Gamifying the Annotation of Physical Spaces

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ABSTRACT

In this paper, we will discuss the topic of crowd sourcing the annotation and documentation of physical spaces through the use of gamification. Annotating and documenting physical spaces involves communicating information about different distinct locations around the world. Gamification has been used frequently to improve user experiences in non-gaming systems, but it has yet to be implemented in such a way that users will be encouraged to extensively document the physical spaces in which they live. The documentation of public spaces can be a very resource heavy task, so a way to distribute the workload among many users would dramatically reduce the time spent annotating these spaces as well as significantly reduce the cost. The application "Bubbles" is presented as an example of a system designed to collect location-based information through user's posts that are created during game play. Two user trials of the game produced data that was examined and used to determine viability of this method and future research opportunities.

Keywords

Gamification, Annotation, Documentation, Crowd Sourcing, Location-based Systems.

1. INTRODUCTION

The main idea behind the annotation of physical spaces is to communicate enough information about an area, such that people are able to accomplish their intentions as easily as possible. We will define the annotation of physical spaces as the creation of information to be conveyed either physically or virtually, relating to places located around the world where people can physically go. Further, we will define space as the environment in which objects exist and events occur. Place on the other hand, we will define as a space with a corresponding context or meaning. For example, Harrison and Dourish (1996) provide the example of a conference hall in contrast to a theatre [6]. Although these two structures have similar spatial features (such as lighting and orientation), a person who sang and danced while in a conference hall would be regarded as odd. They argue that we would describe this behavior to be "out of place", not "out of space" and that it is place, not space, which frames appropriate behavior.

Street and building signs are common examples of annotations that are quite necessary for people to find what they need to and although these are common, they are very general pieces of information. A problem lies in the fact that depending on the goals a person has, what information is relevant can change drastically. For example, when searching for a restaurant to eat at, relevant information would include quality of food, service and prices of local restaurants - which often relies on local knowledge and opinions - and would not include nearby clothing or electronics sales. For this reason it is not spatially feasible to create all of these annotations in the form of physical signage. Technology has provided us with a way to make all of this information available without the limitations of space. By virtually annotating physical spaces, individuals can search for and select appropriate information for their needs. The issue now is how collect this information because annotating and documenting a physical space can be time consuming and costly.

Figure 1. A student creating a note about the quiet study space that they found.

Public annotations of physical spaces often obtain a very accurate depiction of how a population interprets a given space. This is often the kind of information people are seeking when looking at annotations. There are currently several systems that already work with this concept such as Yelp and Urbanspoon. These are both restaurant review systems that are designed to take public opinions of restaurants and make them available to anybody who wishes to access them. The information communicated by these systems is a meaningful step above and beyond what a mere restaurant map would communicate because they provide detailed information that people desire in certain situations. This is evident in the growing popularity of these sites. The system presented in this paper will attempt to gather this detailed and publicly driven information about physical spaces, while not limiting the subject matter to strictly restaurants.

We will investigate the concept of crowd sourcing this documentation by creating a system in which users will annotate physical spaces, thereby distributing the work and making it significantly more cost efficient. The idea behind this project is to use game design elements to encourage users to complete the task of annotating spaces without the need to monetarily compensate them for their time. This could be very useful when attempting to annotate a small space, such as a campus.

First, we will further discuss the usefulness of annotating spaces as well as some of the benefits and difficulties that come with allowing the public to partake in the annotation [2]. Then we explore the importance of having this solution be location-based. This includes providing additional motivations for users who use the system as well as increasing the likelihood of information integrity and understandability [1,2,3]. After that we will see what is involved within the process of gamification and what are good

ways to evaluate it [4,5,7]. Finally, we will take a look at a system that is designed with the intent of encouraging users to document and annotate the locations that they visit. We will be addressing the points that have been discussed throughout the paper in order to explain the though process behind each of the key features.

2. RELATED WORK

Previous work that has been conducted relating to this project can be broken up into three general categories; annotation of public spaces, location-based systems, and gamification. We will define public spaces as physical or virtual areas that are open and accessible to all.

