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Lessons from a Year of Citizen Science

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ABSTRACT

The 3rd annual Citizen Cyberscience Summit (Feb 20th – 22nd, 2014) held in London, UK, brought together a diverse international community of scientists, software developers, industry, policy makers and citizen scientists, to share advances in this field. My own academic experience lies in molecular ecology and conservation. Participation in citizen science for me has been both a hobby and something I increasingly aim to incorporate into my research. However, to truly keep up with the progress in citizen science and to explore its potential both for my own work and for tackling environmental challenges, a different approach is required. I chose to spend a year participating as a casual volunteer in as many projects as possible. As a young scientist fascinated and inspired by this emerging field, I hope this year long foray gave me a unique perspective to bridge both volunteers and academics and evaluate where we are now, and the direction that we might aspire towards as we broaden the horizons of citizen science.

1. INTRODUCTION

If current trends continue, the 21st century is likely to be overwhelmingly characterized as a period of global environmental challenges. The scale and impact of established issues such as climate change and biodiversity loss are predicted to become more severe (IPCC AR5, 2014), while efforts to mitigate these continue to lag significantly behind needs and aspirations. Meanwhile, we must be constantly aware of new and unforeseen emerging challenges.

This situation presents a significant challenge both to the scientific community in terms of prediction, quantification and monitoring, and to wider society in terms of adaptation and mitigation. Fortunately, the scale of the scientific response to these issues is also becoming increasingly global and inclusive; and perhaps even more optimistic than has been the case in the past.

Moving forward into the 21st century, our response will require communication and collaboration on a scale not previously seen in science. As such, the rapidly developing field of citizen science and the growing global network of participatory citizen scientists will likely play a crucial role and may represent a novel and much needed model for inclusive international collaboration.

The 3rd annual Citizen Cyberscience Summit (Feb 20th – 22nd, 2014) held in London, UK, brought together a diverse international community of scientists, software developers, industry, policy makers and citizen scientists, to share advances in this field. My own academic experience lies in molecular ecology and conservation. Participation in citizen science for me has been both a hobby and something I hope to increasingly incorporate into my own research. However, to truly keep up with the progress in citizen science and explore its potential both for my own work and for tackling environmental challenges, a different approach is required. Whereas in many disciplines it may be sufficient to browse the literature and attend conferences, I believe citizen science requires hands on involvement within communities. In other words, academics should make time to become citizen scientists.

To explore the potential of citizen science, I decided to spend a year participating as a casual volunteer in as many projects as possible. During my year, the number and diversity of projects 'on the market' rose significantly. I chose projects that were well-suited to my activities, for example; the computer based Snapshot Serengeti (www.snapshotserengeti.org) in winter, and outdoor based Plantlife wildflowers count (www.plantlife.org.uk/things_to_do/wildflowers_count/) in Summer. I supported familiar fields such as conservation, and tried entirely new topics like astrophysics (www.galaxyzoo.org) and neuroscience (www.eyewire.org).

As a young scientist fascinated and inspired by this emerging field, I hope this year long foray gave me a unique perspective to bridge both volunteers and academics and evaluate where we are now, and the direction that we might aspire towards as we broaden the horizons of citizen science.

The following observations and suggestions emerged from my year of volunteer participation in citizen science and fruitful discussions at the Citizen Cyberscience Summit 2014 (CCS14).

2. DIVERSITY OF PROJECTS

An essential tenet of citizen science is the willingness of citizens to participate.

To encourage full public participation from across society, citizen science must move beyond narrow fields where it may have traditionally been strong, such as ecological surveys or image analysis, to provide broader appeal (Miller-Rushing, Primack & Bonney, 2012).

Diversifying citizen science activities may not only improve credibility by encouraging support and advocacy from a broader range of supporters, but also extend the benefits of this scientific approach to novel fields.

The number of emerging projects in recent years (some of which are summarized in Dickinson *et al.* 2012) is extremely encouraging. The growing number of research groups becoming involved with citizen science is leading us to a point in the future where there will be suitable projects available to cater to all interests. This is valuable both for research, but also for education.

It may prove challenging for one single organization or database to keep track of this growing diversity, especially as many projects may be most effective at local scales. However, there are several useful resources for exploring the current diversity of projects (see Table 1).

3. SCIENTISTS ARE CITIZEN SCIENTISTS TOO

It is perhaps easy to forget that a large network of highly motivated citizen scientists already exist in academic institutions around the world. As research advances, many academics become experts in increasingly narrow and specialized fields whilst maintaining broad interests across other topics.

Academics are ideal candidates for testing new citizen science ideas and methods. They are frequently well practiced at critical observation, and in their role as citizen scientists, they have the advantageous perspective of bridging the gap between members of the public and the typically more-academic project creators.

From discussions at CCS14 it seems that here there may also be a missed opportunity, with many academics not having the time or opportunity to experience other projects. Perhaps a reasonably sized group of testers could be incorporated into a project review process, or perhaps there could be a dedicated session in future CCS events where apps or platforms are put through their paces and feedback is collected.

4. LARGE GROUPS OF PEOPLE CAN BRING UNIQUE PERSPECTIVES TO TACKLING GLOBAL ISSUES

The benefits of engaging citizens in research have been widely discussed (Dickinson, Zuckerberg & Bonter 2010). These include the creation and collation of extremely large data sets gathered over extensive geographical areas; monitoring rare or invasive species, phenology and disease; and the ability to analyze large data sets in a short time, to name just a few.

However, a related concept that has seen less discussion is the incorporation of unique perspectives such as traditional or local knowledge from citizen science participants in the developing world. Examination of the potential for this approach has proven promising (Danielsen *et al.* 2005).

