“Sharing small pieces of the world”: Increasing and broadening participation in Wikimedia Commons

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ABSTRACT
Wikimedia Commons is the largest online repository of freely-licensed multimedia files, including approximately 42 million images. A portion of these images serve to illustrate articles across more than 290 different language Wikipedias and “sister projects.” However, in comparison to photo-sharing sites like Flickr and mobile apps like Instagram, Commons is largely unknown to the general public and under-researched by scholars. We conducted an exploratory study to determine if an alternative means of contribution—a mobile application that gamifies implicitly desirable and useful behavior—could broaden awareness of and participation in Commons. Our findings from an online survey (*N*=103) suggest that by creating value around implicitly desirable behaviors, we can create new opportunities and alternative pathways for both increasing and broadening participation in peer-production communities such as Commons.

Author Keywords
Participation; gamification; photo-sharing; mobile games; mobile apps; Wikimedia Commons; survey research; commons-based peer production.

ACM Classification Keywords
• **Human-centered computing** → **Wikis**; Collaborative content creation; Smartphones

INTRODUCTION
Launched in 2004, Wikimedia Commons (hereafter Commons) aims to “provide a media repository that: (1) makes available public domain and freely-licensed educational media content to all, and (2) acts as a common repository for the various projects of the Wikimedia Foundation” [35]. Like other “sister projects,” Commons is built from the same technology as Wikipedia, enabling anyone to contribute. As of 2018, Commons contained more than 44 million files with more than 30,000 active users (i.e., users with activity in the past 30 days), and more than 100 million pageviews per month.

However, Commons is consistently beset with usability issues such as challenges with batch uploads/downloads, content findability, and content evaluation [36]. Despite an uptick in mobile page views in late 2014, total page views (browser and mobile combined) dropped significantly in late 2015 [38]. Moreover, community members have expressed concern that Commons will soon be “outflanked” [36] by Google Photos—despite each platform’s different mission.

Though Commons—like other Wikimedia projects—does not consider itself to be a social platform, contributors interact via Discussion pages, Project pages (e.g., Help Desk, the Administrators’ Noticeboard) and the Village Pump, a “page used for discussions of the operations, technical issues, and policies” [36]. Additionally, Commons features monthly photo challenges and, at times, coordinates with Flickr Photowalk organizers and photographers to improve Commons’ coverage of particular subjects (i.e., Wiki Loves Monuments seeks to improve documentation of cultural and historical monuments). In fact, commons-based peer production systems like Commons *depend* upon volunteers to contribute, curate, and maintain content. Though Commons averages more than 30,000 “active” users each month, “very active” users range between 1,5000-2,000 per month [38]. This relatively small group of volunteers is often overwhelmed with backlogs, some of which date back almost a decade [33]. For example, contributors have commented upon how difficult it is to upload photos to Commons and how the new Android app might address this issue [34], indicating a community-based desire for design improvements.

In addition to technical challenges such as image uploads, contributors to Commons must also navigate intricate policies concerning copyright and permissions, reoccurring vandalism, problems with other users, and photography critiques. Similar to Wikipedia, these factors create a sociotechnical environment that can be intimidating for new users (e.g., [14,18]). But because Commons supplies more than 290 language Wikipedias and “sister projects” such as Wikivoyage and Wikispecies with images and other multimedia resources [31], it is vital the project be continuously maintained and managed. Questions about images and representation in Commons are particularly relevant given research about how the presence of images

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impacts perceptions of article quality on Wikipedia (e.g., [40]), how image search results can reify gender stereotypes [17], and in light of current campaigns to increase the visibility of women and/or minorities [1] in Commons and, thus, in Wikipedia globally.

The majority of public press about the community has detailed controversies centered on the prevalence of amateur pornography (e.g., [19,26]) and co-founder Jimmy Wales' involvement in removing pornographic images (e.g. [13]). Compared to its outsized impact, Commons has received relatively little attention from scholars with a few notable exceptions (e.g., [29,36,27,3]); while the latter two studies use Commons as a means to an end (e.g., to study the semantic web and/or metadata), only Viegas (2007) [29] focuses on participation in Commons.

To build on this prior work ([29]) and motivated by the question *"How might gamification increase and broaden participation in Commons?"*, we proposed a mobile game focused on photo-sharing. We then conducted an online survey that included both a description and wireframes of the game.

In the sections that follow, we first provide a review of prior work necessary to frame our contribution. Second, we introduce *Scavenger Hunt*, a mobile game design allowing us to directly survey the efficacy of one particular type of bespoke intervention specifically for Commons (i.e., sharing and rating photos). Third, we present the results of an online survey, highlighting the design patterns most salient for potential players which indicate specific opportunities for future game designers. And fourth, we conclude with a discussion of the potential for interventions such as Scavenger Hunt to create opportunities to improve online communities such as Commons by focusing on human needs rather than community needs.