2.1 Annotations in Public Spaces

There have been multiple papers done on annotations in public spaces, but one that was very closely linked to this project was about GeoNotes [2], a location-based information system for public spaces. This system is designed to connect information pieces to specific positions in physical spaces. The largest difference between this system and the one proposed here is that we shift our focus onto the topic of user motivation through to use of gamification. That said, much of what is discussed in the GeoNotes paper is very important to this project. In their research they discuss different aspects of annotating public spaces as well as location-based annotations. A few of the paper's points that are most relevant to our system are discussed in this section as well as the next one.

Although public spaces in the physical world have been largely commercialized in terms of annotations via messages/logos on billboards, clothing, cars, etc. [2], virtual public spaces remain largely accessible for anyone to express their thoughts and opinions. Some examples of this freedom in virtual space are Yelp and Urbanspoon, which were discussed earlier. These systems provide everyone the opportunity to see what others have thought about a specific place without having to go out of their way. Having a convenient way to access relevant information is a large factor in why annotating public spaces is so useful.

As was explained before; allowing the public to annotate physical spaces often obtains a very accurate depiction of how the population interprets that space, which is often the kind of information people would want when looking at annotations. The downside of providing this access to the public is that it opens the door to possible inappropriate or offensive content. This ties in very heavily with levels of anonymity [2]. In a system with complete anonymity, there is a higher chance of this offensive content because an author is not morally or legally accountable for statements made. On the opposite side of the spectrum, a system with full non-anonymity will discourage authors from posting at all for fear of public criticism and even possible legal charges. A middle ground between the two is the concept of anonymous signatures where authors have the comfort of knowing that they can express themselves without as much public scrutiny. This system still deters illegal actions because of the increased chance of being caught [2]. This is important to keep in mind when designing this project in order to protect authors while still maintaining a reasonably "clean" space.

2.2 Location-Based Systems

Lots of research has been conducted in this area, many of the papers referring to either Geocaching or Foursquare as the system of focus. Geocaching involves hiding a container in a particular location, and then publishing the latitude and longitude coordinates for other geocachers to find [3]. This system is relevant to this project because we can learn how to motivate users to go out of their way to accomplish a task. Foursquare is more of a gamified check-in system where users compete for "ownership" of spaces by the frequency that they visit them [1]. This system is relevant both in the fact that it has gamifying elements as well as being a pervasive location-based application, from which we can learn how this is accomplished and implement these aspects into our own application. I have chosen two papers that each focus on one of these systems and the motivations behind the users of them. This section will discuss some of the points these papers explored relating to this project as well as some concepts from the GeoNotes paper mentioned in the previous section.

With the increasing number of devices with GPS capabilities, location-based applications are becoming more and more common. Applications such as Geocaching and Foursquare have large user groups that they have built up and sustained over time. There has been previous research done on the motivations of users who regularly use these types of systems. Some of these motivations included the discovery and exploration of new places [3], personal tracking, and meeting new - or socializing with old - friends [1]. Although the system that this paper is proposing will differ in several ways from these ones, these general motivations can be carried over and used to create a better user experience.

Using location when considering annotations also has many useful functions. Spatial context is a useful tool when communicating about a topic. If it is known that the author and the reader share the same spatial context, then the annotation can refer to that context without a loss of understanding [2]. For example, a note on a door saying "make sure that this is properly closed" suggests that the door should be checked when leaving, but without the spatial context, it is unclear what the note is referring to. The notion of context knowledge for both the reader as well as the author is an important point while designing a system for documenting a physical space. By forcing authors to be in the space they are annotating, we can assume some minimum level of knowledge about the area.

2.3 Gamification

Although referred to under many different labels, there has been quite a bit of research on gamification. Gamification can be described as the use of game design elements in non-game contexts. One source that will be referred to defines the term gamification as a large focus of the paper's topic [5]. Another refers to this concept as "games with a purpose" or GWAP, but still discusses the purpose and effectiveness of gamified systems [4]. And finally, one presenting an example of a system designed to use gamification to support navigation [7].

