Citizen Science in Open Science context: measuring & understanding impacts of deeper public participation in science

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Synopsis

• Overview of citizen science activities today across Europe – Modes of participation; Relationships between scientists and the public; Disciplines; and Cultures
• Positioning citizen science within wider public engagement – example from DITOs
• Emerging policy responses to citizen science
• Measuring & evaluating
In the past decade, the awareness to citizen science has grown rapidly.
Underlying trends

- Levels of education (esp. rise in higher education)
- Technological developments (Web, mobile phones, broadband)
Biodiversity

• Innovations in what and where information can be capture: Sauvages de ma rue helps identify the distribution of wild plants in dense urban areas.
• Volunteers continued to contribute observations
• Met Office WOW approaching 15 million
• Volunteers also use automatic weather stations
Citizen Science

Long running Citizen Science

Citizen Cyberscience

Community Science

Ecology & biodiversity
Meteorology
Archaeology
Volunteer computing
Volunteer thinking
Passive Sensing
Participatory sensing
DIY Science
Civic Science
Volunteer computing
Volunteer Thinking

Geo-Wiki interface

a) area measuring tool
b) fields that has been delineated and measured by a participant
c) overview board with a work that has been done by a participant
d) system of grids
e) access to different open layers, e.g. Google or Bing
f) buttons to select fields a participant sees in a red box: very large, large, medium, small, and very small, no fields
g) skip buttons
h) button to open current location in Google Earth Application
i) view examples
j) ask experts for help
Passive Sensing

- In passive sensing, participants download a software, and sometimes connect a sensor, to allow for a wide network of observation.

- Quake-Catcher provide detailed seismographic observations
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OdourCollect
392 Tweets

Mapping odours with #CitizenScience for citizens’ empowerment. Smell and share!
Idea by @RosaAriasAlv developed by @iber civis Seed and main tool of @dNOSES_EU
© Barcelona, España  odourcollect.eu  Joined December 2016
428 Following  284 Followers

Followed by Citizen Science Global Partnership, CitSci TC, and 31 others you follow
DIY Science

Join the Flood Network Community

BECOME A FLOODWATCHER - KEEP AN EYE ON THE MAP

You don't need any fancy technology to become a Floodwatcher. You can take readings from gaugeboards or take photos and we can include them in our data. We're building a network of people and sensors around the country to monitor flooding at a local level.

The information helps people to make better decisions during floods and quickly shares knowledge of a changing situation. We combine Environment Agency data with crowdsourced sensors in ditches, streams, drains and even under floodboards to give a near real-time picture of levels.

INSTALL A FLOOD MONITOR

Do you live within 40m of a river or stream and have broadband? Would you like to know water levels when you’re not home? Flood Monitor contributes to the resilience of your community by sharing this information.

You can install a Flood Monitor and see your readings live on the map every 15 minutes. Flood Monitors (£250) are available to groups or individuals who’d like an unobtrusive, low-cost way of monitoring water levels and contributing this to a bigger community.

If you'd like a sensor then email us and we'll get in touch. We have a small supply of sensors to donate to community groups and individuals can buy one for £250.
Astrophysics: counting galaxies

- Need to assemble large data sets of classifications
- The classifications can only partially automated, and need human assistant
- Use of cognition and crowdsourcing
Participants discussed the initiation of the study.

Participants volunteered to self experiment, with control drawn from other participants.

**RCT: PatientsLikeMe Lithium Study**

In 2008, a small Italian study was published suggesting that the drug Lithium could slow the progression of ALS. In response, hundreds of members of PatientsLikeMe began taking the drug and using a new tool and a matching algorithm to conduct a patient-lead observational study. The results of that study, published in Nature Biotechnology, show that we were unable to replicate the promising findings of the Italian group, but that PatientsLikeMe may provide a useful way of conducting observational studies faster and cheaper than existing trial methods.
Crowdsourcing RCT results

• Biomedicine developed statistical techniques to merge results from multiple studies (meta-analysis)
• Cochrane Crowd is a system for the classification of journal abstracts to assist systematic reviews and meta-analysis
Geography/Anthropology: Towards Intelligent Maps

Data collection: Sapelli, ODK, EpiCollect, CyberTracker

Data repository and management: GeoKey

Data analysis and visualisation: Sapelli

Sapelli Collector

GeoKey

Sapelli Viewer

European Research Council
EPSRC
Engineering and Physical Sciences Research Council
Sapelli is an open-source project that facilitates data collection across language or literacy barriers through highly configurable icon-driven user interfaces. We encourage people to download the app from the Google Play store, or from our GitHub repository and deploy it for their own purposes.

