App Movement: A Platform for Community Commissioning of Mobile Applications

Andrew Garbett, Rob Comber, Edward Jenkins, Patrick Olivier
Open Lab,
Newcastle University
Newcastle upon Tyne, UK
{a.garbett, robert.comber, edward.jenkins, patrick.olivier}@newcastle.ac.uk

ABSTRACT
There is an increasing demand to encourage inclusivity in the design of digital services. In response to this issue we have created App Movement, a platform that enables the promotion, collaborative design, and deployment of community-commissioned mobile applications. The platform facilitates collaborative customization of a common app template, for which the development and deployment of the app is fully automated. We describe the motivation, design and implementation of App Movement, and report the findings from an 8 month deployment wherein 27 campaigns were created, 11 of which have been successful, and over 1,600 users pledged their support using the platform. We present three case studies to demonstrate its use and adoption in successful and unsuccessful campaigns. We discuss the implications of these studies, including questions of governance (ownership of content, liability of user generated content and moderation), sustainability and the potential to extend App Movement beyond location-based review apps.

Author Keywords
Community commissioning; community information systems; mobile applications; app development

INTRODUCTION
As digital services and goods become integrated in everyday life there is an increasing demand to encourage inclusivity in the design and ideation of these services in order to ensure they best serve the population in which they operate [16,22]. Crowdfunding platforms, such as Kickstarter [19] and Indiegogo [27], can be seen as a step towards encouraging inclusivity and participation in the commissioning process that enables highly motivated individuals to engage the public in the funding and promotion of projects. However, the success and delivery of these projects often becomes intrinsically bound to the motivations and perspectives of the campaign creators themselves rather than the desires of the funders.

Outside of crowdfunding platforms and in an industry context the perceived levels of demand and commercial value of a final product often dictate the levels of motivation for commissioning technology. This often results in niche or small communities waiting until it is commercially viable before the technologies are commissioned. Despite this, communities have demonstrated their ability to appropriate technologies in order to address current needs. Instances such as Facebook pages has enabled communities to engage in social movements [3] as well as the leverage the real-time nature of Twitter to organize protests [9]. In each case the technologies in use are not directly designed for the purpose at hand, but rather generic enough to be appropriated as the community requires.

New models of technology commissioning and ownership are emerging to address this issue. Scholz [22] introduces the concept of *Platform Cooperativism* wherein "worker-owned cooperatives could design their own apps-based platforms, fostering truly peer-to-peer ways of providing services and things". Within this model commodities and services are provided by, for, and to the benefit of, the cooperative. We explore this design space further through the deployment of App Movement, an online platform that facilitates communities to; propose and promote ideas for mobile applications in response to community needs, collaboratively design the concept through a series of customizable features, and automate the development and deployment of customized app template. Through the design of the platform we hope to begin to understand how communities might themselves commission technologies and services.

In this paper we contribute the design of a system for the community commissioning of mobile applications. We describe the motivation, design and implementation of App Movement and discuss it's usage over an 8 month period wherein 27 campaigns were created and over 1,600 users pledged their support, resulting in 7 mobile apps and a combined user base of over 6,000 members. We present 3

CHI'16, May 07-12, 2016, San Jose, CA, USA
ACM 978-1-4503-3362-7/16/05.
http://dx.doi.org/10.1145/2858036.2858094

case studies to provide insight into how campaigns unfold as well as the final adoption of the resulting apps. We also discuss the implications of these studies, including questions of governance (ownership of content, liability of user generated content and moderation), sustainability and the potential to extend App Movement beyond a service model and transition to community ownership.

RELATED WORK

The means by which communities are able to engage with the development of technology has begun to broaden. Open Source software communities, Crowdfunding platforms, and Open Innovation platforms provide the tools for communities to engage, at differing levels, in the commissioning of technology. However, access to these forms of commissioning is often limited by the requirement of technical expertise, knowledge or resources.

Open source software communities such as GitHub, an online platform for collaborative open source software development, allows software developers to collaborate on projects with other likeminded individuals, propose new features, and provide possible solutions to problems. These solutions are either accepted or rejected by the core development team who may include it in next release. Although open source development encourages collaboration within the community there still remains the issue of exclusivity in regards to technical skills required to contribute towards these projects. The acceptance and moderation of new feature requests are also governed by a core team and can sometimes be problematic. Existing research [26][4] found that the acceptance of new features relied upon social cues relating to the reputation of the individual [14], extended discussion and deliberation, and levels of community support behind a solution [26]. All of these factors demonstrate there is a community commissioning process within Open Source software. However, community members still require extensive technical expertise before they can become accepted contributors to a project.

Research regarding design focused participation online attempts to overcome these issues of technical expertise requirements. Fischer *et al* [6] define *meta-design* as a series of "activities, processes, and objects to create new media and environments that allow users to adopt the role of designers". Fischer *et al* [6] express that non-designers (consumers of technology) should be able to influence the design of the systems they utilize and that we as system designers should in fact design to enable these forms of interactions. However [6] argue that the role of a designer must be thought of as a spectrum ranging from *passive consumer* to *meta-designer*, and that design focused systems should be developed to enable varying levels of collaborative participation. An attempt to include communities within the process of research itself can be seen in the design of Citizen Science platforms wherein researchers commission a community of willing citizens to collect scientific data at scale and under the direction of scientists. Often studies collect data around environmental phenomena such as bird migrations [20] and annotation of cultural heritage collections [17]. In this model citizens participate in studies that they feel is important to them, joining a group of enthusiasts around a topic of interest. The management and design of the study however, is still very much under the control of the researchers leading the project. The final outputs of the research are aimed towards the publishing academic papers rather than to responding to a community's needs directly. Kim *et al* [10] present a platform for citizens to commission their own Citizen Science research projects and enable the collection of data through the customization of a mobile web application. In this model the community themselves actively participate in the creation, collection and analysis of the data for their own purposes and are able to enact upon their collective actions rather than passing this responsibility on to researchers. Within the context of community led media production Bartindale *el al* [21] present a system that enables audience members to commission and orchestrate the capture of multi-camera footage from live music gigs. The system provides non-media-professionals with the ability to establish a video production team in order to contribute towards the filming of live events. The collective contributions of the audience are then returned to the performer who is able to use the footage in their own music videos. The motivation behind participating in the process is the feeling of satisfaction resulting from inclusion within the collective actions of the community.