In ecology, for example, approaches and strategies that work in Europe may be ineffective in other field site locations. Similarly, models that are calibrated in one region may be poor predictors of another. Efforts to engage potential citizen scientists in the developing world would seem prudent, and may prove fruitful.

Thus, the advantage of citizen science is not just in incorporating novel perspectives from members of the public for research, but enabling and empowering participation of previously unrepresented and increasingly large groups through technological innovations.

CCS14 showed that a number of projects are already progressing in this direction, including Sapelli (Stevens *et al.* 2013) and Moabi DRC. With the ubiquity of smart phones and other emerging technologies, this is only likely to grow (Newman *et al.* 2012).

5. CITIZEN SCIENCE KEEPS QUESTIONS SIMPLE, TO THE POINT AND OPTIMISTIC

The success of any given citizen science project depends to a large extent on effective engagement with potential participants. This was achieved remarkable well by many of the projects presented at CSS14, with well-articulated challenges and objectives central to their respective concepts.

Many projects garner support online through press releases, news reports, social media, smart phone apps and more. The nature of these mediums is that information must be

concise and descriptive. At their conception, citizen science projects must be molded with the public domain in mind. For example, projects might formulate short memorable names, elegant and interactive web-interfaces, and/or well-articulated and compelling back-stories. The results of this can be seen in the diverse and exciting cross section of projects presented at CCS14.

Perhaps an unintended benefit of the citizen science project design process is that it forces hypotheses, aims, methods and outcomes to be kept simple and straightforward. Straightforward hypotheses or aims are easier and quicker to deliver to potential participants. Additionally, simple methods reduce potential sources of error or bias among participants that may have widely differing abilities or starting knowledge. Clear, relevant and perhaps optimistic outcomes may help improve motivation.

6. CITIZEN SCIENCE AND EDUCATION

The benefits of citizen science extend far beyond the limits of data collection and analysis. As a tool for education and public engagement, citizen science holds great promise due to its participatory 'hands-on' nature.

Several authors have linked the process of participation with increasing scientific literacy, earth stewardship and the resulting overlap with future policy in society (Dickinson and Bonney 2012; Shirk *et al.* 2012).

In terms of global challenges, this is significant because citizen science projects that engage participants and collect data from broad geographical regions are a step towards facilitating collaborations internationally. Thus, this is perhaps a useful prerequisite and first step towards working together to solve them. As a result, citizen science generates a network of educated, passionate people, who are more interested because they feel they have a stake in the outcome(s).

7. CITIZEN SCIENCE, NETWORKS, AND MOTIVATION

Rather than simply a method for use by existing researchers, the popularity and effectiveness of citizen science has resulted in the formation of a field in its own right. Recent research shows that the primary motivation in at least one group of citizen scientist is a desire to contribute to scientific research (Raddick *et al.* 2013). Thus it may be the case in the future that participants engaged with one project may be motivated to try other existing or newly launched projects simply because they are also citizen science efforts.

Thus, an exceptionally valuable outcome of the popularity of citizen science may be the natural formation of a readily mobilized network of self-motivated volunteers with skills transferable between projects. This would be a well-situated asset for society, with the ability to respond quickly to emerging research questions such as tree health and the spread of invasive species.

8. LARGE DATASETS AND UNEXPECTED OUTCOMES

Perhaps more than in any other field, the large-scale geographical and temporal data collected from citizen science projects has numerous other potential applications, many of which we cannot currently predict and may be of even greater value than initially intended. The current efforts to improve data collection, quality, management, access, storage and the ethics of use are likely to facilitate this work in the future.

The scope of these applications range from unexpected large-scale ecological patterns in organisms (Silvertown *et al.* 2011), to novel discoveries in astronomy (Fortson *et al.* 2011), and in the future a growing number of studies may capitalize on extensive datasets in ways that would be impossible to predict when founding these projects.

9. RE-INVENTING THE WHEEL

With any organically growing field, there is a significant risk of separate groups unintentionally replicating each other's efforts.

From observations and fruitful discussions at CCS14, it appeared that several platforms have been independently developed that fulfill similar roles. Although competition has many benefits, and a strong outcome is likely to result, care should be taken to avoid expending resources on 'reinventing the wheel' in an emerging field. Potential solutions are widely known, but improved communication, collaborations and a greater number of opportunities to present work to peers at events such as CCS14 can only benefit citizen science as a whole.

Simultaneously, several relatively new organizations (e.g. the Citizen Science Association and European Citizen Science Association) are emerging that seek to encompass the field and increase the ability of the community to network. This should be encouraged and developed; however, there is the risk of replicating efforts with respect to association support services as well.

10. FOCUS ON THE SCIENCE AND THE REST WILL FOLLOW

At the risk of contradicting some of the earlier points in this article, it is worth briefly mentioning the focus and evolution of the citizen science field.

There was much discussion at CCS14 surrounding the development of various professional bodies and associations, ethics, inclusiveness and best practices. These are all critically important and hallmarks of an established and effective field, but should not be at the expense of doing the actual citizen science.

Rather than becoming too concerned and reactive to each development, if the field can continue to focus on producing the best quality citizen science projects that engage with growing numbers of participants producing excellent data and discoveries; then I hope we can all be optimistic that everything else will fall into place.

11. AMBITION AND MOVING FORWARD

If the message from the Citizen Cyberscience Summit were to be summarized in one word, I think it would be 'ambition.' Time will reveal the full potential of the projects presented, but it is clear that many are already experiencing significant success. One final point when considering the future is the following quote, which was originally meant as advice for skiing, but I think holds true for citizen science too.

"With each step, try to reach a bit further forward than you think you can" – Tarka L'Herpiniere

I look forward to the next summit with much anticipation!

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