The sequence of interfaces that will be presented to the user in the project is described in the project's XML file. The transmission of complete records is handled autonomously by the Sapelli platform, which periodically checks for connectivity and determines the most appropriate means by which to transmit the compressed data to another phone or a GeoKey web server.

This website should help to get started with creating bespoke data collection apps that meet individual requirements.
Gbiné, Cameroon
Haklay, 2013. Citizen Science and volunteered geographic information: Overview and typology of participation, *Crowdsourcing Geographic Knowledge*
POLICY AND PRACTICE
Citizen Science emergent: environment


‘Often the best information comes from those who are closest to it, and it is important we harness this local knowledge if we are to tackle climate change adequately... people are encouraged to give their own opinion on the quality of the beach and water, to supplement the official information.’
EEA WaterWatch

WaterWatch - Bathing water quality for Europe
Community of practice - associations

- (2012)-2014 – Citizen Science Association
- 2013 – European Citizen Science Association
- 2014 – Australian Citizen Science Association
- 2017 – African & Asian Citizen Science networks
Local networks emerging

- Across Europe, national networks emerging
Policy awareness and impact

Accelerating Citizen Science and Crowdsourcing to Address Societal and Scientific Ch

H. R. 6414

To encourage and increase the use of crowdsourcing and citizen science methods within the Federal Government to advance and accelerate scientific research, literacy, and diplomacy, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

November 30, 2016

Mr. Tonko (for himself, Mr. McKinley, and Mr. Kilmer) introduced the following bill, which was referred to the Committee on Oversight and Government Reform.

A BILL

To encourage and increase the use of crowdsourcing and citizen science methods within the Federal Government to advance and accelerate scientific research, literacy, and diplomacy, and for other purposes.

Whenever possible, citizen science should be encouraged, where citizens become providers and users of data. This will reinforce and give new meaning to the policy of open access to publications and data; this openness should enable citizens and citizen groups to participate in evidence-based policy and decision-making. This could give rise to new types of partnerships, such as “P4P’s” or “P4.0s” where “people” are working together with the public and private sector. This could be systemically implemented on European, national and regional levels.
MEASURING & EVALUATING
UK Engagement Escalator

- 65 active in BioHacking & DIY Science
- 6,500 BTO Garden Birdwatch
- 74,000 regular Zooniverse participants
- 520,000 in RSPB Big Garden Birdwatch
- 2.1m visitors to Natural History Museum
- 14M view Blue Planet II
- 64M UK population

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 709443
7 Levels of Engagement

- Everyone
- Passive consumption of science
- Opportunistic or highly limited participation
- Active consumption of science
- Joining volunteer computing or thinking
- Data collection and analysis
- High engagement in DIY science

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• Likely to be unhelpful, and potentially damaging interventions in citizen science evaluation
Evaluating Citizen Science goals

- Each citizen science project is a balancing act between the scientific goals, scale and depth of engagement, benefits to different stakeholders - NO PROJECT CAN DO IT ALL
A taxonomy on learning outcomes in citizen science projects. 3 main categories:

1. personal development,
2. generic knowledge & skills,
3. project-specific knowledge and skills

Source: Laure Kloetzer, University of Geneva
<table>
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<tr>
<th>Resources</th>
<th>Activities</th>
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| R1-Financial resources | A1-Develop outreach plan  
|                  | A2-Run events (Public)  
|                  | A3-Run events (Public - hard to reach)  
|                  | A4- Run events (Science practitioners)  
|                  | A5-Run events (Policy makers)  
|                  | A6-Plan & design for communication and dissemination  
|                  | A7-Development of content and tools for communication and dissemination  
|                  | A8-Run evaluations  
|                  | A9-Plan and development of innovation hubs  
|                  | A10-Write and submit deliverables to funders  
|                  | A11-Manage the project |
| R2-People        | A1-Develop outreach plan  
|                  | A2-Run events (Public)  
|                  | A3-Run events (Public - hard to reach)  
|                  | A4- Run events (Science practitioners)  
|                  | A5-Run events (Policy makers)  
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| R3-Material resources | A1-Develop outreach plan  
|                  | A2-Run events (Public)  
|                  | A3-Run events (Public - hard to reach)  
|                  | A4- Run events (Science practitioners)  
|                  | A5-Run events (Policy makers)  
|                  | A6-Plan & design for communication and dissemination  
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|                  | A10-Write and submit deliverables to funders  
|                  | A11-Manage the project |
| R4-Intangible assets | A1-Develop outreach plan  
|                  | A2-Run events (Public)  
|                  | A3-Run events (Public - hard to reach)  
|                  | A4- Run events (Science practitioners)  
|                  | A5-Run events (Policy makers)  
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| Beneficiaries       | Public  
|                    | (A1, A2, A3, A6, A7, A10, A11)  
|                   | Science practitioners  
|                   | (A1, A2, A3, A4, A5, A6, A7, A8, A9, A10, A11)  
|                   | Policy Makers  
|                   | (A1, A5, A6, A7, A9, A10, A11)  