Gamification has been used in many systems in order to motivate users to become engaged with a higher intensity and duration [5]. The idea behind this process is to tap some of the brainpower that is spent playing video games and use it for a productive purpose. More than 200 million hours are spent each day playing computer and video games in the U.S. alone [4]; if even a fraction of that time could be put towards a useful task, it could majorly cut back on the time and money poured into many trivial tasks. The success of a gamified system is how many people use it and how much information is collected. When evaluating the system proposed in

this paper, we will use a previously defined method of sidestepping the philosophical discussions about whether something is "fun" or "enjoyable" and instead observing whether people are inclined to use the system or not [4].

The paper which attempts to define gamification discusses how the line between gamified systems and full games can often be blurry and can depend on the context of the specific person who is using the system. Some people may "use" your system and others may "play" it. This makes it difficult to say exactly what a gamified system is [5]. For the context of this project, we do not need to define whether the system is a gamified system or simply a game; the purpose is to make a system that encourages users to consistently want to input data. That being said, this other paper does mention several game elements and game design elements that are often found within games and have been thought, by many people, to increase the amount that users enjoy a system. Some of the elements we will make use of are: self representation with avatars; reputations, ranks and levels; marketplaces and economies. As said in the paper, simply having these elements does not make a game, but the inclusion of them is thought, by some, to improve the experience.

The final paper that will be used in this section presents a system that closely relates to our topic. EyeSpy is a game designed to exploit human computation and knowledge through mobile game play [7]. It does this by rewarding players for both finding photos and tags that others have created as well as being the creator of a photo or tag that has been found. Tags that are able to be found frequently are good to use to assist navigation since they will be easily spotted when someone is trying to get their bearings. The application that they designed used Wi-Fi fingerprints to determine a user's position because it obtains a quicker lock than GPS, but does not provide as wide of a range of coverage. Although our system is more concerned with obtaining context for places rather than recognizable features or landmarks, we can learn from the many similarities; particularly the way in which they have their users both collect the data as well as confirm that it is useful.

3. DEVELOPED SOLUTION

This project will be a location-based mobile application designed on the Windows Phone in which users will be incentivized to create annotations about the spaces that they visit.

3.1 Intention of System

The goals which we want to fulfill with the system we design include, (1) encouraging users to input information about places they go through the use of game play. This is so that we may obtain this information without and an extensive amount of time or money invested into it. (2) The information that we collect should be representative of what the user wishes to express, therefore a choice of medium to communicate through should be provided. This will help to make sure that the context of a place that is communicated with the information is what the population truly thinks about the place. (3) The information that is collected should be linked to specific locations so that it can be used to show that the thoughts and opinions expressed are related to that area. (4) The system should include a way to differentiate between posts that most of the population agrees with and ones that do not reflect the public's view of the place.

3.2 Game Play Scenarios

Scenario 1: Larry checks his phone and sees that his pet, Bonkers, is nearly leveled in its food interest bar. Larry goes to a burger place and takes a photo of the area. Bonkers gets fed from this photo and Larry gets bonus points for leveling Bonkers' interest. Larry can now see all of the other users that have recently been here.

Scenario 2: Larry has saved up quite a few points from leveling up Bonkers and checks the store. He sees a hat that he wants to get for Bonkers. He spends his points to get the hat and his pet can now wear it.

Scenario 3: Larry walks into a Mac Hall. He pulls out his phone and checks the most recent and most popular bubbles. He sees that someone has posted about how good their food was, so he decides to try it out. After eating, he joins the other user's bubble so that others will be more likely to see it.

3.3 Design of System

The Windows phone application, Bubbles, was created as an example solution to our problem. Some important design choices were made in an attempt to meet the goals of our system.