The contribution of this study is two-fold. First, our findings help us to understand why younger people (≤ 30 years of age) who report being comfortable with social media and mobile technologies do not contribute to Commons. Second, our findings support the social feasibility of creating alternative pathways for different kinds of user to participate in peer production communities like Commons.

RELATED WORK

While a wealth of interdisciplinary research about commons-based peer production systems and online communities informs our research, we have chosen to scope our review of related work to studies about three directly relevant topical areas: gamification; photo-sharing; and participation. These three bodies of literature are relevant to our study because the intervention we have proposed is a mobile game focused on photo-sharing intended to broaden and increase participation in peer production systems.

Gamification

For the sake of this review, we introduce the subject of gamification from two perspectives, enumerating examples from each and leaving to the reader the task of exploring the subject in greater depth.

Gamification and extrinsic motivations

Gamification is frequently defined as game design elements added to impact engagement-with or performance-on an interaction. In other words: badges. Along these lines, Barata et al. [5] show how gamification in an academic setting can drive student engagement, increase awareness of reference material, and improve grades. By adding badges and points to an existing course, the researchers observed a significant increase in lecture downloads, final scores, and positive feedback from students.

Many corporations have gamified their products (e.g., Waze, Foursquare), aiming to create a more collaborative and participatory environment. Cechanowicz & Gutwin [10] applied principles of gamification to the well-studied realm of online market surveys and found that the addition of a game mechanic improved participation. Interestingly, they found the effects were not significantly dependent upon factors such as age, gender, and prior experience with games. This key finding suggests the benefits of gamification could be equally spread among contributors and hence foster diversity.

Gamification and intrinsic motivations

Beyond badges and points, a subtler form of gamification involves the creation and/or mediation of information intended to impact perceptions of a community and, by proxy, membership and involvement in that community. Prior work by [11] and [25] have examined how mediating information related to the state of a community can impact identification with that community and, accordingly, continued membership and levels of interaction. For instance, Dabbish et al. [11] found that by presenting members of an online gaming forum with a running list of participants in that game (e.g., showing individual players entering, playing, and leaving a game), the players who remained had an increased sense of the vibrancy of that community—that is, they noted an increase in common identity from the remaining players [25].

Thus, the prior research tends to support our line of inquiry into whether adding gameplay elements could create a more engaged user base, both by crafting a reward system around contributions (e.g., extrinsic motivator, or the game itself) as well as the presentation of elements around that community (e.g., increasing implicit awareness of and identification with that community).

Photo-sharing

In the past decade, dedicated photo-sharing platforms such as Flickr and Pinterest and apps such as Instagram and Snapchat have become ubiquitous, while social media platforms such as Facebook, Google Plus, and Twitter have also incorporated and prioritized photo-sharing features. Consequently, there exists a wealth of research about photo-sharing behavior in online communities (e.g.,

[20,24,30]). For example, Van House et al. [28] established the ways in which people use digital images for social purposes and self-expression when a camera phone at-hand presents minimal barriers to personal use and photo-sharing. Similarly, Nov et al. [21] conducted a study about online-photo sharing behavior on Flickr and found intrinsic motivations such as commitment to the community and/or service and structural embeddedness in the network are significant factors that drive participation.

These findings suggest an approach to gamification more focused on creating interactions that fulfill implicit human desires as a proxy for community development, rather than focusing explicitly on the community itself.

Participation in peer production systems

Researchers have investigated many different aspects of participation in commons-based peer production systems, including: fundamental differences between participation in peer production systems versus other forms of firms and markets (e.g., [8]); the virtues of participation (e.g., [9]); motivations to participate (e.g., [6,7,37]); and different kinds of participation, including reading and lurking (e.g., [4,23]). More recently, researchers have begun to investigate how systemic bias impacts participation in systems assumed to be open and free [15]. Relatedly, in its strategic direction last year, the Wikimedia Foundation (WMF) expressed a renewed commitment to broadening participation by 2030: "We will break down the social, political, and technical barriers preventing people from accessing and contributing to free knowledge" [39].

Some researchers have argued people who participate in Wikipedia are "born, not made" [23] but that customizing the initial contribution process might result in higher rates of retention [*ibid*,18]. However, participation in Wikimedia Commons has been less well-researched, defined, and understood. While "increasing participation" refers to simply the quantity of contributors, "broadening participation" refers to including a diversity of contributors from different genders, age groups, socio-economic backgrounds, language groups, and countries of origin.

Currently, there is not a great deal of diversity in the demographics of community members. Wikipedia contributors are primarily male (84 – 91%, depending on the study), predominantly Western, with the majority (53%) under 30 years old [37]. To increase and broaden participation in system like Commons, one can imagine leveraging gamification to enact what Haythornthwaite [16] describes as a "lightweight" model—a model in which rule-based, anonymous, and discrete contributions can be recognized by quantitative measures—to be a way forward.