Within the context of community-led event planning, Cheng and Bernstein [2] explore *activation thresholds;* commitments that are conditioned on others' participation. The *Catalyst* platform introduces activation thresholds for on-demand events in order to create a sense of urgency to participate. Within the platform campaign creators are able to create a sense of urgency through setting explicit quantities of available roles in which a user may commit to. Within this context minimum threshold requirements are explicitly set by the event creator and the design and coordination of the event is conducted outside of the platform. The event is loosely defined on the event page which allows for related discussions through a comment system and email correspondence. Participation within these events were typically at a smaller scale (between 2 and 30 participants).

Previous research of community-oriented location-based review systems such a FeedFinder [1], demonstrate that communities are indeed both motivated and capable of sustaining community driven mobile information resources where there is an actual need. FeedFinder arose through a process of engagement with mothers and established the need for location based review service that allowed new mothers to rate and review local businesses in regards to how breastfeeding friendly the location felt to the reviewer. With local promotion of the application, FeedFinder, was

adopted by the originating community, shared amongst its members, and propagated to other regions of the UK and beyond. In this instance the technology was conceived through a user-centered design process, and developed by the research team in response a need. In contrast, App Movement has been designed as a community-commissioning platform, that is, a generalization of the system and processes by which apps such as FeedFinder are designed, developed, deployed and promoted.

Communities can also leverage technology to facilitate activism. Warren [28] explores how communities can become empowered through the act of grassroots geospatial mapping. Typically, those with vested interests in the placement of boundaries are the ones who decide to commission cartographers. However projects such as OpenStreetMap [18] demonstrate how bottom-up collaborative efforts can result in a free and open public resource. Such projects can be seen as a form of sousveillance [13] providing communities with the ability to collate and annotate maps, allowing them to hold authorities accountable for their actions. Further examples of this can be seen in FixMyStreet [11] that provides citizens with the ability to report on local issues. In other areas of civic action, platforms such as Petitions.parliament.uk enable citizens to engage government in discussion on matters raised through online petitioning. Citizens have also used platforms such as Change.org to raise awareness of national issues outside of parliamentary debate, such as food waste in out of date supermarket goods [24], and used media coverage to compel industries to review questionable practices.

Crowdfunding platforms have also been similarly appropriated as vehicles for social good through encouraging media coverage of global issues. In particular, the Indiegogo crowdfunding Greek Bailout Fund campaign [29] was able to raise in excess of €2.3 million towards the Greek economic crisis, despite the fact that the campaign's target was set at an unachievable €1.6 billion. The creator leveraged the power of social and traditional media to raise awareness of the campaign and garner support [5]. Social media platforms such as Twitter and Facebook [3] have also been appropriated as tools of activism through the sharing of campaigns and petitions. In real-world social movements such as the Arab spring, research has shown [9] that social media played an important role in the mobilization of protesters, dissemination of real-time information to new outlets and raising awareness through online debate. Communities have demonstrated they are more than capable of appropriating existing technologies in order to achieve a purpose. However, a number of barriers still prohibit the broader participation in the commissioning of technology. Issues around knowledge, resources, skills and services still exist. Platforms such as crowdfunding attempts to encourage entrepreneurial individuals to produce products using community support albeit with limited participation to the design process. Open Source software can mobilize a community of developers to create solutions however there are technical limitations on contributing to the process. Platforms exist to provide services for communities to adopt, such as FixMyStreet, however these services are not directly commissioned, designed and owned by the communities themselves. It is this issue that we attempt to address through our research and with the development of the App Movement platform.

APP MOVEMENT

App Movement allows communities to commission, collaboratively design and automatically generate their own mobile applications. Currently the system provides users with the ability to create a location based review service, such as FeedFinder [1] or Trip Advisor [12], that allows communities to rate, review and add locations to a shared map. The App Movement platform has been developed with the intentions of providing a number of different templates from which to choose from. The platform encourages a grassroots approach to identifying community issues and provides the tools necessary for communities to establish their own community driven information systems. Our approach attempts to remove the technical barriers to app development and provides a democratic process in which to engage a community in the design of these forms of technology. Through removing this technical barrier and scaffolding the process of commissioning we also hope to engage those communities who might not typically engage with the commissioning of technology. The result of this is the deployment of an ongoing service which we hope to explore as communities begin to establish their own information systems in the future.

The creation of campaign pages, or movements, for instance for 'dementia friendly shops', allows individuals to engage the community in promoting the concept and establish if there is a real need for the proposed idea. The nature of proposing an idea leads to a sense of ownership of that idea. The result of this sense of ownership is the increased motivation to promote the concept and engage the community in the appraisal of the idea. In this model the researchers do not play an active part in the promotion of the concept and simply provide the community with the means to promote the idea themselves. With this configuration we argue for the design of the platform as a tool for appropriation by the community that allows communities to more accurately address issues they face.

The Process

The App Movement platform allows users to establish a campaign, known as a *movement*, which takes the form of a Kickstarter [19] or Change.org style campaign page (Figure 1). This page serves as the means by which community members can communicate their concept and promote the idea to others. Throughout the system users can also participate in discussion around the campaign idea, overall design and specific design tasks. There are three phases that a movement will transition through as time progresses and

targets are met: the Support Phase, Design Phase and Build Phase. Within each phase the community is asked to interact with the movement in either promoting the campaign page, contributing ideas to the app's design, voting on submissions, downloading the app and finally publishing content within the app.

Much like crowdfunding platforms, the campaign must hit a fixed target number of supporters to confirm there is a real demand behind the idea. This target is intended to ensure that the app will have a sufficient number of users who are ready to contribute content and promote the app. Once the app has reached it's target it enters the design phase whereby supporters can contribute towards the app name, color scheme and rating options as well as vote on submissions made by other members. This democratic process allows every community member to have an equal say on the final app's final design. After this phase is complete the idea moves to the final phase where the mobile app is automatically generated using the design features voted for by the community. Once this build process has been completed, using automated build scripts, we are able to publish the community designed mobile applications to the Apple App Store and Google Play Store. When the apps have been released anyone can download the application and contribute to the content within the app. The result of this is the establishment of a community driven information resource, available to be shaped by them.

