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Watching or being watched

Enhancing productive discussion between the citizen sciences, the social sciences and the humanities

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Highlights

- The growing success and take-up of citizen science needs to be accompanied by increased reflexiveness in the field.
- Social science and humanities research shows that citizen science has a broad history and brings important alternative perspectives on the relationship between science and society.
- Better collaboration between citizen science and the social sciences and humanities, especially Science and Technology Studies (STS), should be facilitated to the benefit of all parties.

Introduction

Citizen science reshapes hopes for a democratisation of scientific knowledge production through the empowerment of grassroots initiatives to conduct research. At the same time, more and more professional scientists, scientific institutions and policymakers have started to engage with citizen science, often pursuing the benefits of fostering participatory research in terms of their own goals, which may differ from those of citizen scientists (see also Ballard, Phillips & Robinson; Haklay; Novak et al.;

Smallman, all in this volume). In this situation, it becomes important to reflect on citizen science, including the many and varied projects, methodologies and communities that make up this approach to science and technology, as well as its recent popularity and the side effects thereof.

Recent years have seen an increase in literature on citizen science from a growing and increasingly international (but mostly Western) networked community of practice (Kullenberg & Kasperowski 2016). Significantly, a journal has been founded to support discourse and reflections about citizen science, *Citizen Science: Theory and Practice*. These developments point to the potential for a growing (and shared) *reflexivity* of citizen science. Reflexivity is understood here as the generation and exchange of knowledge about how citizen science works, with the aim of better understanding and improving it. Such reflexiveness, however, cannot be limited to merely making more knowledge about citizen science available, but fundamentally requires critical engagement with the underlying assumptions of participatory research as well as the practical consequences of these assumptions. The social sciences and humanities have an especially important role to play here.

A reflexive perspective should consider how participants, the people who do the work in citizen science projects, could be explicitly acknowledged and invited to integrate their views and needs into the projects. However, the first issue of the *Citizen Science* journal appears to speak to the perspective of institutionalised science and the 'scientific outcome' of citizen science projects. For example, the most read articles cover topics including the 'credibility' of volunteered data (Freitag, Meyer & Whiteman 2016) and the 'effectiveness' of citizen science (Muenich et al. 2016). The democratisation and empowerment of volunteers, which could also be framed as valid goals for citizen science projects as 'the outcome for the people', are largely absent. Critical observations of this kind are important when working towards greater plurality and inclusivity in citizen science.

The success of citizen science and need to meet the expectations of various stakeholders (e.g., participants, researchers and policymakers) mean that citizen science practitioners in turn need to establish and continuously refine a self-reflexive culture. Within such a culture, topics like the power relations between amateurs and experts or the community impact of citizen science projects should be discussed with other practitioners and participants.

There is also a long history of scholars in the social sciences and humanities doing research *on* topics directly related to citizen science,

even before the term 'citizen science' was coined in its contemporary usage (e.g., Irwin 1995). This scholarship typically reflects on the phenomenon from the perspective of the various academic fields which explore the shifting relationship between science and society. For example, historians have begun to ask how citizen science fits into the broader history of public participation in science, while sociologists and political scientists are concerned with how the phenomenon reshapes expertise and the demarcation of social spheres in democratic societies (Strasser et al., forthcoming). Such reflections from the social sciences and humanities offer important contributions to the field. Researchers in these fields might, for instance, work together with citizen science practitioners and participants to find and analyse pitfalls, and help identify and scrutinise the (sometimes implicit) biases that may occur while setting up a participatory endeavour. In this co-reflexive process, questions may arise, particularly around how to best manage access and remove barriers to research participation (e.g., at the level of language) and the manner in which the focus of science-public dialogue is framed (e.g., the kinds of questions that are – or are seen to be – important to the different parties to a citizen science project).

Despite the increasing number of venues for exchange and critical discussion among practitioners as well as the proliferation of research on citizen science, citizen science practitioners and scholars from the social sciences and humanities sometimes still appear to be disconnected. There is an often misleading, but perpetuated, self-understanding of these communities as being part of different intellectual spheres – here the natural sciences with their 'strict epistemologies' and there the more 'hermeneutical' humanities (*a longue durée* of C.P. Snow's 'Two Cultures' [Snow 1959]). This can make it difficult to find common ground for exchange and co-production, even when it comes to topics or projects where a joint endeavour could be promising. Setting up self-reflective and multi-perspective citizen science projects could be one of these endeavours and might hold the key to finally overcoming old distinctions, not only between 'experts' and 'laypeople', but also between the 'sciences' and 'humanities' (see Dobreva 2016; Crain, Cooper & Dickinson 2014).

