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Summary: Citizen Science

Citizen science has recently become a buzzword loaded with hopes and meaning. Various actors advertise it as fostering participation and inclusion, as empowering less privileged/less educated/less you-name-it, as raising ecological conscience and fostering stewardship, all while solving problems of gathering large data sets over wide geographical distances. But what actually is citizen science? Who does it, why and how? And why should we bother with how engaging in citizen science affects those who volunteer?

We invited **Anna Lawrence**, biologist and forester with a keen interest in the social dimensions of science, and **Daniel Dörler** and **Florian Heigl**, two ecologists who established BOKU's citizen science group, to discuss with us.

CITIZEN SCIENCE HAS MANY NAMES – OR: WHAT IS CITIZEN SCIENCE?

Two things make it difficult to understand the concept of citizen science: first, there is no clear-cut, universally accepted definition of what citizen science is (and what it is not); second, much of what could be classified as "citizen science" has been undertaken and reported on using other names (e.g. action research, participatory research,...).

However, what is clear is that citizen science involves citizens or volunteers, who did not train as researchers, in the scientific process. The extent of this involvement can vary substantially, both in terms of quantity (time that volunteers spend), as well as quality (the degree to which volunteers become involved in the scientific process). Whereas only a few moments and little to no expert knowledge might be needed to report the sighting of an animal or a diseased tree, up to many hours can be spent crafting a project idea, and elaborating mechanisms to collect and analyze data.

CITIZEN SCIENCE: OUTSIDE OF FORMAL INSTITUTIONS OR "SITTING INSIDE CONVENTIONS"?

The concept of citizen science has undergone quite a radical transformation. When sociologist Alan Irwin, who coined the term in 1995, described it as "a form of science developed and enacted by the citizens themselves", he clearly positioned it as "knowledge generated outside of formal scientific institutions". Little more than a decade later, ecologist Jonathan Silvertown described citizen scientists as "volunteers who collect and/or process data as part of a scientific enquiry". Anna Lawrence emphasized the radical shift that underlies

CITIZEN SCIENCE – DOING RESEARCH AND ENGAGING THE PUBLIC

In citizen science, just like in other efforts of participation, the spectrum offers different approaches. On one end, there is clear labour division between professionals and volunteers; on the other end, work is more co-operative.

Distinctive features include, but are not limited to the following questions:

- Who takes the initiative?
- Who frames the research question?
- Who designs experiments and methods?
- Who analyses the data?
- Who decides how data is used?

TOP-DOWN

Extractive

Projects are designed by scientists, while volunteers merely supply data, which, in turn, is analysed by scientists.

Consultative

Volunteers approach scientists with a research question; scientists design experiment to answer question and analyze data

BOTTOM-UP

Collaborative

Projects are designed in partnership.

A central take-home message of the evening:

Even a top-down project can be deeply meaningful for involved volunteers, change their values, beliefs and sometimes their lives (**transformative**), while also bottom-up projects can simply perpetuate the status quo and fail to foster change.

this evolution of the term's definition.

THE TERM MIGHT BE NEW, BUT THE IDEA IS NOT

However recent the term might be, citizen science is not a new trend. In many countries and societies, community members have traditionally recorded signs of nature like indicators of seasonal changes, or the occurrence of particular animal or plant species. The scientific discipline of phenology that seeks to relate periodic events of animal and plant life cycles to climate variations emerged from these observations. Phenology can look back on more than 300 years of history in Britain. The oldest Austrian project has been collecting data on weather phenomena since 1851, explained Daniel Dörler. Scientific knowledge that has been established on such large phenological data sets has proven highly relevant and represents some of the best evidence of climate change, stressed Lawrence.

CITIZEN SCIENCE IS TAKING OFF IN AUSTRIA

In 2013, Dörler and Heigl launched the online platform for Austrian citizen science (www.citizen-science.at) which features projects from diverse disciplines. While the lead subject is still biology/ecology (57%), the humanities (15%) and geography (10%) are on the rise. Social sciences and medicine each account for 5% of projects on the platform.

As in many other countries, attention to volunteer participation in scientific projects is increasing: while the annual Austrian citizen science conference has just been held, the call for sessions for the upcoming one is already open (<https://goo.gl/o39oDq>). The conference of 2018 will be held in cooperation with the Swiss and the German citizen science platforms.