Support Phase

Users begin by creating their *movement* (campaign page) wherein they are prompted to enter a title, short and longer description of the idea and select the "type" of app from a series of available app templates. When users start a new movement they are taken through an onboarding process that prompts them to invite, in their own opinion, the most influential community members who will subsequently receive an email containing information about the newly created movement. We feel it is important for the creators themselves to identify these important individuals in order to facilitate a truly bottom up approach. Once the movement has been posted on the platform the user must then gather support from 250 other community members within a 14-day period. In order to support the movement, new users must visit the movement page and simply click the support button to register their support. The user will be presented with a modal popup in which the App Movement platform and process is described and the user is made aware that they will be invited to contribute to the design of the application. They are also made aware that they will receive email updates, every 7 days, about the progress of the movement. In order to verify the authenticity of the supporter users are asked to complete a reCAPTCHA [7]. Prior to this the user must register with the platform using a simplified inline registration form within the support modal that requires a full name, email and password. Once the user has supported the movement they will be sent an email

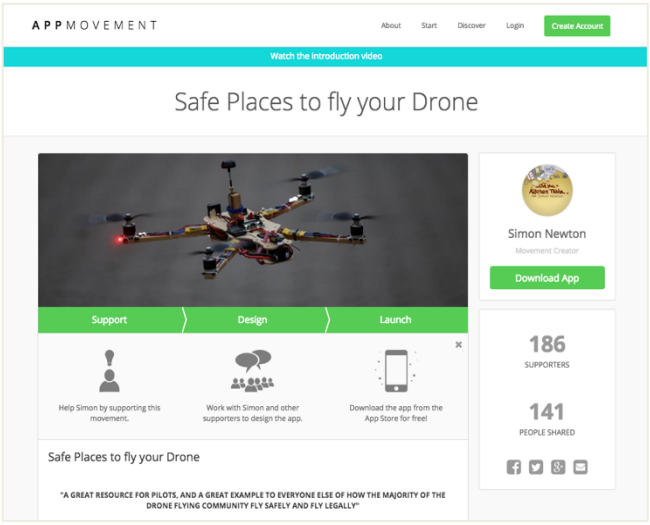

Figure 1. Movement campaign page

welcoming them to the App Movement platform and providing the movement details. The user will then receive email updates letting them know important information about the progression of the movement.

Users are able to engage in discussion on the movement page using the comment system at the bottom of the page. The comment system allows users to vote comments up or down as well as reply to a specific comment. The supporters also have a series of share options in order to share their campaign on Facebook, Twitter, Email and Google+. When the user shares the campaign link they share a unique code that allows the platform to track the click through rates and referral details of the requests to understand where the link was shared online.

After the 14-day support period has passed and the supporter target of 250 supporters has been achieved the movement progresses into the design phase. Supporters are sent an email inviting them to the design area where they can contribute ideas and vote on other user contributions. It is possible for the supporter target to be exceeded during this period. If the target is not met, supporters receive a notification telling them they failed to reach the target number of supporters and the movement page is set to unsuccessful. The movement continues to be listed on the platform however no further users can support the idea.

Design Phase

After the support phase has been completed the movement progresses into the design phase for next 14-days. The design area is accessible to the supporters via the movement page. The design area (Figure 2) provides users with a series of design tasks (Figure 3) wherein supporters are able to contribute their ideas for customizable elements of the application such as app name, icon, color scheme, rating options and map marker pin style. A design task (Figure 3) comprises of two components; an interface showing existing contributions and a submission interface in which

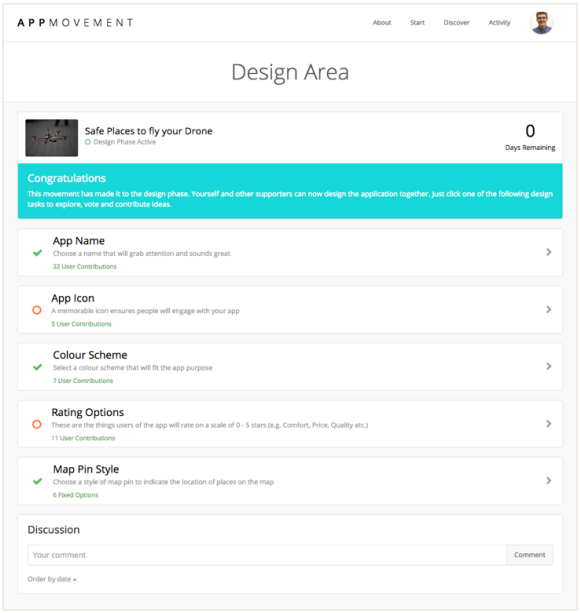

Figure 2. Design Area showing available design tasks

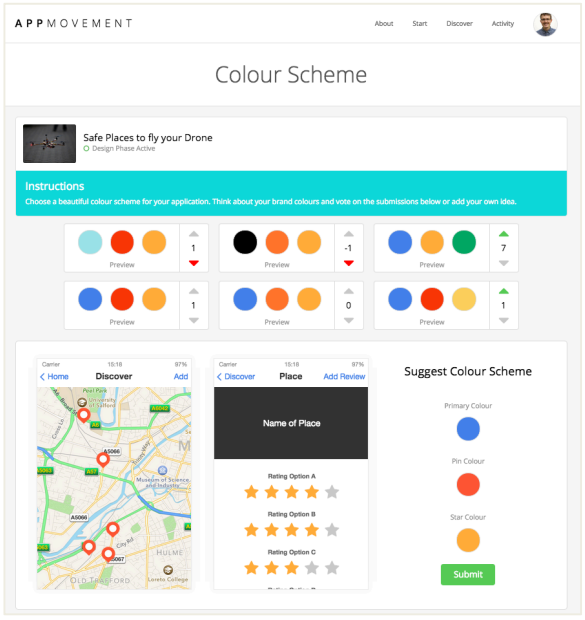

Figure 3. Design task - Selecting app color scheme

the user can contribute their own ideas. Contributions are listed as tiles with up and down arrows and the current vote score, calculated by number of up votes subtracted from the number of down votes, negative vote scores are possible. When viewing the design task the contributions are listed in created date time order and are not ranked by vote score to avoid popular contributions gaining a disproportionate number of votes due to their popularity and position. Users can contribute any number of submissions for appraisal by the community. Users are able to contribute their own ideas as well as vote up or down on contributions made by other users. Users cannot vote more than once on each contribution and cannot vote on their own contributions. All contributions and votes are displayed anonymously. The motivation behind anonymous contributing and voting was to encourage a candid response from users. Suler *et al* [25] define this as the *online disinhibition effect* which is afforded by the opportunity to separate an individual's actions online from their in-person lifestyle and identity.

