COMPETITIVE EDGE:
USING GAMIFICATION AS AN EFFECTIVE OCR CROWDSOURCING MOTIVATOR

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Abstract

The New York Public Library’s “What’s on the Menu?” transcription project is just one example of how public libraries facing increasing budget cuts are turning to alternative methods such as crowdsourcing to help make their digitized collections more accessible to the public. As crowdsourcing ventures rely upon the maintained participation of volunteers, it is essential that libraries have an adequate understanding of what motivates these volunteers. The aim of this study is to determine whether the introduction of game-based play increases the motivational levels of volunteers for OCR crowdsourcing ventures, particularly within the realm of the public library. The study will be conducted through an experimental design based at the New York Public Library in which crowdsourcing participants will be divided into two groups; one group will use a traditional method of OCR correction and the other will use game-based play for OCR correction. Participants will include all study volunteers whose native language is English. Should the data prove to be distributed normally, an independent t-test will determine whether a statistically significant difference is seen between the groups. The study aims to determine whether the independent variable of gamification will increase the dependent variable of participation by at least 20% over traditional methods. Should the study prove such an increase, libraries will be equipped to dramatically increase productivity on future OCR crowdsourcing projects through the use of game-based play. The study will also provide insight into whether demographics such as age, gender, employment status, or ethnicity might impact volunteer participation levels, and therefore merit future examination.
Introduction

According to the 2011-2012 American Library Association (ALA) Public Library Funding and Technology Access report, 56.7 percent of public libraries reported flat or decreased budgets, a trend that has steadily affected libraries since 2009 (Hoffman, Bertot and Davis). As public libraries face increasing budget cuts each year, many are turning to alternative methods such as crowdsourcing to make their collections more accessible to the public. Libraries are also looking increasingly to digitization of their collections, and as such, of particular interest to many libraries is the concept of using crowdsourcing for OCR improvement projects. This proposal hypothesizes that gamification (incorporating game elements and mechanics into non-gaming websites and software) can be a valuable tool in such projects, as it appeals to the motivating factors of rewarding high achievement, creating an online environment of camaraderie, acknowledgement of volunteer contribution, and raising the bar to increase the challenge, to achieve and maintain participant interest in such projects.

Libraries have been consistently converting their materials over the past few years into the digital domain. This is particularly true for older original documents which may be fragile and susceptible to deterioration through regular use. Having this content available in digital format allow patrons to easily access and search this information from their own homes. However, before the data from digitally scanned source documents can be made properly searchable and accessible, the data should be translated into searchable text in order to make proper use of these rich resources. The most common approach for this is to run the scans through an optical character recognition (OCR) process, which can then make the text searchable (Chrons). However, OCR can still make mistakes, and is particularly troublesome when dealing with handwritten documents, those with a variety of typefaces or fonts, those with complex layouts, historic spellings, and distortions caused by the item’s storage conditions (Liu).

There is no simple solution to this problem, and most often it is solved by simply having a human volunteer manually correct the OCR errors by referring to the original scanned text. However, the process of manually correcting OCR is both routine and time consuming, and most libraries do not have the staff members to dedicate to such projects. Therefore, for such projects, crowdsourcing (the combination of “crowd” and “outsourcing”), has become an increasingly popular model for distributed problem-solving. Through the distributed work of a large number of people, much more work can be done in a brief period of time (Jovian).

The most critical success factor in any crowdsourcing venture is that of initial and continued volunteer motivation, as this is the crux upon which the success or failure of the process lies (Liu). A crucial question for libraries, therefore, is how to best design motivational mechanisms to promote such participation. As the formalized concept of crowdsourcing is rather new (the term was coined only in 2006), the research on the motivating factors for crowdsourcing in general and routine forms of crowdsourcing such as OCR correction is rather limited. In some crowdsourcing cases, extrinsic motivations (e.g. immediate payoffs, delayed payoffs, social motivation, etc.) have been found to have a strong effect on the time spent on the crowdsourcing project. For many, however, intrinsic motivations are more important, particularly those appealing to enjoyment-based motivations (Kaufmann). As such, one area of some demonstrated success is that of using gamification to achieve initial and continued motivation in crowdsourcing ventures. TypeAttack, for example, successfully digitized 505 newspaper snippets within 5 weeks, and the process achieved an average transcription accuracy of 99% at word level (Jovian).