This chapter has three aims: (1) to give examples from current social science and humanities research on citizen science; (2) to point out areas where joint ventures between these two communities promise to add value, illustrated by two case studies; and (3) to inspire further instances of co-operation by critically reflecting on the authors' own attempts to produce such an encounter. It is also hoped that making this possibly

fruitful alliance accessible to the wider community of citizen science practitioners will stimulate further productive and critical engagement between the various communities engaged in citizen science.

Current research on citizen science

The first international European Citizen Science Association (ECSA) conference in Berlin (19–21 August 2016) aimed to give an overview of the current state of citizen science in Europe. From both a humanities scholar perspective and citizen science 'activist' perspective, it was evident that the citizen science scene is still in a phase of self-identification and development. While some, for example, the executive chair of ECSA in her welcome speech, addressed citizen science as a global movement which frames the 'idea of responsible citizenship and of responsible research' developing discursive and political power, others may treat citizen science more instrumentally as a tool for citizen involvement in the achievement of predetermined scientific and educational goals.

Many discussions focused on questions about how to make the best of the involvement of the public in terms of scientific outcome. Questions such as 'How reliable is the data produced by citizen scientists?', 'How can we measure "data quality"?' and 'How can we make citizens better "sensors" or better "observers"?' were important to many scientists, citizen science practitioners and policymakers. Likewise, the standardisation of such 'quality aspects' and citizen science in general, as well as the professionalisation of the field, were discussed. Other prominent topics included technology and learning outcomes (e.g., in schools) via citizen science. Citizen science was on the one hand framed as an additional 'scientific method' among others (that needs to follow an orthodox epistemology via 'universal' values like scope, data quality, fruitfulness, etc.) rather than as an 'opportunity for empowerment' (see also Wyler & Haklay in this volume). However, on the other hand, it has the potential to become both at the same time.

With its strong focus on developing 'policy' and 'standards', the community brought together at the ECSA conference framed citizen science in a way that did not focus on thinking about the societal and historical backgrounds of the phenomenon and corresponding theories. Additionally, the social sciences and humanities seemed to be rather absent from the main programme, which centred mostly on environmental sciences, citizen science technologies and methods, as well as the policy aspects of participatory approaches. Even if researchers from the social sciences and

humanities do not necessarily do much citizen science themselves, their perspectives could enhance the field when considered and operationalised by practitioners and policymakers. Taking perspectives from the social sciences and humanities into account would benefit the citizen science community, for example, by bringing more knowledge about the sociology of citizen involvement or addressing some of the tensions and dilemmas involved in citizen science work.

Perspectives from Science and Technology Studies

Social scientists and scholars of the humanities played a part in the movement towards making science more participatory through the 1990s and 2000s, and have recently redeveloped their collective interest in the social structures, epistemologies and history of citizen science. Science and Technology Studies (STS), an interdisciplinary field comprising approaches from sociology, history, philosophy and other disciplines, is the most prominent field of investigation from which such reflective studies originate.

Current sociological and philosophical work on citizen science, for instance, discusses topics like the type and degree of participation and the agency of participants. Typical questions in the field include: How is participation framed by citizen science practitioners? How are volunteers engaged, and what is their motivation for partaking in citizen science? How does self-organisation function (e.g., Göbel et al. 2016)? Is citizen science part of a (serious) bourgeois leisure culture of the twenty-first century? Which endeavours and projects are framed as citizen science and why? A good example of this is the work from the research group around Lorenzo del Savio, Barbara Prainsack and Alena Buyx. In a current publication, they question whether crowdsourcing could also be framed as citizen science (del Savio et al. 2016). Furthermore, STS scholars Dana Mahr and Sascha Dickel (forthcoming) ask whether it is possible to enhance citizen science beyond 'invited participation' in a less linear way (with professional scientists 'on top' and participants 'at the bottom'), as Yochai Benkler's concept of commons-based peer production suggests (Benkler 2006).

From the perspective of historians of science, the emergence of citizen science is neither new nor surprising. It is embedded in the larger relational history of science, society and politics: from public experimentation in the eighteenth century (Shapin & Schaffer 1985), the large natural history networks of lay experts in the nineteenth century (Mahr 2014), the

'science for the people' and social responsibility of science movements of the 1970s, to the deliberative consensus conferences about environmental issues and participatory action research in the 1990s and 2000s (Irwin 1995; Mahr 2016). All these historically well-explored episodes prove that the demands of citizens to partake in processes related to science cannot be described as an exclusive phenomenon of the twenty-first century.