Tasks such as contributing an app name and rating options are freeform text entry inputs. When contributing a color scheme the user is presented with a live preview of the app and a color picker palette to select from (Figure 3). The user can select colors for specific elements in the app depending on the app template. In the instance of a location based rating and review app the user can select the primary color, rating star color and marker pin color. Users can also submit images to be used for the final design of the app icon. Within each design task and the design area overview page users can engage in discussion about a given design task or the overall concept of the apps design. After the 14-day design phase period has passed the highest voted contributions are used as the customized elements in the automatic generation of the mobile application. Incomplete design tasks were an issue in a few instances, typically the design of an app icon. Currently the movement creator is contacted by the platform administrators to work in collaboration with designing a final launch icon. Understandably a more sustainable solution is required. Our initial design did not allow for new supporters while the campaign was in the design phase, however we realized that we needed to revise this due to low levels of engagement. This led to the redesign of the process in order to allow for support during the design phase and maximize the potential for participation within the design phase.

Build Phase

Once the design phase has been completed supporters are presented with a launch status indicator that provides feedback on the current status of the movement; building app, submitted to app store, awaiting review, processing for app store and available to download. Within the build phase the native iOS and Android applications are generated using automated build scripts and the highest rated contributions from the contributions from the community. These automated build scripts account for almost all of the build process. The only manual aspect of deploying the apps is the creation of the app store listing page on the App Store and Google Play Store. However, the platform generates a generic block of text for an app's description and title derived from the contributions made in the design phase.

Once the applications have been built they are submitted to the Apple App Store and Google Play Store to undergo the verification process. Typically, the build phase duration is 10-days due to the delay in the Apple App Store review process. However, the actual build process takes a matter of minutes to complete. Once the applications have been listed on the Apple App Store and Google Play store the supporters receive an email notifying them of the available

Movement Title	Supporters / Target	Support Phase (days)	Contributors in Design Phase	Total Comments	Share Button Clicks	Organic Shares	Theme
Safe places to fly your drone	186/50	30	20	58	94	142	Leisure, Hobby
Nut allergy friendly places	50/50	30	5	2	71	22	Health, Food
BAMER women & girls guide to cultural venues	52/50	30	3	3	29	51	Informational
Dementia friendly places	94/50	30	6	25	30	97	Social Care
The best photography spots in the North East	65/50	30	7	12	2	28	Leisure, Hobby
Skate park finder	60/50	30	5	2	5	11	Leisure, Hobby
Best local farm shops	53/50	30	5	1	2	7	Food
Disability accessible facilities	102/100	14	9	52	34	34	Social Care
Gender neutral toilet finder	108/100	14	6	2	37	95	Civil Rights
Bariatric-surgery friendly restaurants in the North East	127/100	14	10	16	24	107	Health, Food
Breastfeeding welcome here	331/250	14	39	72	52	78	Health

Table 1. Successful movements that have reached a target number of supporters.

application. The mobile application is then available for both the members of the community and general public at no cost. The movement continues to be listed on the App Movement platform as launched, with a "launched" status and links to the app stores. The movement page also ensures transparency in the design of the app with the design area available to view by the general public, including the discussions at the time.

Implementation

The App Movement ecosystem consists of a web platform written in PHP with a series of MYSQL databases, RESTful Application Programming Interface (API) for communicating between database and mobile apps, Python build tools for the automated build process and native iOS and Android app templates written in Objective C and Java respectively. The main App Movement web platform runs from a centralized database with each generated mobile application utilizing its own independent database enabling us to scale the App Movement platform horizontally as required. The mobile applications communicate with the App Movement platform via an API. The API has been designed with a core set of endpoints for authentication and setup functions, with a separate set of endpoints capable of handling different templates, applications, and app versions. Users are able register with the App Movement platform through either the website or any of the generated applications. Users are then able to access the App Movement platform and mobile applications through a single sign-on user account.

OVERVIEW

The App Movement platform was launched in Feb 2015 with 1,667 users supporting 27 movements, 11 of which have been successful in reaching their target number of supporters. Within this period an additional 4,403 users have registered through 7 generated mobile applications, currently available in the Google Play Store and Apple App store. At the time of writing 4 apps are due to be released or in the process of launching. Our results are based upon data collected for 11 successful movements. Table 1 provides an overview of the successful campaigns. We experimented with both the target number of supporters ranging from 50 to 250 people and the duration of the support phase ranging from a 14 to 30-day period. The platform currently sets the supporter target to 250 supporters with a 14-day support phase and 14-day design phase.

The promotion of movements is achieved through the sharing of the campaign page. Users are able to share a movement from the campaign page using share buttons for Facebook, Twitter, Google+ and Email. We found that the majority of users chose to share their movement through Facebook (64.21%), followed by Twitter (23.42%), Google+ (8.16%) and Email (4.21%). The share buttons were clicked 760 times with a median average of 30 clicks per movement. We were able to track both page views and unique visitors to campaign pages allowing us to calculate the conversion rate of new visitors in becoming supporters of a movement. We saw conversion rates ranging between 3.66% to 25.79% with an average visitor-to-supporter conversion rate of 9.6%.