Within a game-based crowdsourcing project, the players are able to perform useful computations as a by-product (Jovian). Crowdsourcing games can provide imbedded incentive mechanisms such as enjoyment-based
motivation, the appeal of a social community, the addition of titles and ranks to create competition and a sense of achievement, continued skill variety, and direct feedback to ensure continued participation (Jovian). As such, this research proposal aims to demonstrate the significance of gamification to the motivational levels of OCR crowdsourcing ventures particularly within the public library realm.

KEY TERMS

- **CROWDSOURCING**: This is the concept of distributed work. Essentially, a problem or task is opened up to an unknown group of volunteers working in their spare time to complete the project. Through the work of a large number of people, much more work can be done in a brief period of time. For example, the public might be asked to help tag images, analyze large amounts of data (citizen science), or help improve optical character recognition (OCR). Inherent in the understanding of crowdsourcing is the use of a large group of people to accomplish a significant and large goal.

- **GAMIFICATION** (games with a purpose): The use of game design techniques and mechanics to enhance non-game contexts.

- **INTRINSIC AND EXTRINSIC MOTIVATION**: Intrinsic motivation moves an individual to perform an activity for the sake of the activity itself; extrinsic motivation is activated from the outside (e.g. monetary rewards or recognition) (Acar).
Public libraries facing budget cuts and an increasing demand for digitized collections have begun to turn to alternative methods to increase accessibility of their collections. One area particularly focused upon is that of using crowdsourcing to improve upon optical character recognition (OCR) for collection items. Gamification has become the topic of much related literature, as it seems to appeal to the motivating factors of personal enjoyment, rewarding high achievement, creating an online environment of camaraderie, acknowledgement of volunteer contribution, and increasing challenges, which can improve participant interest in such projects.

A review of relevant literature was conducted to determine what the primary motivating factors are within crowdsourcing ventures, particularly those with a focus on OCR correction; and whether gamification might indeed prove an effective OCR crowdsourcing motivator by contributing toward those motivating factors. A search of Library Literature Full Text, Library and Information Science Abstracts, and WorldCat produced 57 results for the term *gamification*; however, most of these results dealt with the use of gamification for learning and literacy, with none covering the topic of gamification and crowdsourcing. A search for the term *crowdsourcing* produced 606 results, so an AND Boolean search was performed to also include the term OCR. This presented four results, one of which was relevant to the topic at hand. Other searches for the terms *crowdsourcing AND gam* (using the wildcard to produce results for game, gamification, and gaming) as well as *crowdsourcing AND motivation* produced 47 and 27 results respectively. Most of the gaming articles dealt with the topic of marketing and education, though a search for motivating factors of crowdsourcing produced three relevant articles.

As the topics of gamification and crowdsourcing are multidisciplinary, Google Scholar provided a number of results not found by searching the traditional library-focused databases. For instance, a search for gamification AND crowdsourcing from 2000-2012 produced 75 results, three of which were relevant articles, and one of which provided a thorough case study of an OCR gamification project. Replicating the search combinations noted above, Google Scholar presented around twenty additional relevant articles, many of which provided international perspectives on the topic. Further references were found within the bibliographies of each relevant article.

Little research seems to exist specifically for the use of gaming for OCR crowdsourcing projects, though this type of crowdsourcing project has been gaining increasing popularity amongst libraries over the past five years. To provide a thorough survey of the field, all scholarly articles found from 2000-present that discussed gamification crowdsourcing projects were considered, with a high emphasis placed on any that focused upon OCR correction projects. Articles dealing with crowdsourcing motivational factors as well as gaming motivational factors were also examined.