GOVERNMENTS DISCOVER THE PROS AND WORRY ABOUT THE CONS

Governments are well aware of the power of volunteers – citizen science is often perceived as an unparalleled opportunity to collect large amounts of data at low cost. A British report even suggests that "staff morale might be improved by working with volunteers". On the other hand, there are concerns regarding data quality, legal responsibilities, lack of funding, lack of experience, and the general feasibility of citizen science projects. Resources needed to train volunteers and to provide IT infrastructure are often underestimated. Nevertheless, more sources for funding scientific projects outside of formal institutions seem to open up gradually, added Florian Heigl.

VOLUNTEERS CONTINUE TO PROVIDE ENORMOUS AMOUNTS OF DATA – BUT ARE OFTEN NOT EVEN ACKNOWLEDGED

Strikingly, there is a sharp contrast between how eagerly volunteer-collected data are used and the interest that researchers devote to the volunteers themselves. In an unpublished study that reviewed 133 papers, Anna Lawrence found 77% of authors worry about the accuracy of their data, but only 69% acknowledged the volunteers who collected it. Even less, only 31% had followed up on how this experience with science affected the volunteers.



Contributing to a larger whole can be very motivating, even in absence of a professional reward. Anna Lawrence made her point by sharing her personal experience as a volunteer in a phenological project. "The reporting sites are mapped online and it has this little dot with my name to it which I'm hugely proud of!"



Daniel Dörler and Florian Heigl launched the platform for Austrian citizen science projects. The annual conference has just been held, but the next one is already in preparation.



Discussions about the evening's topic of citizen science already started among the audience before the event.



Similarly, also the speakers were quickly absorbed by burning questions.

TOP-DOWN OR BOTTOM-UP: DOING RESEARCH AND ENGAGING THE PUBLIC

As always with participation, there are different degrees along a spectrum: there can be more extractive forms of citizen science, where volunteers only provide data, but are not involved in analysis or evaluation, and more co-operative forms, where volunteers participate also in designing experiments and methods. While we might be inclined to consider the latter to be more empowering and more rewarding for volunteers, Anna Lawrence reminded the audience not to judge too quickly: "Some people just don't want to get involved in governance; they just want to do nice natural science and provide good data."

ENGAGING OR EDUCATING - WHERE IS THE EMPOWERMENT?

Citizen science is often presented as a tool to engage people in the scientific process; but often engagement is understood as education of the public by the scientific community. This stance on citizen science and other forms of knowledge (local, traditional, volunteers' knowledge) is not unique to industrialized countries – the tensions between science and local knowledge are the same across the world, said Lawrence, who has performed much of her research on citizen science and participatory forest management in the global South. Whether a project will hold true to its aspirations of empowering volunteers depends on many factors: on experiences that volunteers make, but also on the outcomes of the project, for example if it serves as input into policy dialogue. A key element is, whether volunteers derive meaning from participating.

NEW TECHNOLOGIES ENABLE EASY MASS DATA COLLECTION, STORAGE AND ANALYSIS

The advent of communication technologies, like smartphones, has enabled data collection at previously unknown scale – at least in industrialized countries - and rendered contributing data much easier. However, these opportunities also raise new concerns for privacy: who owns this data? Who has access to it? And what can this data be used for? The impressive technological progress threatens to shift the focus in citizen science from participatory to extractive, warned Lawrence.

BRIDGING KNOWLEDGE SYSTEMS, BRINGING STAKEHOLDERS TOGETHER

Citizen science can have benefits for many actors or merely propagate business-as-usual. If it manages to bring citizen knowledge and science together, it can be very successful in bridging stakeholder divides. Surely, efforts to enable public participation in scientific projects will further increase.

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FROM CITIZEN SCIENCE TO POLICY CHANGE – AN EXAMPLE FROM INDIA

Karnataka, India. An NGO and a research institute searched together with foresters and local communities for ways to manage their forests more sustainably, including non-timber forest products like medicinal plants in plans, which traditionally complement locals' livelihoods.

Involvement in the scientific project gave locals more respectability and even led to policy changes at the government level. Villagers, on the other hand, changed practices convinced by methods that were based on their own experience.

On the personal level, one volunteer reported that the project enabled her to travel outside her village for the first time as others now wanted to know more about the village's approach to forest management. One of the foresters described that while he initially felt that participation was a threat to science, he appreciated how the project had coupled citizen knowledge with scientific rigour and provided him with data that he could use for improving management plans in accordance with the locals' needs.



The evening's moderator, Rosana Kral closed by reminding the audience that science has not always been a paid profession.