Users were able to contribute comments on the campaign page, design area and within each design task. Within the 11 movements we observed a total of 245 comments posted on the platform. We found that the campaign page was the primary area of discussion with 61.7% of comments. The design area overview page accounts for only 2.9% of comments with design tasks such as App Name (15.6%) and rating options (9%) being the primary areas in which users held design specific discussions. Within online health

social networks research Van Mierlo *et al* [15] define the 1% rule that states 90% of actors observe and do not participate, 9% contribute sparingly and 1% of actors create the vast majority of new content. Within our own dataset we found that on average 8.82% (ranging from 5.56% - 13.22%) of supporters contributed in the design phase, with a small number of those users contributing the majority of the content. The number of contributions per design task followed a consistent trend, with simpler tasks consistently having a higher number of contributions. On average the App Name task had the highest percentage of contributions (38.1%), Rating Options (30.16%), Color Scheme (18.25%) and App Icon (13.49%). Tasks such as App Name and Rating Options, in which users entered text into a freeform text field, saw consistently higher levels of contributing behavior. Those tasks that utilized custom entry interfaces, such as selecting a color scheme, saw lower levels of contributing. We observed the lowest levels of contributing behavior when tasks required an element of technical expertise, such as designing an app logo.

In order to understand how the rates at which a movement is supported relates to the likelihood of success, we have analyzed when supporters confirm their support during a campaign. Within our dataset we have both successful (n=11) and unsuccessful (n=13) movements that ran for either 14 or 30 day periods and had targets of 50, 100, or 250 supporters. Given that we have differing values for supporter targets and varying durations, we normalized our data to represent the percentage of total number of supporters on day 1. A Mann-Whitney test indicated that the percentage of the supporter target within day 1 of the campaign was greater for successful movements (Mdn=17.2) than for unsuccessful movements in the same period (Mdn=4), U=34, $p=0.029$. Suggesting that the percentage of supporters that a campaign receives in the first day is a significant indicator of success for the remainder of the campaign. Similar results were observed by Hale *et al* [8] within UK Government online petitions whereby the first 24 hours of a petition was a strong predictor of petitions reaching their target.

CASE STUDIES: APP MOVEMENT IN ACTION

Since the very nature of App Movement means that it cannot be evaluated in a controlled manner, we instead use three case studies, each of which proposed location-based review apps for quite different domains (i.e. relating to hobbies, social care, and health) and employed different approaches to community engagement, to better understand the platform's affordances and utilization. Case study 1, *Drone Zones*, allows drone pilots to map and review suitable flying locations; case study 2, *Care and Connect*, helps carers of individuals living with dementia to find dementia friendly locations; and case study 3, *Nut Free*, is intended for people with severe allergic reactions, for which users rate and review restaurants for their awareness of, and practices in relation to, nut allergies. Our choice of case studies also captures a range of levels of uptake within the communities during the support, design and deployment phases. Our documentation of these case studies uses qualitative data, based on online comments, postings and field notes (on discussions between the research team and movement creators or potential creators) and quantitative data pertaining to system interactions on the platform. A range of approaches, from specific solicitation of individuals, to a local social media "push", using Twitter and Facebook, of the App Movement concept were used to recruit movement creators.

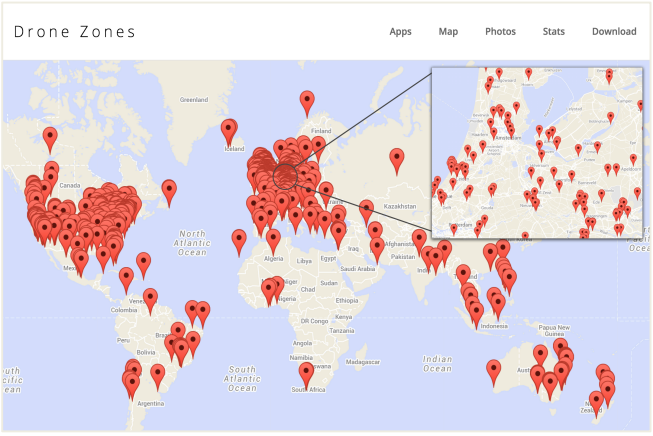

Figure 4. The community mapping of 2,216 suitable flying locations contributing using the Drone Zone app

Case Study 1: *Drone Zones*

Unmanned Arial Vehicles (UAVs), also known as drones, have become readily available to hobbyists and are also be used in activities ranging from aerial photography and surveying to search and rescue. The increasingly widespread adoption of UAVs in giving rise to debate about the legality of some of the applications of drone use, as well as safety and the suitability of flying locations. Within the UK legislation relating to UAV use is in preparation, and at the time of the creation of the Drone Zone movement, the UK Parliament and the Civil Aviation Authority were in discussions to form recommendations of best practice. The contentious issue of where UAVs can be safely flown is a topic that is widely discussed, not just in relation to the safety of the pilot and the public, but in terms of the reputation of the community [21].

The creator of the *Drone Zones* movement. Simon, is an influential member of the drone community who hosts a YouTube channel with over 11,000 subscribers interested in the topic of drones. He uploaded a video to YouTube in order to promote the movement and within 11 hours the target number of supporters (then set at 50) was exceeded. After the release of the *Drone Zones* app, Simon released a review video through his YouTube channel and encouraged his community to contribute their own reviews and locations. Subsequently a number of number of drone related news blogs about the app were posted on tech websites, and two other video reviews of the Drone Zones app were distributed through YouTube.

The initial target for this movement was set at 50 supporters, however, this was quickly surpassed and the movement achieved 186 supporters overall. The supporters actively made use of the discussion functionality throughout the support and design phase and discussed the implications of the application itself as well as engaging in discussion around specific design elements. Discussion points and contributions throughout the design process originated from a number of different supporters. Looking more closely at the comments made on the campaign page users expected the Drone Zones app to have much more of a direct impact on government legislation (e.g. *"Great idea. It shows the powers that be that at least pilots at trying to get our own house in order."*; *"Brilliant! If it succeeds, it could go a long way to helping the various government departments tasked with dealing with the small quad copters.")*. Before launching the app, it is clear that members felt as if they might be able to unify the community, through the use of the app, and demonstrate to the authorities that the community as a whole can be responsible pilots. Supporters also intended on using the app to encourage responsible practices within the community itself (e.g. *"Great idea, especially when travelling abroad - a quite nice way to respect each countries flying rules..."; "This app would not only benefit enthusiasts wanting to fly somewhere but could also encourage responsible & knowledgeable fliers too.")*.