Most of the literature seems to agree that game play involves a minimum of three motivating factors: achievement, enjoyment / immersion, and social interaction. While there is some disagreement over the exact motivating factors for crowdsourcing projects, the three factors noted above seem to be rather universally agreed upon, both within overarching literature and within specific case studies. Among the crowdsourcing case studies, gamification was noted to help achieve initial and continued motivation for crowdsourcing ventures, though most of these concentrated on image-tagging and other non-OCR related crowdsourcing projects.

**CROWDSOURCING PARTICIPANT DEMOGRAPHICS**
Crowdsourcing relies upon sustained input from a group of people working toward a common goal (R. Holley); it is this requirement for sustained input that is both crowdsourcing’s greatest asset and its greatest liability. If a crowdsourcing project is not able to seize the interest of a large number of volunteers and maintain that interest through the duration of the project, it will inevitably be unsuccessful. It is therefore crucial to have an understanding of what factors contribute toward the successful maintenance of crowdsourcing volunteer interest.

To do so, the general makeup of volunteers for such projects must first be established. An examination of the Distributed Proofreaders, Family Search Indexing, Wikimedia Foundation, and the Australia Newspapers digitization projects noted that most of the work is typically completed by only 10% of the users, and that top-tier volunteers vary widely in age, tending to be a mix of retired people and young professionals. Both women and men were included in this top tier, and their ages ranged from 30's to 50's (R. Holley, & National Library of Australia). In the Digitalkoot OCR crowdsourcing project, Chrons and Sundell (2011) found similar results, with the most active 1% completing nearly a third of the work volume. On this project, women spent more of their time playing than men, and completed nearly double the number of tasks. However, the top four contributors were all men. In their case study of TypeAttack, Jovian and Amprimo (2011) also found that a large percentage of the work was completed by only a few players, though they did not provide further demographic breakdown for their project. None of the current literature reviewed delved into the ethnographic breakdown of participants. From the literature that is available, it appears that participant demographics vary widely, and that motivating factors relevant to a large age range and gender breakdown should be considered.

**GENERAL MOTIVATIONAL FACTORS IN CROWDSOURCING**

General motivating factors for crowdsourcing volunteers have been examined to some length in relevant literature. Though listed factors vary somewhat amongst reviews, some overarching trends have emerged. Within psychology literature, motivational factors are typically divided into two types—intrinsic and extrinsic. Intrinsic motivators are those that drive an individual to perform an act for the sake of the activity itself. This type of motivator might include enjoyment of the activity, feeling of challenge, and deep task involvement (Acar).

In their study of a citizen science crowdsourcing venture, Nov, Arazy, and Anderson found that the two most salient motivators for participants were the intrinsic factors of enjoyment and a shared ideology, results shared in a similar Wikipedia study. Though of secondary importance, they also determined that the establishment of a social community for such crowdsourcing ventures should not be ignored.

These factors are also ranked highly in Holley’s (2009) study of volunteers for the Australian Newspapers Digitisation Program (ANDP), as she found that most participants were highly motivated by personal interest in the subject matter and by a sense of helping out a good cause. Other important factors included pleasure in the process, trust and respect given through the project, and concentrating on the outcomes. Interestingly, participants in this project noted that they would have been more motivated with the addition of more extrinsic factors such an online environment of camaraderie, competition, acknowledgement of their effort, rewarding of high achievement, and being able to see the progress they were making.

A study by Kaufmann and Schulze (2011) of 431 participants in the pay-based crowdsourcing venture Mechanical Turk, found that while extrinsic motivators such as immediate and delayed payoffs and social motivators strongly affected the time spent participating in the platform, for many, intrinsic motivational aspects were actually more important. Facets of enjoyment such as task autonomy and skill variety were particularly noteworthy, with the
category of fun and enjoyment ranked consistently high. Human capital advancement, or the motivation of skill training which could be useful for future material advantages was also strongly ranked.

