No Place Like Home: Pet Reunification After Disaster

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Abstract
Pets are important household members, and their welfare and safety are imperative to the emotional welfare of the family. Displacement of pets after disaster events is a serious matter to families and for public safety at large. People are not willing to evacuate without their non-human family members; many will break through evacuation zones to recover animals left behind. In the 2005 Hurricane Katrina event, over 200,000 pets were displaced, and 95% of them were never reunited with their families. The US Department of Agriculture confirms that the problem of reuniting displaced pets and their guardians at this scale is unfortunately common in disaster events. We introduce *No Place Like Home*, a socially networked web and mobile platform that facilitates reunification of non-human with human family members following disaster events. *No Place Like Home* is an effort that supports the formation of small cadres of micro-tasking "digital volunteers" that converge after disasters to do photo- and description-matching; employs a reputation and reward system to encourage use; and uses match-based machine learning techniques to accelerate the manual matching tasks performed by digital volunteers.

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General Terms
Human Factors

Introduction
In the classic film, *The Wizard of Oz*, Dorothy tries to find her way home after a tornado tears through her farm. When the chance finally comes, however, she will

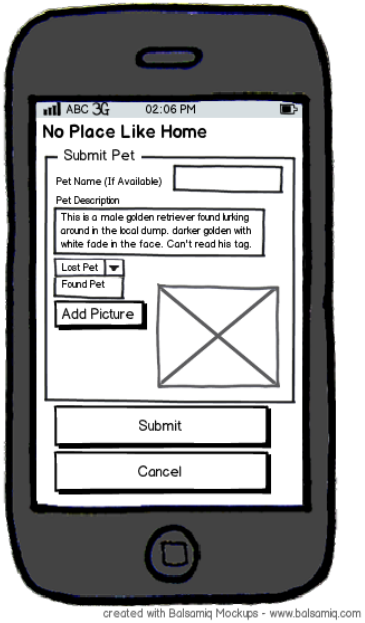

Figure 1. Mockup of a mobile pet reporting tool.

not go without her beloved dog, Toto. Dorothy learns that there is "no place like home," and that it is the family members, both human and non-human, who create that space for connection and belonging. We locate this theme in the context of disaster response and recovery, where pets are frequently separated from their guardians during a crisis event.

Domestic space provides essential functions like sense of safety and connection when life is disrupted. When disaster threatens a home, its occupants work to maintain the family's safety and interpersonal connections. These relationships, even when removed from the physical space of home, remain the most important part of what constitutes "home." Sadly, during a disaster, not all family members stay connected: pets are often left behind during evacuations because they cannot be transported or allowed into shelters. An estimated 200,000 pets were displaced in the aftermath of Hurricane Katrina, of which just 5 percent were reunited with their guardians [3]. In some cases, the "rehoming" of displaced animals led to the courts attempting to decide if rehomed animals could be reclaimed by hurricane victims who had since found their pets [4].

No Place Like Home is an online, social platform for facilitating the matching of pets with their guardians. It allows users to accumulate social reputation and earn rewards and privileges (such as moderation powers regarding the suggestions of other volunteers) for identifying potential matches between reports of lost and found pets uploaded to the system by other volunteers. Studying how features such as these can help motivate users to identify these matches, we discuss our current approach for the design of the tool, which includes personas and scenarios, a cognitive walkthrough, rapid and lean-based prototyping, and usability testing.

Pet Reunification in Disaster Events

Over 60 percent of American households (nearly 73 million) include at least one pet. Pets are viewed by many of these households to be non-human family members. During a hazard event, many people will refuse to evacuate without their pets, or alternatively, will knowingly risk their lives to retrieve them. Research shows that pet ownership has a positive impact on the lives of people, and that when pets are lost during a disaster event, the psychological distress to the guardian exacerbates the effect of the emergency, prolonging the recovery period—particularly for children and the elderly [2,3].