In the design phase approximately 10% of supporters engaged within the design tasks with 20 supporters making a total number of 58 contributions (30 app names, 8 app icons, 6 color schemes, 14 rating options). Supporters (n=24) also cast 132 votes. The Drone Zones app was launched in June 2015 and currently has 6903 users who have added 3625 venues, 2367 additional reviews and 437 photos. The community have extensively mapped Western Europe and USA and has smaller pockets of use throughout Australia, Asia, Middle East and South America (Figure 4).

Case Study 2: *Care and Connect*

The *Care and Connect* app enables carers to find dementia-friendly locations, that is, in the words of the movement creator, Katie, "places people with dementia and their carers enjoy to go, whether this is outside or inside" (from movement description). Katie is a social science academic who works in the field of social gerontology and has strong personal and professional interest in dementia care in the community. Through her work she has close relationships with both local and national dementia organizations. When promoting the movement she shared it with personal contacts on social media, and in her professional role as an academic she also presented the idea to a number of dementia care specific local advocacy groups. The movement had 94 supporters, far exceeding the target of 50. The concept of the dementia friendly places also received a considerable amount of support in the form of comments on the campaign page. A number of local organizations also showed their support by posting about the benefits that the idea might have for their clients and organizations. Unlike *Drone Zones*, the supporters of this movement were mostly localized to the region in which Katie lives [location anonymized for review]. The areas which have subsequently been mapped using *Care and Connect* been mapped are centralized around this area. This is most likely due to the geographic proximity of networks that were approached and promoted to by the movement creator. Within the design phase 6 supporters made a total number of 11 contributions (4 app names, 0 app icons, 3 color schemes, 4 rating options). The *Care and Connect* app has been available since May 2015 and currently has 77 users who have added 78 venues, 53 reviews and 4 photos.

Case Study 3: *NutFree*

The *NutFree* app enables people to map the level of nut allergy-awareness and good practice (in relation to allergies) of restaurants. Those living with nut allergies often face uncertainty when dining outside of the home as they have less control over the food and drink they consume. For example, relaying specific allergies to a member of the serving staff can be uncomfortable and misunderstood, resulting in a potentially life threatening situation. In the words of the creator, Neil, the app "will let you (or your family) share experience of good places for people with nut allergies to eat, and also how good the food is" (from movement description). Neil is a pediatrician specializing children with severe allergic reactions. Before the movement began he contacted a charity that provides information and support to individuals with severe allergic reactions within the UK. His intention was to persuade the charity to create the movement under their own brand in order to leverage their existing national membership network. However, after several discussions with representative of the charity it withdrew support due to a number of specific concerns: potential liability, the lack of readily accessible interface for moderation (by the charity), resource implications for the charity (to perform moderation), and ownership of the content submitted by users within the app. Neil promoted the app through personal networks as well as local patient networks with which he was engaged with. Although the target of 50 supporters was achieved in within just a few hours of the campaign announcement, other than contributions made by the movement creator (who used the comment system to make announcements in the design phase) no comments were added to either discussion sections on either the campaign page or in the design area. Within the design area 5 supporters made a total number of 20 contributions (10 App names, 1 app icons, 2 color schemes, 7 rating options). The NutFree apps have been available since July 2015 and currently have 179 users who have added 90 venues, 75 reviews and 18 photos. The geographic spread of venues contributed by the users is nationwide, with the majority of contributed content relating to the geographic region in which Neil lives and works, and with reviews generally focusing on restaurants in city centers.

DISCUSSION

App Movement was made publicly available in February 2015 and since then we have seen the participation of more than 1,600 supporters and the registration of over 4,400 users for apps resulting from successful campaigns. Through our case studies and other movements proposed through the platform, we can gain insight on the nature of both successful and unsuccessful campaigns, reflect on assumptions we made in our design and operation of App Movement in relation to what success of a movement means, and consider issues that have arisen relating to governance of both the apps themselves and the data which they solicit.

What makes a successful campaign?

The creators of movements and their motivations for creation has varied considerably between the 27 proposed to date (11 successful). In general terms we can distinguish four categories of creators: were; *members of communities of interest*, *lone citizens, professionals,* and *organizations* (which we discuss later in relation to *governance*).

Communities of Interest

Successful movements such as *Drone Zones* or *Local Photography Spots* were created by members of communities of interest that the movement creators were seeking to mobilize. In these cases, the creators (Simon: Drone Zones; and Ahmed: *Local Photography Spots*) used the discussion section of the campaign page and established social media of the target community (e.g. Ahmed's use of the Facebook page of his local photography group) to mobilize support. A desire to act as a community was very apparent in many of the statements of support that included explicit references to both their own needs but also the collective good of the community. This is evident in the case of *Drone Zones*, wherein the campaign page allowed for the discussion around attempts to establish best practices around drone piloting.

Lone Citizens

Our findings indicate that most of the unsuccessful movements, or successful movements that resulted in app with low-levels of utilization, were created by lone citizens. Although acting on issues that were personally important to them, and that were of prima facie interest to a wide constituency of other citizens (e.g. electric care charging stations, gluten free restaurants, rating local landlords), were unable to leverage sufficient support (e.g. through social media) from a like-minded community. Through post-campaign discussions with a number of such movement creators, it became readily apparent that beyond the creator's initial friends and family, support for these campaigns waned after the first tranche of promotion and ultimately resulted in failed movements.

Professionals

Care and Connect or *NutFree* were campaigns initiated by professionals, and academic researchers (Katie: *Care and Connect*) and a clinician (Neil: *NutFree*). On one level their initiation of successful campaigns points to the potential of App Movement as a grassroots commissioning platform, in that neither Neil nor Katie sought to leverage official endorsement by their employers (a University and a Hospital Trust) but instead adopted to call to direct action that App Movement espouses. As professionals, and experts working in areas of social and health care, they were well placed to leverage both their professional networks. In Katie's case this included colleagues within her discipline and local activists and advocates of people with dementia who she engaged with through her research on dementia care. In Neil's case this involved local patient networks in particular. It is therefore apparent that professionals such as Katie and Neil, while not actual members of communities of interest in the manner that Simon (*Drone Zones*) or Ahmed (*Local Photography Spots*) are, were highly aware of communities and networks of need (including formal organizations such as local charities) and their professional standing as experts means they are well placed to solicit support from their members.