**GAMING INCENTIVES**

In order to determine if game-based applications might present compelling motivation for OCR crowdsourcing ventures, an examination should be made of the incentives that draw users into game play itself. Many cross-disciplinary studies have been conducted on this topic. For instance, one study performed on 1,000 video game users determined that the top game-based gratification factors included competition against other individuals, the challenge of the task itself, diversion (using the game to avoid stress or responsibilities, or to fill time), social interaction, fantasy (doing things they would not normally be able to do), and the stimulus of emotions through game play (Fang and Zhao). Feedback from game-based crowdsourcing ventures such as Eyespy and Peekaboom includes comments that players enjoyed the games, found them fun, and that the competition among players was a major motivation to continue playing. Others commented that the games were addictive, and that achieving high scores motivated them to continue playing (Goh).

Yee (2006) presented a study in *Cyber Psychology & Behavior* which surveyed 3,000 online social game players to find that there are at least ten motivational components within gaming, organized into the three components of achievement, social interaction, and immersion. These same three areas were found to be the predominant gratifying factors in a survey of 7,000 players of *EverQuest*, a popular Massively-Multiplayer Online Role Playing Game (MMORPG) (Goh). Sub-areas of importance within both studies included the desire to advance, an interest in the game mechanics, the appeal of competition, socialization and the desire to form relationships with others, being part of a group effort, discovering new information, role-playing, customization, and the ability to escape from real-life problems (Yee). These areas closely mirror many of the motivational factors also found to be important within crowdsourcing projects. Interestingly, Yee also found that while male players tended to rate achievement factors more highly than women, women were drawn toward the relational components of the games. However, both rated social components quite highly. By focusing on game-based play that includes all three components, libraries might lend a stronger chance of success to their projects.

**GAMIFICATION CASE STUDIES**

While most of the case studies available at this point for game-based crowdsourcing lie in the area of image tagging and folksonomies, Digitalkoot, a crowdsourcing project to correct the OCR on the Finish national newspaper archives, is one example of a project recently employed through a gamification process. Chrons and Sundell (2011) discuss the project in their 2011 paper, “Digitalkoot: Making Old Archives Accessible Using Crowdsourcing”. One of the challenges they noted with game-based crowdsourcing projects is the requirement to be able to introduce meaningful tasks into the game without breaking game play and while providing real-time feedback on player actions. Despite these challenges, however, they found the project to be immensely successful. In the first two months they saw 4,768 users donate more than 2,740 hours to accomplish more than 2.5 million tasks. The typical user spent around 9.3 minutes on the games, and they obtained an accuracy rate of more than 99%.

TypeAttack, a Facebook game created through collaboration between the National University of Singapore and the Library Board of Singapore, is another example of the use of gamification to enhance the OCR of digitized documents. In their article, “OCR Correction via Human Computational Game”, Jovian and Amprimo (2011) discuss their results. TypeAttack focused upon several game-based incentives including competition with friends via Facebook, the use of titles and ranks to create a sense of achievement as well as competition, updates on
Facebook’s news feed and the ability to invite friends to play intended to create a sense of social community. They found that the social gaming element required a higher initiation period than other social applications, but once started, they had strong results. Within the first five weeks, they had 3,980 players who had digitized 505 snippets (around 5 lines each). Players averaged 10 minutes of play, a similar number to Digitalkoot who averaged 9.3 minutes (Chrons). As with Digitalkoot, their project found an accuracy rate of more than 99%.

SUMMARY

OCR crowdsourcing ventures present significant promise for libraries with increasing patron demands but decreasing budgets. However, many crowdsourcing tasks can be repetitive and somewhat mundane. Therefore, it is important for libraries to find ways to appeal to as many motivating factors as possible in order to have a strong chance of success. For this reason, the concept of gamification, or turning task-based activities into a game, has been seen by many as a favorable motivator for such projects.

