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ANECDOTE

Does It Make Sense to Professionalize and Institutionalize Citizen Science?

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Abstract In this article, I share an anecdote about citizen science and use it to reflect on this rapidly growing field of scientific activity, its funding, and its governance. The paper focuses particularly on the epistemic and social challenges that accompany increasing demands for professionalization and institutionalization of the Citizen Sciences.

The Anecdote

At the end of 2015, I was invited to one of the founding events of the Competence Center-Citizen Science in Zurich. Between talks and canapés, I got to know many colleagues and learned about their exciting projects. But among all the academics, one thing struck me: where were the "ordinary citizens" who are supposed to be at the center of the discussion about participatory knowledge production? Even more than by their absence, however, I am still preoccupied by what one of the keynote speakers said: "We have to institutionalize and professionalize Citizen Science". To this day, I wonder—as someone who has been researching public participation in the production of both science and technology since 2009—what exactly the speaker meant by this and whether this objective might not in fact unnecessarily limit or even render impossible what participatory research or citizen science might otherwise contribute to both society and the institution of science.

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Institutionalization and Professionalization

Institutionalization refers to the process by which a field of inquiry (as a set of practices, methods, and values surrounding an epistemic object) becomes established and recognized as a formal area of study within academic discourse, research, and professional institutions. This involves the creation of dedicated departments, research centers, and academic programs focused on the specific science in question. Thus, as a field of inquiry becomes institutionalized as a scientific discipline, it usually obtains greater legitimacy and support from the broader scientific community and society. Complementarily, the concept of professionalization refers to the process of establishing methodological and theoretical standards, consistent qualifications, and ethical guidelines for individuals practicing within the emerging scientific field in question.

In the 1990s, the sociologist of science Thomas F. Gieryn described such processes as a kind of academic "boundary work" [1]. As with the emergence of nation states, borders are drawn. An inside, an *Us*, and an outside, a *Them*, are constructed. In the process, certain ways of thinking about an epistemic

object, some practices, certain methods, and particular qualifications are excluded or included in this process of creating a field or discipline. In discussions about participatory research and citizen science, one of the ways in which this has been expressed in some cases is that excessive attempts have been made to create a taxonomy of possible forms and types of participation to help define the professional and institutional boundaries of citizen science (e.g., [2–5]).

Typologies as Boundary Work

The typology formulated by Rick Bonney, an ornithologist and citizen science organizer at Cornell University, which was also adopted by the US National Science Foundation, differentiates between "contributory projects" designed by professional scientists and "collaborative projects". In contributory projects, the public is asked to collect and share various forms of information and data, while in collaborative projects participants may also be invited to refine the project's design or to analyze certain data points [6]. Other typologies focus on the goals of the participatory projects as well as on the environments in which they are carried out [6]. In a paper from 2011, the computer scientists Andrea Wiggins and Kevin Crowstone distinguish between five forms of participatory research [7]. The categories they have defined are *action research* for local civic topics, *consersation research* for environmental preservation and resource management, *investigative participation* for the collection of environmental information, *virtual citizen science* for solving predetermined tasks via gamified online environments like *Foldit* or *Galaxy Zoo*, and *educative participation* in formal and informal settings such as schools. Though it reveals the spatial variations of participatory research, from local outside environments to the virtual sphere, this categorization does not highlight the inherent hierarchies of contemporary citizen science [8].

Thus, most attempts to define the boundaries of citizen science by ordering and arranging seem to be top-down constructions that seek to integrate participatory forms of knowledge production into the established institutional system of science. They implicitly normalize the idea that citizen science projects need to originate from a genuine academic perspective and must be organized by professionals who invite the public to participate [9]. In this way—from the perspective of the inherent logic of the scientific system—a somewhat fuzzy concept like citizen science can be turned for example into a subject for policy-making, a field or even a discipline. It therefore opens the door to the development of national and international funding schemes, and for new academic journals, organizations, and associations like the European Citizen Science Association. Yet the inherent normativity of such endeavors can also have a strong limiting effect on a field's ability to renew itself, to conduct creative research, and to be epistemically irritated by outsiders. This problem affects all forms of institutionalization and professionalization, but can have fatal consequences, especially in the case of the citizen sciences, which depend on an epistemic diversity or polyphony of the voices contributing to a subject.