Social Media Literacy and the Need-Understanding Gap

In some cases, there appeared to be an existing and active community with a genuine need for a technical solution such an App Movement location-based review app. These movements had an active campaign stage, but the resulted in an app that was a relative failure in that it was not adopted by the anticipated number of users (nor were many reviews produced). *Care and Connect* was one such case, in that is was both well supported (94 supporters in response to a target of 50) and advocated (25 comments, 30 share clicks and 97 organic shares) but saw much reduced participation in the design phase (6 contributors) and low levels of engagement with the final app (61 venues, 36 reviews) even after considerable post-launch promotion by the creator at dementia-related events. What we appear to be observing in such cases (see also the *Disability Accessible Facilities* movement) is a gap between the needs of a community, as well as their willingness to advocate for their cause, and their understanding of (or capability to engage in) the forms of participation that App Movement requires. That is, to understand that value of the resulting app depends on the production of reviews by supporters and other users, and that the appropriateness of the review criteria in the app are dependent on participation by supporters in the design phase. In the case of *Care and Connect* this is more likely to have occurred the average age of carers of people with dementia in the UK is between 60-65 years old, and age-group for which levels of social media usage is known to be lower.

On reflection it is clear that App Movement failed to anticipate this need-understanding gap in the design of its onboarding and supporter confirmation process. One approach to addressing this would be to integrate an element of participation before an individual can support a campaign, similar to Cheng *et al* [2] who highlight the potential of higher-friction signups requiring payment or

increasing a sense of urgency through role-based thresholding. For example, initial participation might require potential supporters to contribute towards an aspect of the app's design or perhaps even contribute initial data point that would also be used to populate the app before it is launched. The development of such participatory onboarding processes would thus serve the dual purpose of educating users as to the expectations of movement supporters, but also mitigate some of the cold-start barriers (i.e. no initial data in a community data sharing application) that App Movement was originally conceived to address.

Organizations and Governance

We both observed and encountered a small number of organizations (charities, government bodies and commercial enterprises) that engaged, to some degree, with the App Movement process, from proposing fully fledged campaigns to inquiring about features of the apps the platform generated. In these discussion the concerns of organizations nearly always turned to issues of ownership and moderation. Positions on moderation differed between government, for-profit, and not-for-profit organizations, with government bodies expressing clear desires to maintain control over the user generated content for the purpose of political expediency (e.g. local government directorate considering App Movement for community engagement in local decision making).

By contrast non-profit organizations were more concerned with their legal responsibilities (e.g. national charity in relational to a proposed maternal health services review app) or the maintenance of the duty of care they owed to their network (e.g. national charity in relation to creation of the movement that led to NutFree). Non-profit movement creators also generally had very specific intentions in mind when creating the campaign page, and in each such movement the campaign page was used as a platform to promote their own organization using links to their own websites and including branding on the campaign header image. The principal concern of for-profit organizations was the maintenance of brand consistency (e.g. online retailer) and the potential threat that un-moderated content might pose to this. Furthermore, for-profit organization expressed a desire for more control over both the design process (being resistant to the benefits of a limited feature template) but also wanted to maintain control over the final output. In reality, moderation was a feature of App Movement apps that we had considered but not addressed adequately. Although in the successful campaigns, malicious user behavior was rare, the concerns of organizations who considered themselves to have more at stake means that future versions of App Movement will necessarily need to incorporate a sustainable model of moderation. With the assumption that such a model will require the involvement of the organizations, communities of interest, professionals or lone citizens themselves, the question of governance naturally arises.

Community Commissioning

App Movement is an initial exploration into the concept of community commissioning platforms. It explores how individuals can establish and engage a willing community in the design and adoption of an automatically developed community driven information resource. These generated tools should be seen as the first step of data collection that could offer future prospects of wider civic participation resulting in change. Designers should consider how individuals might begin to explore, share, and export this community contributed data through analytics interfaces. In doing so, individuals could create evidence to enact legislative change and encourage into civic debate. However, the ownership of contributors' data and rights of users to access and even withdraw their data will need to be addressed. Similarly, we need to consider whether these platforms are deployed as a managed service, or develop a facility to "transfer" resulting apps to the community, as Scholz [22] suggests. Further to this, we might also consider how to enable communities to re-evaluate and redesign these services once they have become established. These limitations of App Movement highlight the fact that even given its track record of meaningful and moderately large-scale use, it is at best an initial foray into the design and development of platforms for community commissioning of software and services.

CONCLUSION

We have presented App Movement, a community-commissioning platform that enables communities to propose, design and automatically generate their own mobile applications (in this case a location-based review app). In future research we hope to explore how communities appropriate the applications generated by App Movement. We want to understand how community driven information resources become established, looking closely at the roles of key influencers in the sustaining of these resources. Future design work will also focus on the types of applications that are generic enough, but offer enough functionality, for communities to establish other forms of community driven information resources. We also hope to explore the design of these forms of system to allow citizens to export the data contributed by the community, and utilize this data in local and issue activism. Ultimately we hope to be able to hand over the platform entirely to communities for them to appropriate it as they require.

ACKNOWLEDGEMENTS

This research was funded by the UK AHRC KE Hub for the Creative Economy (AH/J005150/1 Creative Exchange) and EPSRC Digital Economy theme SIDE Research Hub (EP/G066019/1). Data supporting this publication is openly available under an 'Open Data Commons Open Database License'. Additional metadata are available at: 10.17634/154300-5. Please contact Newcastle Research Data Service at rdm@ncl.ac.uk for access instructions.