(1) Game-like elements were used in an attempt to make the application fun to use. If users get enjoyment out of using the application, then they will be more likely to continue to use it, and therefore continue to provide information. The game elements that were used in the creation of this application were: self representation with avatars; reputations, ranks and levels; marketplaces and economies [5]. The users of the system are given a virtual pet to take care of, which helps them to become engaged in the game using visual stimulus. They can gain experience for their pet's interest bars by creating notes – referred to as "bubbles" in game – with a type corresponding to their pet's interests. For example, a note created about a burger joint would provide experience for their pet's food interest bar. The interest bars provide a short term goal that the user can achieve so that they do not lose interest while working towards their larger goals. When an interest bar completely fills up, the pet gains a level in that interest category and the bar is emptied. When this happens, the user is awarded with a large number of points. A small number of points are also given whenever a bubble is created. These points can be used in the shop, towards a variety of visual upgrades for their pet. This provides a longer term goal to keep users engaged over an extended period of time.

(2) The option to choose either text or photo when creating a bubble gives the user some freedom in the medium that best communicates what they want to say in their post. This should hopefully allow a more accurate interpretation of places that are annotated.

(3) The device's GPS is used to track the user's location. When a bubble is created; the user's current longitude and latitude is linked to it. This does a couple things for us. First, it is necessary in order to keep track of where the information is referencing for data collection purposes. Second, it can be used to influence users to create location related topics when making a bubble. Users are able to view bubbles created by themselves and other users, but only if they are within a certain range of them. When they know that their notes are not visible to everyone at all times, and rather only to people that are within the bubble's radius, they may be encouraged to make posts that have relevance to that particular

place. This should shift the action away from feeling like a twitter status update to feeling more like leaving behind a post-it-note.

(4) Allowing users to "verify" the information being posted – that is, to confirm that it indeed is an accurate reflection of the place – is done by allowing users to "join a bubble", which is essentially equivalent to "liking" or "+1'ing" something on a forum. The bubbles with the largest populations will be displayed higher on the list within a given area. This type of public rating system reduces much of the work required to weed out irrelevant or inaccurate information about a place. It also ensures that an area is accurately portrayed because it is the public who are determining the information's relevance.

Ideally, the system would have networking capabilities so that bubbles created by one user could instantly be viewed by all other users within the area. Unfortunately due to time constraints, data (such as bubble content and user information) is instead stored locally on the phone.

3.4 Implementation

The system was implemented using C#, WPF and the Windows Phone 7.1 SDK. User info, shop info and bubble data are stored locally on the phone using isolated storage. Setting up a server that hosts a database for this information would be much more practical for this type of application, but unfortunately due to time constraints that was not possible. GPS was used to track the user's location and save the longitude and latitude along with a bubble whenever it is created. Then, when the user wishes to view existing bubbles, their current GPS location is used to see if they are within range a given bubble's radius. If so, then the bubble is displayed to the screen, if not, then it is ignored. For bubbles created with a photo as content, the built-in camera app is used.

3.4.1 User Interface

We will now go through the flow of the user interface and what each of the screens does. For this section we will be referring to figure 2 and dividing it up into small portions based on the letter assigned in the top right hand corner of the screen.

(A) The Navigation Bar is accessible from every screen (aside from the camera) and is always located at the bottom. This bar has 4 buttons: pet (B), create (C), view (D) and shop (E) which all navigate the user to the corresponding screen.

(B) This is the pet screen, which is used as the main screen for the game. Whenever the application loads up, this is the screen it will go to. Basic user information is displayed on this screen, such as points, experience bars for each of the pet's interests and the image of the pet itself. The pet info button near the bottom of the screen navigates the user the pet info screen (F).