METHODS

We administered an online survey in two rounds roughly a year apart. Below we detail our methods, including ethical considerations, survey design and recruitment, and data collection and analysis.

Ethical considerations

We applied for and received Institutional Review Board approval from our institution before we began recruitment. All respondents were asked to indicate: (1) they were age 18 or older; and (2) they granted consent before proceeding with the online survey. Once each survey closed, we used a random number generator to select four respondents to receive a $25 USD Amazon gift certificate, awarding a total of eight survey respondents via the email addresses they provided. After awarding the gift certificates, we downloaded the survey data as CSV files and removed all identifying data from the survey responses. (Email addresses were maintained only in the online web survey tool used to administer the survey.)

Scavenger Hunt, survey design, and recruitment

Scavenger Hunt

To effectively disentangle participants' motivations to contribute to Commons from their desires to engage with a different type of online community, we designed a mobile game to frame our questions: *Scavenger Hunt*. The basic gameplay mechanic has two parts: in the first, players would be provided with opportunities to take photographs of artifacts and locations in their area—a literal scavenger hunt—with the photo request locations being automatically scraped from Wikipedia articles with the "Image requested" template, or from articles with the "Coord" template present but no images. We note such an approach should likely scale to non-English Wikipedias as well, provided other languages have similar templates (e.g., in Spanish, Wikipedia: Imágenes_solicitadas). The second primary gameplay mechanic is the "Photo Battle," where instead of (or in addition to) taking photographs, players could view and rate the photos of other players in the same area. These ratings could potentially then be aggregated and presented on the Talk pages for the corresponding article, providing both additional resources as well as augmenting commentary for the original authors of those articles. Overall, a primary goal was to create a gaming interaction in which the typical motivations for gameplay would be distinct from the value that game might generate for Commons.

Survey design

We developed our survey through an iterative design process, soliciting feedback from peers and community members at each iteration. Our final survey design consisted of 16 questions. Questions 1-4 requested demographic information, including age (drop-down menu), gender (free text), current country of residence (free text), and zip or postal code (free text). Questions 5-8 asked the respondents to indicate their experiences with games (e.g., PC, console, web, and mobile) via both Likert scale questions (5 and 7) and free text questions (6 and 8). Questions 9-11 asked respondents to indicate their experiences with online communities via Likert Scale (9), checkbox (10), and free text (11) questions, and included a brief introduction to Wikimedia Commons. The respondents were then presented with a scenario for a mobile game (Scavenger Hunt)

featuring both a photo scavenger hunt and an opportunity to rate photos (Photo Battle). Questions 12-15 asked respondents to comment on the proposed game and indicate possible future contributions to Commons.

Recruitment

We recruited respondents via existing mailing lists (e.g., university, Wikimedia, and special interest mailing lists) and social media networks (e.g., Twitter, Facebook groups, Slack channels) as well as via a sub-Reddit dedicated to survey research (r/sampleSize). We also posted physical flyers both in and around the university campus and in off-campus neighborhoods outside of a 10-mile radius to the university. Finally, we shared digital copies of our flyers with colleagues in Central Texas who printed and posted them at a local community college.

Data collection

We collected our data in two administrations roughly a year apart (February 2017 and 2018). We administered both rounds of the survey via an online web survey tool developed and maintained by the University of Washington. Respondents were not required to sign in and/or provide their email addresses unless they chose to (1) participate in the raffle and (2) consent to being contacted for a brief interview.

Survey 1: 2017

Survey 1 was administered in February 2017 for approximately four weeks; 56 respondents completed this survey.

Survey 2: 2018

Survey 2 was administered in February 2018 for approximately three weeks; 47 respondents completed this survey.

Data analysis

Quantitative analysis

Because demographic data (aside from age) was reported via free text, we first normalized the data. After cleaning the data, we used R to derive descriptive statistics. We then created exploratory graphics and tables in Tableau.

When conducting our quantitative analysis, we considered the various nominal and ordinal variables of interest such as country of residence and preferences (e.g., for photo-sharing websites, types of games, and frequency of gaming). However, because the moderate sample size (*N*=103) was not conducive to multivariate analysis, we restricted ourselves to descriptive statistics. We manually coded the responses to the final survey question to categorize respondents' levels of enthusiasm for contributing to Commons after reviewing the proposed game.