According to historical work, science almost always relies on lay expertise and lay assistance by members of the societies in which it unfolds. The scientific spectacles of the *Ancien Régime* testify to this as well as the networked activities of Darwin, Wallace and Mendel, or the mass-work of volunteers collecting plant specimens for Carl Linnaeus and his binominal nomenclature (Shapin & Schaffer 1985; Golinski 1999; Bensaude-Vincent & Blondel 2008; Shapin 2010). The epistemological goal of this natural history–type of science was to unfold the book of nature by collecting and comparing huge amounts of data (Strasser 2011), an approach to research that provoked collaboration with various publics, for example, large-scale networks of volunteers conducting field observations in vast geographic areas for biogeographical research (Mahr 2014). In the nineteenth century, this resulted in a 'knowledge society' integrating scientific citizenship. Although the professionalisation of science had already begun at this time, the rising and confident bourgeoisie framed volunteer scientific work as a highly valuable and meaningful leisure activity. Therefore, thousands of laypeople-driven scientific societies emerged and fostered research that could keep up with the work conducted by professionals (Daum 2002). In sum, modern science was naturally considered as something that had tasks for almost everyone who was willing to participate. Science and society were inseparable.

This raises the question of why, in the early twenty-first century, science has become something that needs to be reconnected with society – why is modern science detached, estranged, unintelligible, not helpful on everyday issues and sometimes not even fully trustworthy (for example in the cases of nuclear research, GMO (genetically modified organisms) or pharmaceutical research)? Relatedly, why do many people hope to overcome this situation by participating in (or setting up) 'citizen science'? The answers to these questions are complex, but two factors are noteworthy: the rise of experimentalism in the twentieth century and the process of social differentiation. Experimentalism brought science from the field to the laboratory (Kohler 2002; 2006); in other words, from open spaces to closed ones, not accessible to everyone. Furthermore, experiments needed special – often expensive – equipment and required distinctive education. Social differentiation goes hand in hand with this since

Box 7.1. Case study 1. Who are the citizen scientists?

At the core of citizen science projects lies the belief that the making of science can be improved by extending participation in the research processes to a broader public. Whether they are called 'amateurs', 'the crowd', 'people' or 'citizens', unpaid participants are increasingly enrolled by scientists not just to discuss and learn science, but also to actively engage in the production of scientific knowledge. However, little is known to date about who these participants are, especially with regard to their education and professional backgrounds (but see also Haklay in this volume). The limited surveys which have been carried out tend to represent only the most active participants and do not represent the majority of participants.

A project by Jérôme Baudry, Elise Tancoigne and Bruno Strasser focuses on the identity of participants in distributed computing, where volunteers share their computer(s)'s power to advance data processing in several research areas. The project mines the online profiles of the dedicated BOINC platform (where projects include Seti@home, Rosetta@home and LHC@home, among others) as well as the users' data (e.g., points earned, country) to provide a richer picture of the demographics of volunteering in science.

the accelerated division of labour in the first half of the twentieth century finally led to the rise of professional 'scientists' and other 'experts' as distinct 'truth classes' (Mahr 2016). The old social contract was that science produces reliable knowledge while politicians make decisions for the good of society on this basis (Gibbons 1999). This succeeded as long as public trust in the expertise of experts remained (Beck 1991; Mahr 2016). Public clashes between experts exposing differences in underlying values and, with it, the knowledge they put forward, undermined this trust (Frewer et al. 2003). Today, discussion has turned to the role citizen science can play in a new social contract between science and society (Maasen & Dickel 2016; and see Smallman on Responsible Research and Innovation in this volume). The case studies of STS work on citizen science, discussed in the following two boxes, demonstrate the potential for enhanced and productive discussion between the two spheres.

Box 7.2. Case study 2. Citizen science between democratisation and economisation

Following a 'participatory turn', seeking to democratise science and technology (see for example Irwin 2006), new inclusive forums have been established on science- and technology-related issues over the last two decades. These spaces aim to promote mutual respect for different ways of reasoning and often portray public participation as free from strategic bargaining and manipulation. However, participatory approaches often lack reflection on, and remain disconnected from, their context of application. One important phenomenon here is the orientation of science and technology towards economic ends, which has been labelled 'economisation'.

    To fill this gap, a project by Hadrien Macq studies public participation to assess the ways in which democratisation and economisation imperatives interact, conflict or complement each other, and how the design, process and outcomes of participatory exercises are impacted. He focuses on two domains and policy levels: the European research and innovation policy and the Walloon Region's digital strategy, which both promote political strategies relying on the creative potential of multiple societal actors to achieve economic goals. The project uses a two-step methodology to analyse the dynamics shaping participation in science and technology and its political-economic context across these policy levels. First, a critical discourse analyses if, and how, economisation influences the way participation is conceived by its sponsors. Second, participant observation and interviews with participation professionals and engaged parties assess the way the design, conduct and outcomes of participatory exercises are affected by the economisation rationale. Macq seeks to understand how the economisation of science and technology influences public participation, therefore providing a crucial platform for the theoretical and empirical investigation of the normativities of public participation in science and technology. In this respect, attention is paid to the reorientation of public participation in science and technology as conceived and promoted by the European Union under the Horizon 2020 programme. The recent promotion of citizen science as a priority within the new 'Open Science, Open Innovation, Open to the World' programme is scrutinised as part of the shift from public engagement in decision-making to public participation in innovation processes.