(C) The create screen is where the bubbles are loaded with photo and text information and then stored into the isolated storage. On this screen the user must select a category for the note (either food, entertainment, exercise or other) and then optionally add text or a

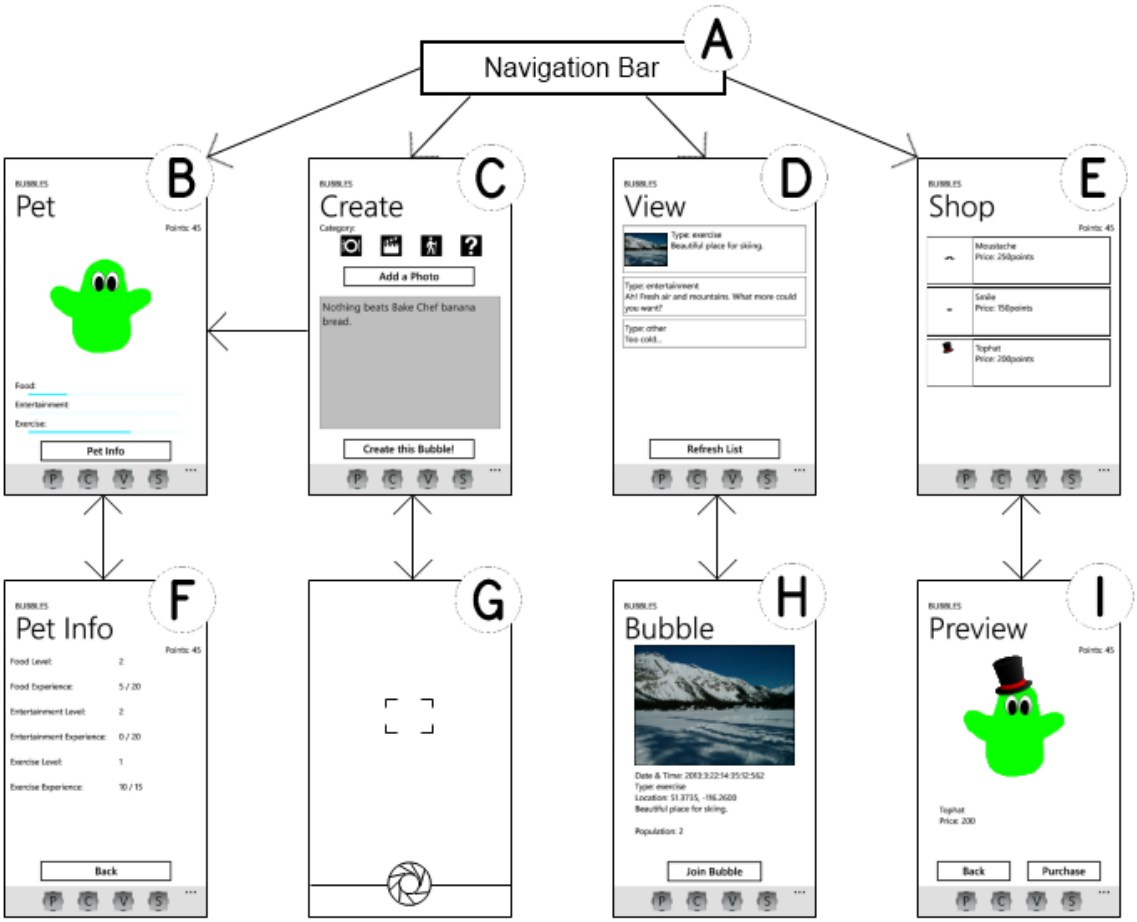

Figure 2. User interface flow diagram of the application bubbles.

photo as content. When the "create this bubble!" button is pushed (located near the bottom of the screen), a popup is displayed notifying the user of their successful bubbles creation and then returns the to the pet screen, where the experience in the bars will be updated to their new values. When the "add photo" button (located below the category icons) is clicked, the built in windows phone camera app is launched. After taking a picture, the user is returned back to their note-in-progress, but the photo button is replace with a photo instead. The user may scroll up and down the page when it gets too large for the screen.

(D) The view screen is where the user may view their own, and other user's bubbles that are within range of them. A list of bubble summaries is displayed upon navigating to the screen. When the "refresh list" button is clicked, the list is updated with bubbles that are within range (in case the user is on the move while on this screen). When any of the bubble summaries are clicked, the user is navigated to the bubble screen (H).