As seen through the related literature, although somewhat more significance is found in intrinsic motivators such as enjoyment and shared ideology, a combination of both intrinsic and extrinsic motivators seems to be the ultimate goal of an effective crowdsourcing project. It is also noteworthy that the majority of these highly ranked factors such as enjoyment, social interaction, competition, and ranking might be appealed to at once by game-based construction. Additionally, relevant OCR crowdsourcing case studies such as those presented by Digitalkoot and TypeAttack display compelling results that might indicate the effectiveness of gamification as a motivator for OCR crowdsourcing ventures. As sixty-five percent of American households play computer or video games (Fang and Zhao), and the average American has played 10,000 hours of video games by the age of 21 (Eickhoff), the potential of channeling a portion of this human effort toward game-based OCR crowdsourcing projects seems well worth examining.
METHODOLOGY

Methodology

This proposal hypothesizes that the introduction of game-based play to an OCR crowdsourcing venture will increase the motivation of volunteers. In a recent study by Goh and Lee, the use of gamification to increase motivation amongst crowdsourcing image tagging volunteers presented a strong correlation between the two. While this was a motivating study, image tagging is in and of itself a short project with little repetition and constant change. Therefore, a question remains about the effects of gamification on more routine and potentially tedious crowdsourcing projects such as OCR correction.

RESEARCH DESIGN AND SETTING

TYPE OF STUDY

Motivation is a complex factor, and there can be no one cause that ensures initial and continued participation in any crowdsourcing venture. In the case of gamification as an effective motivator for OCR crowdsourcing projects, therefore, it would be expected that gamification would be a contributory condition of such crowdsourcing participation. This means that gamification is expected to increase the probability that initial and continued participation would occur, but that it does not make participation certain. The way this would be expected to be measured is through concomitant variation, which shows that the independent and dependent variables are related in the way expected. In this case, one would expect a positive relationship between gamification and participation in an OCR crowdsourcing venture. The logical consequence would be that greater participation should appear in more cases where gamification is present than when it is not present. As Connnoway and Powell suggest, the most effective method for testing a causal hypothesis is through an experiment. In this case, a posttest-only control group design will be employed, and stratified random assignment will be used to determine the control and experimental groups (Connnoway). The experiment will consist of a control group performing traditional OCR correction, and an equally sized group performing game-based OCR correction. Both groups will tackle the OCR correction of the same dataset.

The New York Public Library (NYPL) launched their “What’s on the Menu?” crowdsourcing project in April of 2011 with the intent to transcribe a portion of their 45,000 menus dating from the 1840s to the present. To date, the project has been immensely successful, with their initial goal of transcribing 9,000 of these menus completed within the first three months alone. Considering both their experience and success with a similar crowdsourcing venture, the NYPL would be an effective venue for such an experiment. The study would be designed based upon a mirrored crowdsourcing venture, though for another of their collections. This will help to avoid skewing of the results due to prior familiarity with the existing project. As gamification is expected to be a motivator independent of subject matter, the area of project source materials should be determined simply based on the needs of the library itself. The control design would match that of their previous project, as this will help to eliminate participation decline due simply due to design error.

The study will be run through the NYPL website, with mirrored designs for most portions of both the experimental and the control group. The experimental group will, however, use a game-based design for the OCR correction process. This design will be based upon the successful Digitalkoot project, as this will again help to eliminate distortion of results due simply to basic design flaw. The advantage of this model is that it already incorporates the primary gaming incentives of achievement, competition, social interaction, and immersion that
are noted in the relevant literature as suspected motivators for crowdsourcing projects. Therefore, it should serve as an adequate sample of game-based motivation. The game is also rather gender-neutral in focus.

PROJECT TIMEFRAME AND LOCATION

New York City is an ideal location for such a study, due to its unique amalgamation of people from numerous cultures and backgrounds. The project will include a one month period for promotion, and a three month timeframe for running the initial test. The three month period has proven within the relevant literature to provide an adequate sampling of the scope of the participation in most crowdsourcing projects.

RESEARCH VARIABLES

DEPENDENT VARIABLE

Participation will be analyzed by ratio measurement, with level of participation determined based on the number of minutes each volunteer participated in the project (starting with zero).

INDEPENDENT VARIABLE

The introduction of gamification as a crowdsourcing method is expected to affect the participation of OCR crowdsourcing volunteers.