Qualitative analysis

To conduct our inductive qualitative analysis, we collected and aggregated the free text responses to three open-ended questions (11, 13, and 14) from both administrations of the survey (*N*=262). Using Google Documents, one author conducted *In Vivo* coding and shared her memos with the other two authors. We then iterated on these preliminary codes and memos to develop a codebook consisting of 17 codes. Though each question asked the respondent for different kinds of information (e.g., reasons to contribute to Commons, reasons to play or not play the proposed game, ways to improve the proposed game) the free text responses across questions were coded holistically as respondents often provided unsolicited information and/or did not answer the question directly. One author applied the codebook to all 262 responses while the other two authors coded a random selection of 50 responses each. We then calculated our inter-rater reliability (IRR) score using ReCal2.[1] Across 16 codes, our percent agreement ranged from 91-100%. For the code *Other*, our percent agreement was 79%. After discussing our IRR scores and adjudicating differences, we agreed our percent agreement for *Other* was due to the desire to capture additional data and did not impact our identification of dominant themes.

FINDINGS

In the following section, we describe our findings in aggregate. We begin with an overview of the demographics of our respondents and then discuss findings from our quantitative and qualitative data analyses grouped by the most common themes.

Demographics

Age

Across both surveys, our respondents tended to skew young with 77% identifying as age 30 or younger (see Table 1).

Ages	# of Responses	Percentage
18 - 21	30	29%
22 - 25	23	23%
26 - 30	26	25%
31 - 40	13	13%
41 - 50	4	4%
> 50	6	6%

Table 1. Self-reported ages of survey respondents (*N*=102). Note: One survey respondent chose not to answer this question.

Gender

Two respondents identified as agender, 52 identified as women, and 49 identified as men (*N*=103).

Country of residence

The majority (65%) of our respondents indicated their current country of residence is the United States. The second most common country of residence (15%) was India. Overall, 14 countries of residence were represented,

[1] http://dfreelon.org/utils/recalfront/recal2/

including the United Kingdom, Norway, Netherlands, and France (*n*=2 each) as well as Albania, Canada, Finland, Hong Kong, Ireland, South Africa, Switzerland, and the United Arab Emirates (*n*=1 each).

Quantitative Data

In the following section, we provide an overview of responses to the Likert scale and checkbox questions (Questions 5-10) we posed to determine our respondents' experience with games, photo-sharing, and online communities. We also include relevant findings from free text responses where appropriate. Finally, we report our respondents' likelihood of contributing to Commons.

Experience with games

Overall, our respondents reported moderate levels of experience with games, with mobile games being the most common.

Frequency of game-play

Only five respondents indicated they do not play any games. Among the 22 people who do not play mobile games, 17 participants indicated they avoid mobile games but play desktop, web, or console games. However, mobile games were the most preferred gaming medium with 45 respondents playing mobile games more than once a week and 18 respondents playing mobile games exclusively. In their free text responses, respondents also referred to several mobile games, including Pokémon Go and Ingress. (See Figure 1.)

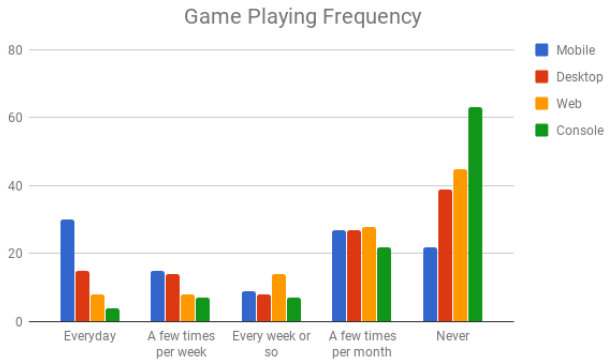

Figure 1. Self-reported frequency of playing games on different media for survey respondents (*N*=103).

Game type preferences

Respondents overwhelmingly stated a preference for puzzle games as compared to other types of games (e.g., action, real world, cards). (See Figure 2.)

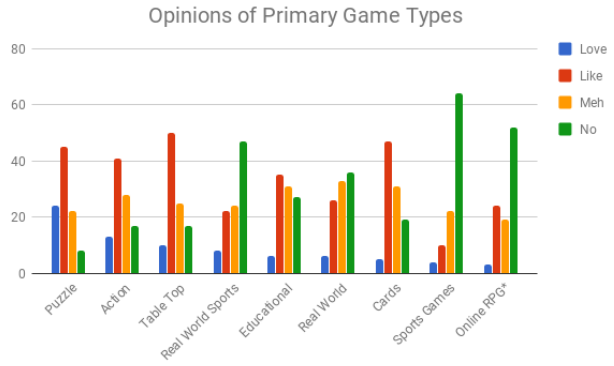

Figure 2. Self-reported preferences of game types for survey respondents (*N*=102). Note: One survey respondent chose to not answer this question. (*Online role-playing games).

Reasons for avoiding mobile games

Sixteen respondents chose to express reasons for why they avoid mobile games. The most common reasons include: lack of a smartphone; preferences for real-world interaction; and finding mobile games addictive. Interestingly, one participant mentioned they avoid mobile games altogether because they view contributing to Wikipedia as the "best MORPG" (massive online role-playing game) and would rather "play" it instead.