(E) The shop screen is where users can see a list of the different items available for them to purchase using points. The user's current points are displayed in the top right hand corner so that they can easily determine what they have enough for. When an item is clicked on, the user is navigated to the preview screen (I).

(F) The pet info screen displays detailed information about the user's pet, such as the level of each interest and how much experience they have gained towards the next level. When the "back" button is clicked, the user is returned to the pet screen (B).

(G) This is the built-in windows phone camera app. When the user takes a picture, they are returned to the create screen (C).

(H) The bubbles screen shows detailed information about a selected bubble, including creation time, GPS location, content, population and an image if a photo was included in the content. If the user wishes to support what the bubble is depicting, they can click the "join bubble" button which adds them to the population of the bubble and returns them to the view screen (D).

(I) The preview screen shows the name and price of the item along with an image of what the user's pet would look like if they were to purchase it. When the "back" button is clicked, the user is returned to the shop screen (E) without purchasing the item. When the "purchase" button is clicked, a popup appears either stating that they have successfully purchased the item, or that they do not have a sufficient number of points to make the purchase and then the user is navigated back to the shop screen (E).

4. EVALUATION

To determine the viability of using this system for solving our problem, data was collected and analyzed. Below, we will see the method taken, the participants used as well as the results.

4.1 Method

To evaluate the game, two rounds of user trials were completed. Each rounds consisted of 2 participants being quickly briefed on how to use the system, then they were given a device with the application loaded to use for one week and finally followed by a short interview (30 minutes or less) with them. The notes that they created during game play were also retrieved from the devices. In an attempt to simulate how the application would function with a network connection, notes that were created during the first round of trials were loaded onto the devices for the second round. This was done so that we could see if and/or how users interacted with other's posts and whether it made an impact on the amount that they enjoyed the game or found the application useful.

4.2 Participants

The participants that were used in the trials were selected so that the locations that they visit during their daily routines would be similar. This was done to increase the chance that the notes created during the first round of trials would be more likely to be seen during the second round, which would simulate the circumstances of there being a larger number of users. All participants were male students between the ages of 22 and 25, enrolled at the University of Calgary. All participants were enrolled in the faculty of science, two of which were in the department of computer science. Each of them had at least an acquaintance with the others and some knew each other quite well, including two participants who reside in the same household.

4.3 Annotation Data

After each trial round, the data was collected from the devices and then analyzed. To get a understanding of the patterns in the data, the information was categorized and graphed.

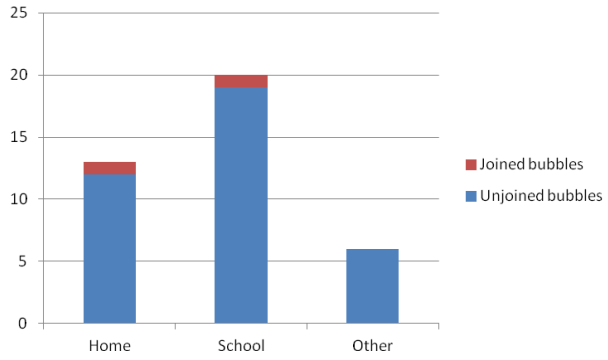

Figure 3. Bubbles created by participants during trials, categorized by location.

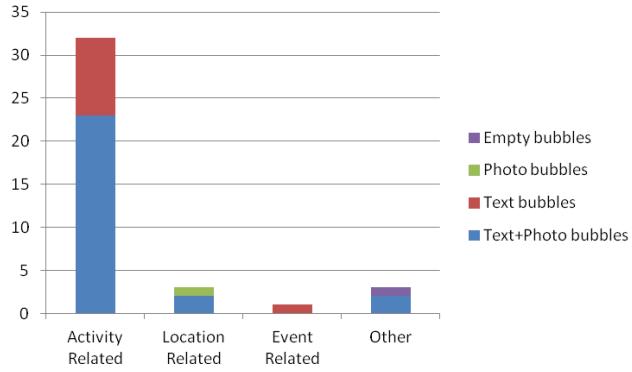

Figure 4. Bubbles created by participants during trials, categorized by topic and color coded by content type.