The displacement of pets in disaster is a large-scale, recurrent problem. After Hurricane Katrina, many pets were either transported out of state and rehomed, or destroyed. There was very little in the way of organized support for connecting guardians with animals. Years later, cases were still being brought to courts as guardians attempted to reclaim animals which had been rehomed by the authorities without their knowledge.

The challenge of maintaining connections between pets and their guardians in disaster was recognized by the US Government's passing of The Pets Evacuation and Transportation Standards (PETS) Act (2006). This Act, conceived in direct response to the domestic pet problems encountered during Hurricane Katrina provides funding to US States to help maintain connections between all human and non-human family members in evacuations [6].

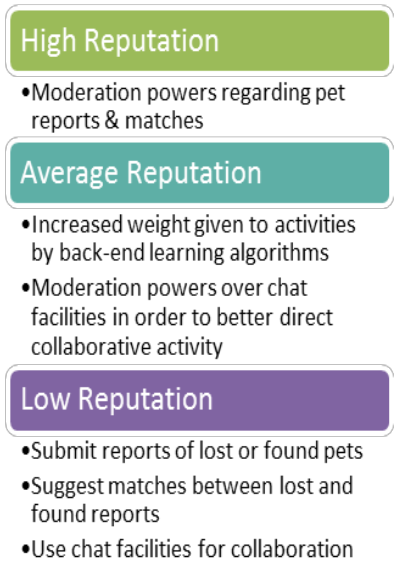

Figure 2. Actions available to users at varying reputation levels.

Related Work: Digital Volunteerism

Research to understand and study historical and ICT-abetted participatory behaviors by members of the public during mass emergency events falls to the field of crisis informatics [5]. Starbird and Palen found that in the aftermath of the 2010 Haiti earthquake, volunteers from around the world converged over Twitter to help make connections between requests and offers for help, among other information processing tasks [7]. These "digital volunteers" are a natural extension of the "spontaneous volunteer convergence" phenomena well-documented in disaster predating ICT [1]. We leverage these empirically-documented behaviors in the work presented here by giving those who want to help in disaster situations — no matter their location — a well-articulated and easy-to-execute task for an important societal problem.

Proposed Solution

Our proposed technological solution is *No Place Like Home*, an online matchmaking tool designed for facilitating pet reunification using digital volunteerism. *No Place Like Home* acts as an infrastructure for the consolidation of reports of lost or found pets (see Figure 1 for a sample reporting tool), and makes use of machine learning algorithms to cull the viable search space for potential matches, presenting users with top candidate matches. *No Place Like Home* uses the result of digital volunteers' activities as a feedback mechanism for retraining and improving its machine learning foundation, making the system a unique combination of human and machine computation.

Reputation and Rewards

No Place Like Home supports the creation and use of social capital among digital volunteers via a reputation mechanism similar to those employed by networks like StackExchange. Users give each other reputation points for positive actions (and can reduce the reputation of non-contributing users), which increases the cohesiveness of the social networks formed during the event. Higher reputation scores grant users greater administrative privileges, allowing the highest rated users to become community moderators. In addition, *No Place Like Home's* back-end algorithms will factor in reputation scores to determine voting power, weighing the actions of highly-rated volunteers over lower-rated volunteers (Figure 2). Users can also view their long-term performance and achievements, as well as those of other users, via a profile mechanism in the application.

Social Connections

Our system will facilitate ad hoc communication and network formation between digital volunteers via chat rooms available on the same interface used for the matching task. These chat rooms will be able to be created and dissolved at will. They will support impromptu social connections, allowing volunteers to rapidly form networks for accomplishing a variety of short and long-term tasks, such as finding a match for a specific pet report, or monitoring reports for several hours on a particular type of pet. Some chat rooms can (optionally) be automatically created for groups of users who have existing social ties on linked social network accounts, such as Facebook or Twitter. Enabling the user-prompted automatic creation of ad hoc groups such as these will catalyze volunteer activities by connecting users with other known users immediately. Chat rooms also contain contextual links to pet reunification activities. For example, if a user in a chat room suggests a potential match between lost and

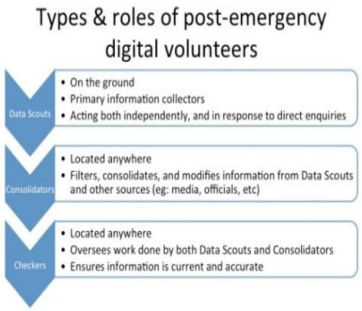

Figure 3. Data Scouts Framework.