CONFOUNDING VARIABLES

The related literature did not indicate that any particular gender, age demographic, career status or cultural demographic served as an indicator of participation level. However, some of the related literature did indicate that males and females may interact differently with varying game types and may participate with differing levels of intensity during crowdsourcing projects. Therefore, gender is a possible confounding variable. No significant participation variation was noted based upon age in the related literature, and in fact, participants within all adult age ranges were noted to contribute rather evenly. However, as the focus of this study is gamification as a motivator, and game play may be affected by age range, it cannot be ruled out as a confounding variable for purposes of this study.

RESEARCH PARTICIPANTS

STUDY POPULATION AND SAMPLING DESIGN

As the purpose of this study is to determine the effects of gamification on OCR crowdsourcing participation levels, the study population will be determined based on all volunteers for the NYPL OCR crowdsourcing project.

INCLUSION CRITERIA

The related literature did not find that any particular job status (employed, unemployed, retired, full- or part-time worker) or cultural demographic served as an indicator of crowdsourcing participation level. Therefore, participants will be included regardless of these factors.
However, as gender and age may serve as confounding variables, a stratified random assignment method will therefore be employed to ensure that an equal distribution of gender and age is seen in both the control and experimental groups (Connoway). Age ranges of 20-34, 35-49, 50-64, and 65-79 will be employed. This data will be collected through a very brief self-reported form which each participant will complete at the beginning of the online signup process. The form will be anonymous, and will only require volunteers to answer the basic questions of gender, age range, and native language (explained below). Further demographic information such as cultural background and basic employment status will also be requested, though not required, as they may provide further insight into potential differences in motivations across these categories.

EXCLUSION CRITERIA

Volunteers will be limited to adults between the ages of 20-79. While this range does not encompass all crowdsourcing volunteers, this does include the typical age spread of most volunteers, and particularly all noted “power” volunteers in the relevant literature and case studies. To avoid skewed results due to language barrier frustration, participants will also be limited to native English speakers. Due to the nature of the crowdsourcing venture, volunteers outside of these parameters will be allowed to complete OCR correction tasks, but will not be included in the experiment results.

PLANNED SAMPLE SIZE

The related literature did not provide mean participation time spent on general crowdsourcing projects. However, the Digitalkoot and the TypeAttack case studies provided average times of 9.3 (Chrons) and 10 minutes (Jovian) respectively for OCR crowdsourcing projects driven by game-based mechanism. If these can be taken as representative studies, then the mean time spent on a game-based crowdsourcing project could be estimated at 9.65 minutes. However, both studies noted that the difference between the highest participation times and the lowest was quite significant. Therefore, for purposes of planning the study sample size, a standard deviation of 10 will be chosen. The expected difference between the mean volunteer time spent through a game-based OCR crowdsourcing mechanism versus that spent through a typical crowdsourcing mechanism might be estimated at two minutes, or 25%. If the above values can be assumed, given an independent t-test analysis, 651 experimental subjects and 651 control subjects will need to be studied to be able to reject the null hypothesis that the population means of the experimental and control groups are equal with a probability (power) of 0.95. The Type I error probability of falsely rejecting the null hypothesis is 0.05 (Dupont).

RECRUITMENT PLAN

The recruitment plan will rely upon the NYPL’s existing network to reach out to subscribers of the NYPL Labs blog, e-newsletters, Twitter, and Facebook pages for volunteers. During the “What’s on the Menu” project, numerous news sites such as the Huffington Post, Art Daily, the New York Times, and a host of blogs also covered the story. If precedence may be found in the Digitalkoot’s project, these articles are likely to have produced a significant uptake of volunteers as well (Chrons). The same approach will also be taken for this study.

RESEARCH MATERIALS

CONTROL CROWDSOURCING SETUP
METHODOLOGY

As previously noted, the control crowdsourcing setup will be based upon the NYPL “What’s on the Menu” model. In this straightforward model, volunteers first select the document they wish to work on. Upon selecting a document, a text snippet image will appear on the screen, with an arrow pointing to the area that should be transcribed. Instructions will be included in a text box at the bottom of the page in which the user can transcribe what they see. They can also select a check box that notes “This is my best guess,” for text that is not quite readable. See Appendix A for a screenshot of the “What’s on the Menu” transcription process.