By looking at figure 3 and figure 4, it is quite obvious that each of them show a large skew towards one aspect of the graph.

In figure 3, we can see that users created posts mainly at home and school, but also in a few miscellaneous locations. What really stands out about this graph is how few of the bubbles were joined by other users. The reasons behind this will be discussed in the results section.

Figure 4 also displays an extreme skew towards one particular category. We see here that a very large portion of the bubbles that were created by users are activity related. This means that the content of the bubble was focused on what the individual was doing at the time. Again, this will be covered in the results section below.

4.4 Interviews

In addition to the data retrieved from the devices, a short interview was conducted with each of the participants and the information collected will be presented in a case for each one. Cases #1 and #2 were used during the first round of trials and Cases #3 and #4 were used during the second.

4.4.1 Case #1

In their daily routine, participant #1 used to use Facebook reasonably often as a social application, but now uses it only a couple times per week and uses no other social-based applications. As for location applications, this user regularly uses a GPS-based application for monitoring where and for how long they exercise. During the interview, they expressed their thoughts on "I've been here" type applications - such as check-in system, Foursquare [1] - and how they seem pointless and are an invasion of privacy. When asked about their motivations and thought process while making notes over the last week, they said that they only did it because of the research trial and would not use the application otherwise.

4.4.2 Case #2

For social applications, participant #2 uses Facebook frequently, but nothing else. They do not use any location based applications in their regular routine. When analyzing the data that was collected from this user's device, it was evident that they used it as a self monitoring/documenting tool with many posts consisting of what they were doing at certain times throughout the day. In the interview they spoke about how it made them more aware about the things they were doing, specifically, "it made me realize how much I eat". They also said that the application was quite entertaining, both because of the game elements and also because it was "kind of fun taking pictures of things that I was doing". When asked about the type of places in which they used the applications, they stated that they never went out of their way to make a note, but rather just took it along with them during their daily routine and make posts whenever they felt like it. They also mentioned that they didn't use it at home very often because they didn't really think about it when they weren't carrying the device around. This participant also made the suggestion that the note types also include an academic category, because they wanted to create posts that leveled up their pet, but much of their time was spent doing things that didn't relate to the 3 current categories.

4.4.3 Case #3

Participant #3 described themselves as being a heavy Facebook user and a very mild twitter user. They didn't think that they had ever used a location based application, but they weren't entirely sure because of all of the apps that they have tried. Similar to participant #2, this participant mainly used the application for self-documentation posts. The store items were somewhat of a driving force for this user with them stating they were determined to get a top hat for their pet. When asked about whether they had viewed and/or joined any other user's bubbles, they said they did find quite a few posts, but didn't really feel that many of them were useful or interesting in any way. "Almost all of the [bubbles] that I found were just about what somebody was doing at the time, so I didn't really agree or disagree with what they said". The user did end up joining one bubble, with the reasoning that they liked the food that the person had been eating and they felt like they should join at least one bubble over the course of the week. The overall opinion of the application was that although it was fun at times, it was a "beyond annoying" having to carry around a second phone. They also mentioned that the bubbles that they had read weren't very interesting to read, but thought that it may be a different if used while travelling.

4.4.4 Case #4

The last participant that was used doesn't usually use any social or location-based systems. They mentioned that during the week, they didn't create very many bubbles because they didn't have anything they wanted to say. The participant also brought up the fact that they didn't see any posts made by other people for the majority of the week, but when they finally did, they got a feeling of excitement and joined the bubble even though the content didn't interest them.

4.5 Results

As we can see from the data collected during the trial, the majority of the posts that were created were activity related. This means that the participants were mainly using the application to document what they were doing at any given time. Although some of these type of posts were expected during the trials, it was shocking that over 80% were on this topic. From talking to the participants we learned that 3/4 of them use Facebook and one of them also uses Twitter. The participant who didn't use any social-based systems only accounted for 2 of the 39 bubbles that were created. So it seems that the self-documenting nature of Facebook and Twitter may have an impact on many users and how they interact with systems that involve creating posts.