Charlie - *the remote volunteer:* Charlie is a 4th grade student whose teacher is interested in assisting victims of a recent earthquake in California. The teacher directs Charlie and his classmates to utilize *No Place Like Home* as a volunteer activity. Charlie enjoys finding matches for lost pets - the activity is almost like a game to him.

Figure 4. Sample Persona (photo copyright Joanne White).

found reports, that activity is reported in all the chat rooms the user is currently a member of. Users who see this report are asked to verify the proposed match. *No Place Like Home* thus achieves focused, rapid verification by prompting for multiple opinions among a relevant, on-task sub-population of users.

Design Process

We outline our design process for the rapid prototyping of *No Place Like Home*, which includes personas and scenarios, design goals, a cognitive walkthrough, and usability testing. Finally, we remark on our findings and discuss our proposed design changes.

Personas and Scenarios

After conducting contextual research based upon the experiences of past disasters as well as our knowledge of the behaviors of digital volunteers, our team began the design process by generating personas reflecting the three types of digital volunteers that can be operationalized for a pet reunification activity. We have identified three classes of the digital volunteer: The **data scout,** who is a primary information collector; the **consolidator**, who performs matching tasks upon the information gathered at data scout stage, and; the **checker**, who ensures that information is accurate, and follows through on the work of consolidators by informing authorities and pet guardians of suggested matches (Figure 3). We used these roles to develop personas (Figure 4) and to create core design goals for the matchmaking system.

Design Goals

Using these personas, we postulated several context-specific pet-reunification scenarios. The common elements led us to develop these primary design goals:

- Because our user population is likely to be demographically diverse (in terms of age, background, enthusiasm, and experience using technology), our solution must enable the simple completion of the matching activity.
- Our solution must also offer tools for completing difficult matching activities because of the potential complexity of the task, to achieve high performance and accommodate experienced users.
- Our solution must be flexible enough to provide a depth of interaction relative to users' levels of interest, time available, and differences in tasks.

We created a low-fidelity prototype using these design goals (Figure 5). Subsequent usability testing on this prototype (and later, a medium-fidelity prototype) focused on a simple matching task in which a user attempted to suggest a match between a lost pet report and a similar (but not identical) found pet report.

Cognitive Walkthrough

Our team performed a cognitive walkthrough of the task in order to create a medium-fidelity prototype suitable for usability testing. Our cognitive walkthrough identified two primary methods for task completion: a user could either scroll through the top suggested matches (simulating the machine learning capabilities of an actual implementation) in the "Found" column, or use the text-based search interface to directly locate a suitable match. The former approach offers a visual experience, whereas the latter approach offers a powerful text-based search interface.

The cognitive walkthrough also identified potential problem areas with our low-fidelity prototype. We felt creating a consistent color scheme to differentiate lost

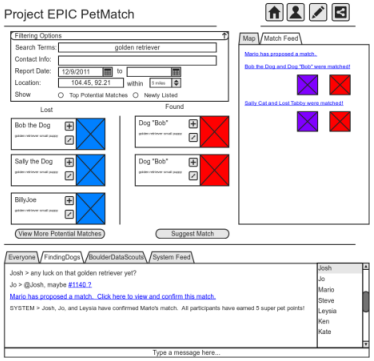

Figure 5. Low-fidelity prototype.