| Outputs            | O1-Deliverables (Reports) (A10, A11)  
|                   | O2-Events (A1, A2, A3)  
|                   | O3-Com & Dis channels, tools and materials (A6, A7, A11)  
|                   | O4-Deliverables (Reports) (A10, A11)  
|                   | O5-Events (A1, A2, A3, A4, A5)  
|                   | O6-Com & Dis channels, tools and materials (A6, A7, A11)  
|                   | O7-Innovation hubs (A9)  
|                   | O8-Growth OF ECSA (All)  
|                   | O9-Project tools and mechanisms (A1, A7, A8, A10, A11)  
|                   | O10-Deliverables (Reports) (A10, A11)  
|                   | O11-Events (A5)  
|                   | O12-Com & Dis channels, tools and materials (A6, A7, A11)  

| ST outcomes        | ST1-Public awareness of science and RRI (O1, O2, O3)  
|                    | ST2-Increased participation in CS (O1, O2, O3)  
|                    | ST3-Improved visibility of CS (O1, O2, O3)  
|                    | ST4-Improved scientific literacy (O1, O2, O3)  
|                    | ST5-Development of methods and tools for CS (O6, O9)  
|                    | ST6-Increased knowledge, skills, & capacity (O4, O5, O6, O7, O8, O9)  
|                    | ST7-Sustainable Development of pan-European centre (O7, O8)  

| MT Outcomes         | MT1-Engagement of citizens in shaping and conducting research (ST1, ST2, ST3)  
|                    | MT2-Social and gender inclusiveness in science (ST4)  
|                    | MT3-Enhanced scientific and civic literacy (ST5)  
|                    | MT4-Capacity of local science actors (ST6, ST8)  
|                    | MT5-Strengthening of European cooperation and support in CS and science (ST7, ST8)  

| LT Outcomes         | LT1-Wider and deeper public engagement in science (MT1, MT2, MT3, MT4, MT5, MT6, MT7)  
|                    | LT2-Maximise European innovation (MT1, MT2, MT3, MT4, MT5, MT6, MT7)  
|                    | LT3-Maximise societal input and external advice to R&I policies (MT1, MT2, MT3, MT4, MT5, MT6, MT7)  
|                    | MT6-Engagement of policy makers in shaping and conducting research (ST8, ST9, ST10)  
|                    | MT7-Policy makers support CS (ST10, ST11)  

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Evaluation: sensitivity required!

- Citizen Science require considerations according to discipline, culture, type of activity, and level of engagement.
- There cannot be a “silver bullet” for evaluation, and rigid criteria can cause harm - by excluding certain activities, sending message to newcomers and innovators that “there is no space for them” etc.
- Mix methods are necessary.
Some possible directions

• “preregistration” model – identify goals, levels of participation, scale and register them before a citizen science project

• “Logic Model/Theory of Change” model – develop several templates for citizen science projects, adapt them for a specific project, and use for evaluation

• “Key Performance Indicators” model – project designers set KPIs out of a set, and need to report on them
Open access

580 pages

31 chapters

121 authors
Summary

• Citizen science has historical precedents, but new types of activities and participants. This is the result of societal and technical trends.

• Citizen science includes a wide range of activities, and if gaining recognition among the public and within the area of research

• Not everyone want deep engagement, but there are methodology for a fully participatory process

• Policy and funding awareness open up new opportunities
The work of ExCiteS is supported by EPSRC, ERC, EU FP7, EU H2020, RGS, Esri, Forest People Program, Forests Monitor, WRI and all the people in communities that we’ve worked with over the years.