Another largely noticeable skew in the data was how few of the bubbles were joined by other users. After talking with the participants, it seems that this may be largely due to two reasons. One reason is that because not all of the users share the exact same daily routines, the locations that they create bubbles may not match up with where the others are looking for them. Unfortunately, this means that unless there are enough users of the system, even in a relatively small space, then there will be little interaction between users. The second reason is tied into the fact that the majority of the posts were activity related. In the interviews, some of the participants spoke about how uninteresting the bubbles that they found were. Because the participants did not relate to what they were reading, they felt no desire to support it. Weeding out useless posts was indeed what we intended to do with the "join a bubble" system, but unfortunately it left us with a very few number of supported bubbles.

5. DISCUSSION

After creating a system in which users collect information during game play, our initial trial results suggest that the data input by users may not be ideal for the purpose that we initially intended. That does not, however, mean that this was a failure. The information gathered during this process can be taken into account and addressed in future iterations of this system.

Self-documentation posts that our trial participants created, although not ideal, can still be used to obtain information about a place. A stand-alone post with content "eating again" may not

necessarily suggest much about the location, but if 10 bubbles with similar content are posted by different users, then it is likely that the place in which these posts are made is a restaurant, food court or some other type of food hot spot. That said, most people probably don't want to read through an excessive number of posts to find out one piece of information, so if these self-documentation posts are to be truly useful, there would need to be some way to summarize many posts into an all encompassing one.

As expected, we also confirmed that people have very different motivations behind using this system. Even with only 4 participants, we still found a variety of different reasons for users to creating bubbles. Some were interested in the game elements, such as buying a top hat for their pet, while others found it entertaining just documenting the thing that they do. Because of this it is important to keep a variety of different ways for users to interact with the program in order to get the largest number of users possible.

From these results it seems that location-based information collection through game play is still a viable solution to our problem, but the system that we designed to solve it is in need of some iterative changes.

5.1 Limitations

There were several limitations of the system and the evaluation of it, some of which we will discuss here. The system should ideally have networking capabilities. In a mobile application designed around users interacting with one another, networking is a very vital part. In our second round of trials, we attempted to simulate this by planting data from the previous round onto the devices. Although this mildly patches the problem; the participants still knew that they are not actually interacting with other users in real time, which can have an effect on how they use the application.

One of the largest problems with the evaluation was that the sample group neither a very large, nor diverse group, consisting of all males around the same age enrolled at the University of Calgary. People of a different age, sex, lifestyle, etc, could have a very different approach to using the system, which is valuable information.

Another issue was that everyone involved in the study already knew each other. Although this may not have been a huge impact, it is another confounding variable that could easily be addressed given more resources, and could potentially change the results. It is possible that the reason so many self-documentation posts were made is because one participant used the system in that way and when talking to the others, unintentionally planted the idea that they should be using it that way as well.

These and other flaws in our evaluation could have skewed the information we collected from it and should be addressed in any future experiments.

5.2 Future Work

We have learned that our system is not necessarily used in the ways that we had expected and in turn did not produce the results we desired. From here it seems that we have two options when continuing work on this problem. First, we can adjust the system such that users are guided towards producing location-based posts and therefore potentially producing the information we want. Or instead we can take into account what users seem to want to do and develop around this. As we discussed before, self-documentation related information can still be used to create context within a space, but in order to easily and clearly communicate this information, we would instead need to find a way in which we could refine it.

6. CONCLUSION

When designing a solution to the problem of annotating physical spaces through the use of game play, we had certain goals in mind and assumptions about how our system would be used. After building and testing this system, the results we obtained were quite different than what we had expected.

From these results we can conclude that using game play to collect location-based information may still be a very viable solution to this problem, but we need to adapt our system and explore the different paths the we can take when moving forward.

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