Experience with photo-sharing

Several respondents explicitly mentioned photo-sharing platforms and apps in their text responses, most notably: Flickr (*n*=12) and Instagram (*n*=57). Only 22 participants indicated they do not share any pictures on social media.

Experience with online communities

Analysis of the respondents use and contribution to various online communities revealed Facebook is overwhelmingly popular with the majority of respondents using it daily.

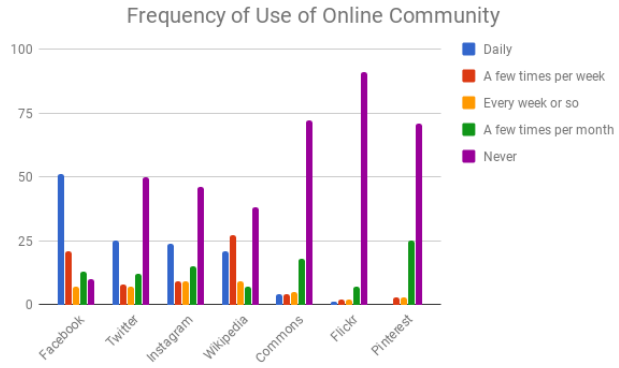

Figure 3. Self-reported frequency of use / contribution to online platforms for survey respondents (*N*=103 overall). Note: N varies with each row. Some survey respondents chose to not answer for each online platform.

While 48 out of 103 participants stated they use or contribute to Wikipedia more than once a week, only 8 participants stated they used Commons at the same frequency. A majority

of participants (70%) also indicated they rarely or never use Commons as opposed to 37% who indicated they never use or contribute to Wikipedia. (See Figure 3.)

Likelihood of contributing to Commons

After learning about Commons and reviewing Scavenger Hunt, 74% of respondents indicated they would be interested in contributing to a commons-based peer production system like Commons (e.g., "Now that you've seen what the game is and how it works, how do you feel about potentially contributing to something like Wikimedia Commons?") (See Table 2).

Likelihood	# of Responses	Percentage
Not Interested	12	13.3%
Maybe / Unsure	11	12.2%
Conditional Yes	20	22.2%
Yes	47	52.2%

Table 2. Self-reported enthusiasm for contributing to Commons (*N*=90). Note: Thirteen survey respondents chose not to answer this question.

An analysis of whether this level of enthusiasm could be differentiated by gender revealed an insignificant difference ($p = 0.46$).

To summarize, our survey respondents skewed young (77% ≤ 30 years) with most calling the United States or India home. They prefer mobile and/or puzzle games, they often use Facebook, and they rarely contribute to Commons or Flickr.

Qualitative Data

In the following section, we detail findings from the free text responses to three open-ended questions. We have organized our findings into dominant themes: desired features for the proposed mobile game; desired rewards for either playing the proposed game and/or contributing to Commons; and potential barriers to adoption of the proposed game and/or contributing to Commons.

Desired features

Our analysis of the aggregated free text responses revealed several desired features, including: ease of use; agency, control, and customizations; and gamification.

Ease of use

While a few respondents explicitly mentioned ease of use in their answers (e.g., "easy to upload," "easy to share," "easy to use"), several others commented on the importance of a "good UI."

Agency, control, and customization

Survey respondents also expressed a desire for maintaining agency and control. For example, many respondents wanted control over notifications:

> *I would prefer having the option of silent notifications, so if i have my phone out and am using it, I can see them and choose to partake. There are times when I don't plan on interacting with my phone, like when I am on a hike, so I would prefer not to have random notifications from apps.* -Woman, age 26-30, USA

Similarly, a man (age 22-25) from India commented, "The notifications shouldn't arrive any time of the day: there should be a window that the user can choose."

In addition to wanting to have control over notifications, respondents also expressed a desire for customizations. For example, some respondents wanted to curate photos (e.g., "Or if there is a collection of pictures making sense, the option to group together and see it as a slide show out of the box") and/or use filters (e.g., "Would there be photo filters involved in the game? If yes, that might make users more interested in taking photos").

Some respondents also expressed concern about how their images might be used and how Commons would ensure credit and provenance.

> *I'd need the loop to be closed—if I knew where my image was being used or how it was useful to somebody, I'd definitely contribute to the platform.* -Man, age 26-30, India

Gamification

Though our survey presented a proposed mobile game, our respondents still asked for additional gamification features. For example, one respondent wrote:

> *I would suggest that for WikiMedia [sic] Commons to be more interesting to a general user who has access to the internet, he/she would probably want to contribute more if he or she were to get something back in return. For example, on Facebook, people get likes or reactions in the form of comments which makes them feel good about contributing, on Quora, you get upvotes and views which makes you want to write more. If Wikimedia Commons were to be built on a platform where people could rate contributions of their friends and colleagues, it would probably draw more interest, especially from the millennials.* -Man, age 18-21, United Arab Emirates

Other respondents explicitly asked for ratings, badges, and leaderboards. Overall, we noted 28 specific requests for gamified elements, including several observations that the proposed game would need to provide a way to "level up":

> *I might play the game for sometime [sic]. But depending on how the challenges go, I might continue or not. I usually get bored of such games to be frank.* -Woman, age 26-30, USA

Desired rewards

In our analysis of the free text responses, we also noted expressions of desires for rewards (e.g., intrinsic rewards

such as the desire to make an impact and extrinsic rewards such as financial and/or real-world compensation).