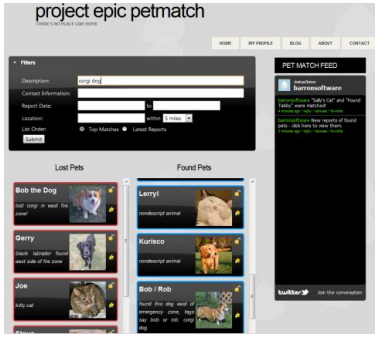

Figure 6. Medium-fidelity prototype.

and found entries would reduce confusion between the two, but we questioned if the color difference might be too subtle for a number of users. We also identified the drop-down text-based search control as a potential area of confusion for users.

Usability Testing & Upcoming Design Work

The final result of this iteration was our medium-fidelity prototype (Figure 6). This prototype was a working website interface which used some JavaScript to simulate actual implementation features. Using this prototype, we conducted usability tests using the think aloud protocol with eight users from age 16 to 71 years old. The task that was the focus of these tests was to identify a viable match between a report of a lost pet ("Bob the Dog") and a report of a found pet which had similar characteristics.

All of our participants were successful in completing the matching task, though completion times ranged widely: the quickest participant completed the task in under ten seconds, whereas the slowest completion time was about five minutes. More importantly, these trials revealed a number of issues with our medium-fidelity prototype's design. These issues included confusion regarding how to propose a match and the language used in the prototype, as well as several visual issues regarding the color scheme and size of controls in the prototype. To address these issues, we plan to change existing language (and include new language) into future prototypes to better distinguish between "Lost" and "Found" pet reports, as well as to better convey the purpose and functionality of the search interface.

Some behaviors exhibited by test participants suggested that the prototype's interface mechanisms and presentation were sub-optimal. Several participants successfully located the match (Figure 7) necessary for completing the task but kept on searching through more entries in order to verify that they hadn't made a mistake, or in order to explore and see if there was a "better" match available than the one they had selected. Other participants wanted to preserve some entries in the "Found" column that they thought might be matches while they looked through other entries. These behaviors suggest that this task involves a higher cognitive workload than we previously thought. We are therefore including new features into a future design to create a more dynamic workspace than is currently implemented in the medium-fidelity prototype. We are considering a locking mechanism which reserves screen real estate for entries a user selects as a feature which could facilitate the behaviors exhibited by our test participants. In addition, we would like to implement a bookmarking mechanism to allow users to preserve pet reports for future investigation. These two mechanisms will facilitate a workflow that permits consideration of many pet entries simultaneously, which matches up with much of the actual behavior we encountered in usability testing.

Conclusion

We have described a common and unfortunate artifact of disasters: that pet guardians are frequently separated from their non-human family members. We believe this is a problem that is deeply connected to the ideas of home and belonging, and we have drawn upon past behavioral research on digital volunteerism that supports the rationale behind pet reunification as a crowd-based task that is backed by some machine learning support. We have introduced our prototype, *No Place Like Home*, which has been designed using user-

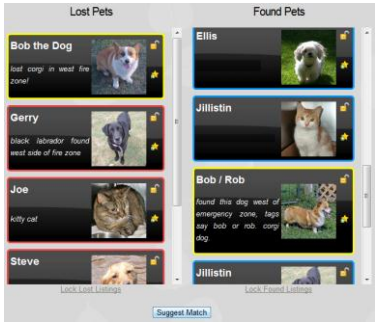

Figure 7. Successful completion of the matching task (matching "Bob the Dog" with "Bob / Rob").

centered design techniques. We continue to investigate how to further improve our design and development for building software that supports citizen-driven recovery efforts in the disaster domain.

We hope that the deployment of the tool will further enlighten our discovery of:

- the type and behavior of users who are attracted to working on this problem
- the most common data that are shared within the system
- the accuracy of all facets of the data

With a deployment during a real event, we will continue to make improvements to both the interface and the back-end software so that the tool will better suit the needs of users and the new tasks they will inevitably spawn.

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