Citizen science studies session at the ECSA conference

With the aim of exploring links between citizen science practitioners and social science and humanities scholars, the authors, together with Anett Richter, organised a session at the ECSA conference in 2016. Initially perceived as quite a niche topic, we were surprised to discover the overwhelming resonance – the session received about one-fifth of all submissions for the conference.

The questions addressed can be summarised in four overlapping groups: (1) case studies by citizen science practitioners reflecting upon their own practices of doing and institutionalising citizen science, for example, Josep Perelló's 'brief story of the Barcelona Citizen Office: community of practice, the rules of governance, and the connection with citizens and public administration'; (2) surveys of the national landscapes of citizen science actors, disciplines and discussions, like Lisa Pettibone's 'What is citizen science today? A case study of current practice in Germany'; (3) studies of single systematic aspects of citizen science practice, such as Gitte Kragh's talk on 'Understanding motivations of citizen scientists'; and (4) generalising accounts that mobilise social science theory to offer reflective views on current practices as exemplified by Sascha Dickel's 'The (citizen-) scientification of society and the pleasures of research. Citizen science as science communication'.

The session format included two parallel streams of discussion with related presentations grouped per topic and at least two talks introducing different perspectives. A key lesson learned is that while many short presentations help to build mutual awareness, more time and focus is needed to explain underlying assumptions, a key in point for seriously exploring connections with substantially different points of view.

Conclusion

While citizen science practitioners are often highly reflexive of their own practices – as shown by the *Citizen Science* journal and work of citizen science associations – these initiatives would benefit from a closer relationship with the work of scholars in the social science and humanities, especially STS scholars, who critically engage with citizen science in their research on relationships between science and society. Moreover, the rising popularity of citizen science creates a growing need to work towards plurality and inclusiveness by collaborating in critical reflection on the

practice of public participation in research, as well as on the standards and institutions forming within and around the community of practitioners. This also opens wider discussions concerning, for example, the relationship between citizen science and the 'knowledge politics' of contemporary societies.

This chapter provided a critical review of main topics of the ECSA conference to illustrate points of departure where more critical reflexiveness is needed. It argues that focusing on the scientific, educational and policy-relevant outcomes of citizen science, along with recipes to increase efficiency, is too narrow and risks treating participants as sensors rather than self-empowered citizens. This is especially concerning given calls for the standardisation of citizen science practice. In the brief overview of current research in STS, the chapter suggested that perspectives from the sociology and philosophy of science can help to scrutinise which forms of public engagement with science and technology are currently framed as citizen science (and thus receive higher attention of academic researchers and funders), which emancipatory aspects are sidelined, and how this can affect the knowledge generated. Historical studies contribute yet another level of reflexiveness by repositioning the current drive to reconnect citizens and science as part of a longer trajectory of changing relationships between science and society, in which lay participation continues to be a key part. The chapter argued that addressing such issues creates added value for both science and society. The authors' own attempt to produce an encounter between citizen science practitioners and scholars from STS was a first step to facilitating such productive exchange. While the workshop format can be improved, it initiated contacts between communities, ignited debates and increased the visibility of the social science and humanities scholars as a central part of citizen science.

There are numerous directions for further activities that promise to be productive for such endeavours. One example is the working groups of citizen science practitioner associations, such as ECSA. Here, citizen science practitioners and other researchers are invited to engage in co-operative projects, thus practising reflexivity in developing common frames of discussion and outputs that are meaningful for all parties. Another route is 'co-laborative' practice (Niewöhner 2016) where, rather than imposing a joint goal for working together from the start, exchanges happen on a more flexible basis with the primary objective of getting to know each other's knowledge practices and being open to where that might lead.

The authors hope this chapter might inspire others to seek new ground for debates surpassing the boundaries of their own disciplines,

vocabulary and maybe even comfort zones. At the same time, peers need to challenge each other and bring about a more reflexive understanding of citizen science practices and how they can be explored, including the different motivations for advocating public participation in scientific research and where they might conflict within and between different stakeholder groups. Finally, shared spaces and tools are needed to identify, reflect and negotiate such goals.

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