Desire to make an impact

Respondents who indicated they were likely to adopt the proposed mobile game and/or contribute to Commons also expressed a desire to make an impact (i.e., gain an intrinsic reward) by submitting unique and/or useful photos. For example, one respondent commented:

> *if i thought i had something that other people could benefit from, i might share it. for example, a photo that depicts something unique that might not already be there.* -Woman, age 22-25, USA

Similarly, a woman (age 41-50) from Switzerland responded "Knowing they [photos] would be useful in a way" would be a motivation for contributing. A few respondents noted they already contribute to Commons and spoke to how factors like "perceived need" motivated them to continue to participate:

> *I contribute to Commons whenever I have images that I expect to use on Wikipedia or Wikivoyage. Often I create these images specifically for the perceived need.* -Man, age >50, South Africa

Expressions of a desire to make an impact were further echoed in respondents' concerns that their contributions might "get lost" in a "sea" of images:

> *I would be concerned about my images "getting lost" in a sea of great images most of which people never see, because they don't want to go through a lot of them to find one they like.* -Man, age >50, USA

This sentiment is also expressed by one respondent's suggested design feature:

> *I'd be much more likely to play if I got a notification saying "Jason from Austin, Texas is doing a project on Bridges of America and needs an image of Fremont Bridge". If my work is helping somebody that would motivate me more.* -Man, age 26-30, India

Desire for a social component

Though our survey did not explicitly ask respondents to comment on social features or affordances, the desire for a social and/or community component was a consistent theme in their free text responses. (In fact, "desire for social and/or community interactions" was the second most activated code after "desire to make impact and/or contribute.") Perhaps because of the way we introduced the game (e.g., Harriet is an avid jogger who is exploring her neighborhood and is prompted to participate in Scavenger Hunt), respondents asked for more community and/or civic-minded features such as the option to participate in photo scavenger hunts with friends and/or contribute to a specific group of photos for one's neighborhood.

Respondents also expressed a desire to compete with others "to be the first to do something" and some said that the "social component" was missing altogether from our proposed game.

Finally, respondents wanted to be able to connect with their friends and integrate the proposed app into their existing social media circles.

> *Connect to Instagram somehow, or to friends on Facebook, etc. Some way to have some "real" friends see your pictures.* -Man, age >50, USA

Desire for credit

We applied the "credit and/or ownership concerns" code 22 times. In some cases, such as below, credit and/or recognition from Wikimedia was important to the respondent:

> *Wikimedia clearly giving me credit for the picture would encourage me. Also, i have been wanting to learn photography and add some pieces to my portfolio. I need a push to go out and click. If I like what I click, I would love to contribute towards the Wikimedia Commons.* -Woman, age 31-40, USA

In other instances, the respondent expressed a desire for credit coupled with some other kind of reward, such as public recognition:

> *[…] The competition would need to offer more than badges -- maybe being featured on a Wikipedia "banner ad" like the one that is always asking for donations, or maybe getting singled out for an interview with an editor from Wired, the NYT or some other publication that covers the web.* -Man, age > 50, USA

Other respondents also spoke to "real world recognition" via links to one's social media profiles and/or through being acknowledged as an "expert" via reviews and ratings (cf. Zomato, TripAdvisor).

Desire for financial incentives

For many of our respondents, contributing their time, skills, and/or photos to Commons without the promise of some kind of financial incentive or real-world reward was the primary reason why they would not play the proposed game and/or contribute to Commons.

We noted 25 instances in which respondents said they required "financial compensation" and/or "incentives" to take and share photos in general. For example, one respondent wrote:

> *I would consider playing it if the earned points/up-votes can be converted into real-world gift cards.* -Woman, age 26-30, USA

Similarly, other respondents noted "Financial incentive: Amazon credits etc [*sic*]" and/or "gift cards" would be needed motivation for them to play the proposed game.