EXPERIMENTAL GAME-BASE CROWDSOURCING SETUP

The experimental crowdsourcing setup will rely upon a similar arrangement as Digitalkoot’s project, though only one of the two Digitalkoot games will be used—that of the Mole Bridge. While the variety of having two different games users can select will likely increase volunteer usage, it is beyond the scope of this project. The experimental Mole Bridge game will closely mirror the basic transcription interaction of the “What’s in the Menu” project, but with a competitive, social, and graphic/game-play setup. When playing Mole Bridge, the goal of each player is to build a bridge to save the moles from falling into the river below. The bridge is made up of blocks, and a new wooden block can be created when a user types the text image snippets they see on the screen. Blocks are automatically added to the screen when a player types a snippet, and these are evaluated at the end of their turn. For each correct answer (determined based upon control responses and other user-generated replies), the wooden block turns into steel, and for each incorrect answer, the block explodes, also taking some neighboring blocks along. Once the bridge is complete, and enough of the moles are saved, the level ends and a final score is calculated (Chrons). In the experimental game, users may compete against each other for highest score, and they may also play their Facebook friends, adding in social interaction to the game. See Appendix B for a screenshot of the Digitalkoot game.

SELF-REPORTED ONLINE FORM

Before any volunteer participates in the experiment, they will first be prompted to complete an online form. This form will ask for basic demographic information, with required fields of gender, age, and native language. See Appendix C for the form template.

ONLINE DATABASE REPORTING SYSTEM

The results of the volunteer application form will be tracked in an online database, which will be referred to in selecting those to be included in the control and experimental groups. At the end of the three month tracking period, total time spent completing transcription, as well as the total number of transcribed snippets will be tracked in this database. Total time spent by all users within the control and experimental groups will be counted, and will be represented graphically in the final results.

DATA ANALYSIS

INITIAL ANALYSES

As much of the relevant literature noted that there may be a significant difference in time spent by various crowdsourcing participants, it is quite possible that there may not be a normal distribution of the data. Therefore, an analysis to determine whether or not the data is normally distributed will be necessary before testing the hypothesis. If the data is shown to have a normal distribution, the difference in the means will be assessed with
an independent t-test analysis. However, if the data is shown not to have a normal distribution, the difference in the medians will be assessed with the Mann-Whitney U test. A difference of 20% between the control and experimental means will be considered significant for purposes of proving this hypothesis.

ADDITIONAL ANALYSES

Differences in results according to age, gender, and optional demographics will also be charted to determine if any of these breakdowns bear significantly on user participation. The same statistical tests noted above will be used to analyze the means of these groups in comparison with the same control groups.

Any variation above 15% will be determined to be significant, and may require further analysis to determine whether these potential confounding variables will require separate treatment amongst demographic divides for best crowdsourcing participation results moving forward.
Discussion

The proposed experimental study attempts to determine if the introduction of gamification into an OCR library crowdsourcing venture can increase motivation for participants.

**SIGNIFICANCE**

Libraries are increasingly turning to crowdsourcing to make the best use of their limited resources while increasing services for their patrons. As crowdsourcing relies upon the initial and maintained participation of volunteers, it is essential that libraries have a thorough understanding of what factors motivate such volunteers. The related literature points to a significant possibility that gamification can increase the motivation of participants by appealing to the incentives of achievement and competition, social interaction, and immersion. While some case studies have examined the role of gamification as a motivator in image-tagging crowdsourcing ventures with promising results, no studies have been presented which explore whether gamification produces the same effect as a motivator for the more-routine activity of OCR correction. Therefore, this study should provide a significant insight into a growing area of crowdsourcing that is particularly relevant to public libraries with newly digitized collections and increasingly limited budgets.

