralized options.

HOMEBREW DATABASES: A CONTINUAL CYCLE OF RECONFIGURATION

Volunteer coordinators create particular assemblages of information management systems to satisfice their needs. Each type of system—personal office applications, paper, and enterprise databases—has its own set of shortcomings, at best, and exacerbates the challenges of information management, at worst. Nearly all of the volunteer coordinators in this study are frustrated with their current assemblages of systems and most are looking for better solutions—ideally, finding one system that can do everything. The problem is that no such solution exists:

> The problem is that all needs to be in the same software. This is what we struggle with. We can't figure it out… having all that stuff together in one software would be great. We were looking at some stuff… but nothing—nothing does it all (L2).

In lieu of a system that can do everything, volunteer coordinators continually reconfigure their homebrew databases—swapping one system for another and hoping the new set of systems will help reduce overhead in managing information. We heard over and over again that volunteer coordinators were in the process of migrating their data from one application to another.

Yet each transition to a new system creates additional work. Existing data either has to be ported—frequently necessitating manual re-entry of the data or selective copying and pasting—or abandoned. New systems rarely, if ever, encompass the same set of features or afford the same degree of flexibility as previous systems. Changes in the information managed by one application influence information management in others.

[2] http://blackbaud.com/products/fundraising/raisersedge.aspx
[3] http://constantcontact.com
[4] http://volunteermatch.org

Our data suggest the prevalence of a recurrent cycle—with each reconfiguration of the homebrew database demanding additional data management overhead and new data management practices. The new homebrew database, never quite addressing all the volunteer coordinators' information management needs or creating new challenges of its own, causes the cycle of reconfiguration to continue.

Volunteer coordinators also reported one additional catalyst that helps to perpetuate the cycle of reconfiguration—the fluidity of stakeholders. Information systems, particularly enterprise or custom databases, often rely on the expertise of someone who may not have a long-term commitment to the organization. When a local expert ceases to be available, the homebrew database has to be reconfigured so that the remaining volunteers and staff can manage the data.

FUTURE RESEARCH AND DEVELOPMENT

The results of this study suggest two trajectories for future research in databases and information management. We believe the outcomes of this future work may be valued not only by volunteer coordinators but also by the many individuals who need to manage information too complex for paper or personal office applications, but who cannot confront the overhead of using enterprise "solutions."

Towards More Human-Centered Databases

One significant trajectory for future research involves the design of more human-centered database systems. Such systems need to be accessible to individuals with limited technical expertise. Although there are some products like FileMaker and Microsoft Access intended to fill this need, these systems still require too much technical expertise to be usable by volunteer coordinators and many others who comprise the volunteer workforce. Indeed, one participant noted that a FileMaker database had to be abandoned when the resident expert left the organization (A2).

The challenge of creating more human-centered databases is not simply a matter of creating more usable interfaces for creating databases—both FileMaker and Access provide numerous templates and visual programming tools. It is also a matter of revisiting the complex models that underlie contemporary database systems. Jagadish et al. have called for "database systems that reflect the user's model of the data, rather than forcing the data to fit a particular model" [11]. In this research, we have begun to gather empirical evidence about how individuals construct representations of their own data. When considering requirements for more human-centered database systems, researchers might consider the ways that participants in our study modeled and managed their data:

- Volunteer coordinators chunked conceptually similar data into multiple, distinct information repositories and genre-specific applications. This observation suggests that human-centered databases need to support the management and integration of multiple types of data.
- Volunteer coordinators continually updated the underlying structure of their homebrew databases to reflect new information needs. This observation suggests that human-centered databases need to support evolving models, allowing the underlying schemas to change gracefully as information needs change.
- Volunteer coordinators reported that scalability was one of the most significant catalysts for the reconfiguration of their homebrew databases. This observation suggests that databases need to scale more gracefully and be useable from the very beginning of a volunteer coordinator's information management process through the maturation of the volunteer program. Databases are currently optimized for supporting very large datasets, but researchers should also consider what it would mean to provide database design and management tools with minimal adoption barriers for individuals with small-scale datasets, to encourage adoption from the outset.

Towards Migration, Import, Export & Syncing Standards

Even with the development of more human-centered databases, it is conceivable that volunteer coordinators will still manage some redundant data across multiple information systems. The volunteer coordinators in this study identified the migration of data between applications as a source of significant overhead. Volunteer schedules that were maintained in a calendar, for example, could not be exported into a spreadsheet to track hours. And while Outlook provided features to exchange data between an address book and an Excel spreadsheet, neither application provided a synchronization capability for data stored partially in one location and partially in another.

These observations suggest that another fruitful trajectory for future research would be the continued development of standards and interaction mechanisms for migrating data between applications, including importing, exporting, and syncing datasets. Although a number of standards (e.g., HTTP) and file formats (e.g., XML and OPML) have been developed to facilitate data exchange among applications, the corresponding tools for managing the mappings among application-specific data fields within these files and automating synchronization across data repositories have neither reached the same level of maturity nor become accessible enough for people without technical expertise.

CONCLUSION

In this paper, we have made the following contributions:

- We characterized the diversity and fluidity of the context and constraints of the work of volunteer coordinators and identified the associated challenges related to information management;
- We described the information management strategies of volunteer coordinators, characterized the homebrew databases they created, unpacked the reasons why they created these systems, and identified the additional information management challenges that were generated by these homebrew solutions;
- We proposed two trajectories for research—more human-centered databases and migration standards—that

would better support the information management needs of volunteer coordinators.

More broadly, this research foregrounds the pervasive influence and implications of evolution in information management. The nature of volunteerism evolves; the role of volunteerism within an NPO evolves; the kinds of information needed to understand volunteerism evolves; the information management practices of volunteer coordinators evolve; and the configurations of homebrew databases evolve. Although this research focuses on the information management of volunteer coordinators, researchers who study broader classes of knowledge workers have noted the importance of evolution, as well—that the meaning of information to a knowledge worker evolves over time (e.g., [12]). As a research community, then, we ought to consider the ways that information systems can be designed to evolve, as well—alongside individuals, groups, and organizations.

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