Expressions of a desire for credit and financial incentives often co-occurred—as did comparisons to how other sites/apps reward contributors:

> *I think it's useful and even philanthropic to donate your images to the commons. While I have never done it, I would totally consider it. However, if I'm honest, I would need an incentive of some type to get me to contribute regularly. That incentive could be anything: money, status, recognition, etc. I think having a reward makes sense, especially since my images could theoretically be worth something. My favorite example is Unsplash.com - this is a site of free images that real photographers submit to. The images are high-quality and totally free under CC. The incentive is that the photographers get recognition and therefore more business, but it's not sustainable beyond a few images per photographer.* -Man, age 18-21, USA

Potential barriers to adoption and/or participation

Finally, our thematic analysis also revealed several potential barriers to adoption of the proposed game and/or to participation in Commons, including: a lack of awareness and/or understanding of Commons; privacy concerns; hardware and/or mobile service limitations (e.g., data costs); and a lack of time and/or interest.

Lack of awareness of Commons

Several respondents explicitly indicated they did not know about Commons before taking the survey. For example, one respondent notes:

> *I'm already interested - didn't know it [contributing to Commons] was even possible until now.* -Man, age > 50, UK

While other respondents indirectly revealed their lack of awareness and/or understanding of Commons by asking questions such as, "One question would be the relevance of community pictures. Are they for informational purposes only? What is the value that Wikimedia Commons is trying to create?" (Man, ages 26-30, USA). Finally, some expressions of concern about both credit and privacy indicate the respondents are unfamiliar with how Commons works (e.g., that it is a pseudonymous community in which users accrue reputation via quantity and quality of contributions).

> *Now I've come across Wikimedia Commons images on Wikipedia itself, I'd never visited the Commons site before. I think the idea is very innovative: crowdsourcing can go a long way, just as in the case of Wikipedia. Would definitely be interested in contributing, although am not sure about the credit process.* -Man, age 22-25, India

Privacy concerns

Privacy concerns emerged as a consistent theme. In particular, respondents expressed reluctance to share their location and/or to share photos of people.

> *I am happy sharing images as long as they are used respectfully and cannot be traced back to me/my identity in any way. I value privacy and do not want others to be able to track where/where [sic] I was beyond what is readily available in the image. […]* -Woman, age 26-30, USA

Being able to control one's location settings (i.e., turning geo-tags on/off) was especially important not only for maintaining one's privacy at times, but also for managing potential harassment as this respondent notes:

> *I'm assuming pics have geo-location data attached, would there be a way to keep that private or remove it? I'm thinking for photos where that's not important like of my pets, or of cheery sunflowers in a bouquet at home. Also for those who might have issues with stalkers or people with nefarious aims.* -Woman, age 26-30, USA

Hardware and/or mobile service

Nine respondents commented upon the limitations of their current mobile devices and/or services, stating that the proposed game might drain their phones' batteries and/or cost too much in data to play. As one of these respondents noted, hardware limitations and data costs could prevent contributions from people who live in parts of the world "where we most need images."

Lack of time and/or interest

A portion of our respondents reported they have neither the time and/or interest to play mobile games in general nor the time and/or interest to contribute images to Commons. For some respondents, the style of game-play did not interest them (e.g., "I'm not a mobile gamer"; "I tend to limit my gaming to story-driven stuff"). For others, taking photos had little appeal (e.g., "I have no interest in Instagram, since I have no interest in taking pictures). Finally, for some, they stated they simply do not have the time to take and contribute photos in general.

Other considerations

In addition to the findings above, we noted 18 respondents reported they have either contributed to Commons in the past or are currently contributing to Commons. Interestingly, two respondents provided detailed reasons for why they no longer contribute, including discovering their images were being used by commercial enterprises:

> *I found that my images were consistently being used by for-profit companies, without complying with licence [sic] terms. Advertising. Publications. Websites. Blogs loaded down with ads. Even on horrible buzzfeed [sic] types that are an aggregate of stealing the work of others. I became frustrated that I was, essentially, contributing to what I consider to be leaching by certain industries, and quit uploading.* -Woman, age 31-40, Ireland

This comment, in particular, echoes other respondents' concerns about credit and provenance.

Considering our quantitative and qualitative data in tandem, we suggest a game-based approach to facilitating contributions in Commons may provide a novel means of increasing participation as well as broadening the demographics of those contributors. Wikipedia [37] has reported 53% of contributors are less than 30 years old and only 16% identify as women. Similarly, Viégas [29] reported the respondents to her survey about the demographics of Commons contributors were on average aged 33.6 and were 100% male (N=29). Conversely, 77% of our participants were under 31 years old, 50.5% self-identified as women, and fully 74% of respondents indicated they would be interested in contributing to a system like Commons after being exposed to Scavenger Hunt. While it is true the demographics reflected in our survey do not reflect the larger demographics of contributors to Wikipedia or Commons, we see the discrepancy between the two as an opportunity to expand contribution to the latter by drawing from the pool of the former. We discuss these opportunities below.

DISCUSSION

In its earliest incarnation, this study aimed to answer two primary questions. First, would it be possible to apply the attention and efforts of an existing group to the production and wellbeing of an existing community where prior there had been potentially little overlap? And second, would that erstwhile application of effort increase awareness of the Commons specifically or peer production more broadly, increasing contributions to these communities? This Discussion section will address these two questions.