REFERENCES

1. Madeline Balaam, Rob Comber, Ed Jenkins, Selina Sutton, and Andy Garbett. 2015. FeedFinder : A Location-Mapping Mobile Application for Breastfeeding Women. *Human Factors in Computing Systems CHI 15*.
2. Justin Cheng and Michael Bernstein. 2014. Catalyst: triggering collective action with thresholds. *Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing - CSCW '14*, ACM Press, 1211–1221. http://doi.org/10.1145/2531602.2531635
3. Clara Crivellaro, Rob Comber, John Bowers, Peter C. Wright, and Patrick Olivier. 2014. A pool of dreams: facebook, politics and the emergence of a social movement. *Proceedings of the 32nd annual ACM conference on Human factors in computing systems - CHI '14*, ACM Press, 3573–3582. http://doi.org/10.1145/2556288.2557100
4. Laura Dabbish, Colleen Stuart, Jason Tsay, and Jim Herbsleb. 2012. Social Coding in GitHub: Transparency and Collaboration in an Open Software Repository. *Proceedings of the ACM 2012 Conference on Computer Supported Cooperative Work*, 2011: 1277–1286. http://doi.org/10.1145/2145204.2145396
5. Thomas Feeney. 2015. Why I set up the Greek bailout crowdfund. *The Guardian*. Retrieved from http://gu.com/p/4a9p5/sbl
6. Gerhard Fischer and Eric Scharff. 2000. Meta-design: design for designers. *Proceedings of the conference on Designing interactive systems processes, practices, methods, and techniques - DIS '00*, L D: 396–405. http://doi.org/10.1145/347642.347798
7. Google. Google reCAPTCHA. Retrieved from https://www.google.com/recaptcha
8. Scott a. Hale, Helen Margetts, and Taha Yasseri. 2013. Petition growth and success rates on the UK No. 10 Downing Street website. *Proceedings of the 5th Annual ACM Web Science Conference on - WebSci '13*, 10: 132–138. http://doi.org/10.1145/2464464.2464518
9. Philip N Howard, Aiden Duffy, Deen Freelon, Muzammil Hussain, Will Mari, and Mrawa Mazaid. 2011. What Was the Role of Social Media During the Arab Spring? *Project on Information Technology and Political Islam*: 1–30.
10. Sunyoung Kim, Jennifer Mankoff, and Eric Paulos. 2013. Sensr: Evaluating A Flexible Framework for Authoring Mobile Data-Collection Tools for Citizen Science. *Proceedings of the 2013 Conference on Computer Supported Cooperative Work - CSCW '13*: 1453–1462. http://doi.org/10.1145/2441776.2441940
11. Stephen F King and Paul Brown. 2007. Fix My Street or Else: Using the Internet to Voice Local Public Service Concerns. *Computers and Society*: 72–80. http://doi.org/10.1145/1328057.1328076
12. TripAdvisor LLC. Trip Advisor. Retrieved September 1, 2015 from http://www.tripadvisor.co.uk/
13. Steve Mann, Jason Nolan, and Barry Wellman. 2003. Sousveillance : Inventing and Using Wearable Computing Devices for Data Collection in Surveillance Environments ∗. *Surveillance and Society* 1, 3: 331–355. Retrieved from http://www.surveillance-and-society.org/articles1(3)/sousveillance.pdf
14. Jennifer Marlow, Laura Dabbish, and Jim Herbsleb. 2013. Impression Formation in Online Peer Production : Activity Traces and Personal Profiles in GitHub. *Proceedings of the ACM Conference on Computer Supported Cooperative Work, CSCW*: 117–128. http://doi.org/10.1145/2441776.2441792
15. Trevor van Mierlo. 2014. The 1% rule in four digital health social networks: an observational study. *Journal of medical Internet research* 16, 2: e33. http://doi.org/10.2196/jmir.2966
16. Patrick Olivier and Peter Wright. 2015. Digital civics: Taking a Local Turn. *interactions* 22, 4: 61–63. http://doi.org/10.1145/2776885
17. Johan Oomen and Lora Aroyo. 2011. Crowdsourcing in the Cultural Heritage Domain : Opportunities and Challenges. *C&T '11 Proceedings of the 5th International Conference on Communities and Technologies*, July: 138–149. http://doi.org/10.1145/2103354.2103373
18. OpenStreetMap Foundation. Open Street Map. Retrieved September 1, 2015 from http://openstreetmap.org
19. Kickstarter PBC. Kickstarter. Retrieved September 1, 2015 from https://www.kickstarter.com/
20. Royal Society for the Protection of Birds. 2015. Big Garden Birdwatch 2015. Retrieved September 10, 2015 from http://www.rspb.org.uk/discoverandenjoynature/discoverandlearn/birdwatch/results.aspx
21. Guy Schofield, Tom Bartindale, and Peter Wright. 2015. Bootlegger: Turning Fans into Film Crew. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems - CHI '15*: 767–776. http://doi.org/10.1145/2702123.2702229
22. Trebor Scholz. 2014. Platform Cooperativism vs. the Sharing Economy. Retrieved September 14, 2015 from https://medium.com/@trebors/platform-cooperativism-vs-the-sharing-economy-2ea737f1b5ad

23. Stack Exchange Inc. StackOverflow. Retrieved September 1, 2015 from https://stackoverflow.com/

24. Tristram Stuart. 2014. Stop food waste in Europe #StopFoodWaste. Retrieved September 1, 2015 from https://www.change.org/p/frans-timmermans-stop-food-waste-in-europe-stopfoodwaste

25. John Suler. 2005. The online disinhibition effect. *International Journal of Applied Psychoanalytic Studies* 2, 2: 184–188. http://doi.org/10.1002/aps.42

26. Jason Tsay, Laura Dabbish, and James Herbsleb. 2014. Let's talk about it: evaluating contributions through discussion in GitHub. *Proceedings of the 22nd ACM SIGSOFT International Symposium on Foundations of Software Engineering - FSE 2014*. http://doi.org/10.1145/2635868.2635882

27. Bogdan Vasilescu, Alexander Serebrenik, Premkumar Devanbu, and Vladimir Filkov. 2014. How Social Q & A Sites are Changing Knowledge Sharing in Open Source Software Communities. 342–354.

28. Yoo Warren. 2010. Grassroots Mapping: tools for participatory and activist cartography.

29. Indiegogo Greek Bailout Fund. Retrieved from https://www.indiegogo.com/projects/greek-bailout-fund