**STUDY LIMITATIONS AND FURTHER CONSIDERATIONS**

As noted in the methodology, this study will only focus on one type of competitive based game-play. Should this study indicate that gamification indeed provides a strong motivator for OCR crowdsourcing projects, one factor that must be considered moving forward is whether the type of game used might increase or decrease participant motivation. In this evaluation, gender may play a significant role. For instance, in a study of 367 16-18 year olds, Bonanno and Kommers found that a large percentage of females tended to prefer puzzle, adventure, fighting, and managerial games, while males preferred first-person shooters, sport, role playing, and strategy games. Therefore, a game design that appeals to both preference groupings would likely be recommended to make the most of gamification as an effective motivator.

Additional consideration should also be made in the user interface of the games themselves. For instance, playability is considered an important factor in user’s experiences in game play, and ease of use, attractiveness, and enjoyment offered by such games has been found to strongly predict whether a user will be enticed into and continue to play a given game (Goh). Therefore, future studies might be made on the best design and game play for such crowdsourcing ventures.

Finally, a study to determine whether game-based crowdsourcing ventures also produce equal or higher quality results as compared to more traditional structures should also be conducted. On this matter, the literature seems to be quite varied, with some sources indicating an improvement in quality and others noting a small decline (particularly over extended periods of time). One argument for concern is that game play may induce cheating to achieve higher results. Another argument is that a challenging game may engage users but produce poor data as players may become too focused purely upon the game play. For example, in a test of game-based image tagging crowdsourcing as compared to a non-game based project, Goh and Lee (2011) found that some loss of quality presented in the game-based version. Conversely, they also found that participants rated the game-based applications as being more challenging and immersive than the manual application, and therefore, enjoyed the process more (Goh). While some quality may be worth sacrificing if higher participation is achieved, an ultimate
balance of high quality and high participation should be striven for. A well-designed game should be able to support the generation of quality data while ensuring that entertainment is not being sacrificed.

CONCLUSION

OCR crowdsourcing provides an important opportunity for libraries to harness the power of the masses to help improve the searchability of their digitized collections. As more and more digitized collections are OCR corrected, immense opportunities are then presented for research development based on their collections, and for increased patronage reach outside the walls of the individual library spaces themselves. The benefits of such projects go far beyond that of simple free labor, as they also invite patrons to take an active role in the development of the libraries’ collections. Should this study prove that gamification increases motivation by the predicted 20% over traditional OCR crowdsourcing methods, libraries will have a notable tool to increase their productivity on such projects. The study should also provide insight into whether demographic considerations such as gender, age, employment status, or ethnicity may also impact participation levels, and should therefore be further examined. With these insights, public libraries will be better equipped to tackle future OCR correction crowdsourcing projects, and to use the technology available to them to make their collections more accessible to patrons.
References


the 2011 44th Hawaii International Conference on System Sciences.


Appendix A

QUENELLES DE BROCHET, Nantua sauce

$9 in Dollars (only if you see a price). More than one price?

☐ This is my best guess (text is not 100% readable)

Enter dish or Cancel

Delete this dish
Appendix B
# APPENDIX C

## Appendix C

### VOLUNTEER APPLICATION FORM

<table>
<thead>
<tr>
<th>GENDER (REQUIRED)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Male</td>
<td>□ Female</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NATIVE LANGUAGE (REQUIRED)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ English</td>
<td>□ Other</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AGE RANGE (REQUIRED)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ 20-34</td>
<td>□ 35-49</td>
</tr>
<tr>
<td>□ 50-64</td>
<td>□ 65-79</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DEMOGRAPHIC INFORMATION (OPTIONAL)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ White / Caucasian</td>
<td>□ Black / African-American</td>
</tr>
<tr>
<td>□ Hispanic / Latino</td>
<td>□ Asian / Pacific Islander</td>
</tr>
<tr>
<td>□ Native American</td>
<td>□ Other</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EMPLOYMENT STATUS (OPTIONAL)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Employed full-time</td>
<td>□ Employed part-time</td>
</tr>
<tr>
<td>□ Currently unemployed</td>
<td>□ Retired</td>
</tr>
</tbody>
</table>

**THANK YOU**

Thank you for completing this application form, and for your interest in volunteering with us.