Potential for increasing and broadening participation

Empirical data as well as prior experience support the view that communities built on member-created content exist, and further, have been successful. Photo-sharing sites like Instagram, Pinterest, and Flickr remain in common use, providing a relatively straightforward means for members to capture, archive, and share the content they find meaningful. Data collected in this study provides a clue to the lasting success of these types of sharing communities.

First, the two most common codes identified in our data across all respondents were the "desire for social and/or community interactions" and the "desire to make impact and/or contribute" (e.g., be useful). Characteristics common among observations coded thusly included the desire to be a part of either a local or a virtual community, to have a tangible connection between one's own efforts and another's needs, and to be responsible—either solely or in part—for the making of something meaningful. Second, also identified in our data were codes indicating the "desire for financial incentives and/or real-world rewards." These three codes identified as prominent in our data were not intentionally created as a hierarchy or a progression describing the desires of our respondents; however, a kind of progression did become apparent. Specifically, the desire to be a part of something, the desire to have a positive impact on something, and the desire to get credit for something.

To offer one suggestion for the delta between the success[2] of sites like Instagram, Pinterest, Flickr, etc., and Commons—each of these desires, unsurprising to observe in hindsight, describe possible affordances to a set of interactions more effectively implemented in the former communities rather than the latter. (This is not an indictment of the functionality of Commons, but an observation of a suggested difference between distinct communities.)

To return to the earlier questions then—first, would it be possible to extend existing efforts to grow or support a community such as the commons? We argue, yes, provided the interaction created to facilitate the growth or continuity of the Commons amplified the ability of those community members to fulfill the desires reported above. And, second, is it possible to transition knowledge of Commons into contributions to other Wikimedia projects (e.g., Wikipedia)? Given the observations above (i.e., the "Likelihood of contributing to Commons" section), we would argue it is possible a game such as our proposed Scavenger Hunt may increase awareness of Commons, and thereby increase direct participation to it or to "sister projects." But in the context of this study we would add, potentially it does not need to. What we have aimed to illuminate: activities exist that are valuable in their own right, even if they result in content that fails to deliver on the desires articulated above. For instance, if an individual enjoys walking through nature and taking pictures, the fact those pictures don't engender a greater sense of community in the photographer should not diminish the value of the act itself. It may not be feasible (or desirable) to gamify Commons. What we are suggesting is there are alternative pathways to contributions to peer production that, if carefully identified and creatively cultivated, can be crafted into compelling interactions that would be more broadly, implicitly, desirable.

LIMITATIONS

Because we used an online survey to gather data, we expect self-selection bias. Additionally, we did not design our survey for accessibility, so we do not expect our findings to be representative of users who have visual and/or motor impairments. We also recognize our sample size across demographics is too small for potential differences to be meaningfully analyzed via multivariate statistics. Finally, we posted our recruitment message to Wikimedia mailing lists, so we expect to see an over-sampling of individuals who are already supportive of open source communities.

[2] "Success" here operationalized as Alexa ranking.

FUTURE WORK

By providing their email addresses and consent, 88% of respondents indicated they would be willing to participate in follow-up interviews. Additional qualitative research—such as semi-structured interviews and/or Participatory Design workshops—would elicit more in-depth data, whereas conducting a similar survey with a larger number of respondents would result in more generalizable data, particularly if we used stratified sampling.

CONCLUSION

According to Alexa's ranking of websites, Wikipedia consistently ranks #5 globally, and Commons generally falls between #250-270 [2]. However, Instagram and Flickr (similar apps and platforms mentioned by our respondents) currently rank #17 and #368 respectively. These rankings indicate (1) Wikipedia is ubiquitous (2) Commons, though it directly contributes to Wikipedia, is less well-known and less frequently accessed (3) Instagram, which relies on a mobile app and prioritizes social features (e.g., liking, following, sending direct messages), is more popular than Flickr.

Wikimedia Commons—like Wikipedia and other "sister projects"—provides users with a wealth of free information and resources in addition to providing Wikipedia (and its readers) with a repository of images and multimedia files. Though Commons is not as well-known as Wikipedia, findings from our exploratory study indicate an openness to learning about and contributing to the project—especially if alternative pathways to participation are available to a wider range of user-contributors.

As one respondent wrote:

> *I like the idea of sharing small pieces of the world I experience with the broader community. What is ordinary to me, might be extraordinary to someone else.* -Woman, ages 31-40, USA

The range of what we experience on a daily basis includes countless moments when we are not thinking about contributing to peer-production communities such as Commons. The study above is an acknowledgement of the value of those moments, highlighting the opportunity for crafting interventions with the capacity to elevate our desires as a means of participation in peer-production communities.

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