Analyzing Practices of Knowledge

In our Geneva-based research group "Rethinking Science and Public Participation" (2015–2019), we devised an alternative way of describing participatory initiatives. Instead of utilizing categories that superimpose normative assumptions and structures of institutionalized science onto a new phenomenon, we studied what the people who participate in research as non-experts and outside of academic settings actually do in practice. Thus, we identified five distinct epistemic practices in these communities: sensing, computing, analyzing, self-reporting, and making [10]. These categories are meant to help us look beyond the labels of "citizen science" and "participatory research" and aim to capture the wider diversity of participatory practices. This typology does not imply hierarchies between the different kinds, they are simply qualitatively different and sometimes hybrid modes of knowledge production. They are "ideal types, not natural kinds that could uniquely define the 'nature' of participatory projects" [10]. Their purpose is to help us analyze and learn about a wide array of participatory phenomena as valid and intersecting forms of scientific and technological knowledge production. While a *sensing* project might primarily focus on quantifiable practices like organized nature observations (e.g., as part of the German bird counting project "Stunde der Gartenvögel") it could also

involve aspects of *analyzing*—for example when participants are invited to make sense of certain forms of data (e.g., variations in the distribution of certain species). Staying close to the actual activities of actors doing participatory or open research makes it easier for us to avoid having unnecessary preconceptions about what is inside or outside of citizen science. Such a perspective can also help illuminate the voids and exclusions regarding the institutionalization and professionalization of citizen science. This applies, for example, to many aspects of (critical) *making* and its related topics such as private tinkering with bio- and nanotechnologies.

Making

In 2010, a group of San Francisco-based biologists and entrepreneurs founded BioCurious, a space they called a "hackerspace for biotech" and a "community lab for citizen science" [11]. To pay the rent of their 3000-square-foot space in a Silicon Valley industrial building "dedicated to non-institutional biology,"they launched a funding campaign on Kickstarter, asking people to "give up their skinny soy pumpkin lattes for a day and donate to support citizen science!" [11]. During the following years, the BioCurious collective conducted several projects, from making bioluminescent plants for bicycle safety to the production of vegan cheese using on-site genetically engineered yeast that produces milk proteins. Since 2010, several similar spaces have been established in major cities around the world, often grouped under terms such as DIYbio", "biohacking," or "making". Among them are Genspace in Brooklyn (USA), La Paillasse in Paris (France), and Hackuarium near Lausanne (Switzerland). The topics, organizational forms and participating individuals working in such spaces are oftentimes inspired by a shared "hacker ethos", thus exemplifying epistemic practices that focus on hands-on making of concrete things and the collaborative production of knowledge in a loosely structured laboratory or workshop setting [12]. Although the projects at these sites aim to produce new biological or technological knowledge based on emerging scientific and technical breakthroughs "close to people's needs" [13] and thus represent a distinct path of participatory research, they are noticeably excluded in most categorizations of "citizen science" and funding schemes.

This may be because questions and topics tend to emerge locally in the maker and DIY sphere and are not initiated and guided by predetermined academic constraints and institutionalized experts. However, it may also be due to the tendency for *making* to usually center on topics whose epistemic nature does not fit the usual predetermined crowdsourcing methods of most citizen science projects. Instead of distributing the collection of data for a project among as many volunteers as possible, for example, maker projects rely on more intimate, practice-oriented and relatively small groups of enthusiasts.

The exploration of nanotechnology is an interesting example of such differences. In institutionalized citizen science structures, there is almost no interest in nano-biotechnology, as evidenced by the fact that I was only able to find one significant citizen science project despite being helped by representatives of some of the leading European citizen science organizations (e.g., the Citizen Science Network Austria, and the Swiss foundation Science et Cité). This project, named "Nan-O-Style", was funded between 2017 and 2019 via the Austrian Sparkling Science program (on which I have served as a reviewer since 2015). Led by the bio-scientist Martin Himly (University of Salzburg), it aimed to collect knowledge about and attitudes towards nanotechnologies among Austrian students [13]. In short: It utilized a crowdsource approach to social science research on nanotechnology but did not integrate these technologies.

This is not the case in the maker sphere. Here, nano-biotechnologies have been on the agenda in a very practical sense for more than ten years. For example, the Hackteria in Lausanne has for several years hosted a nanotech-related initiative in collaboration with the Czech philosopher and experimental designer Denisa Reshef Kera and the Swiss bio- and nanohacker Marc Dusseiller. Their (almost yearly) "NanoŠmano" or "NanoPunk" projects focus not only on generating hands-on knowledge relating to the understanding and use of nano materials (e.g., form, size, function, or visibility under the microscope) but also co-produce concrete and usable prototypes for everyday life [14]. So far, these have included "nanotech spectrophotometers", "lasergrammophons", and the "BeMap". The latter in particular demonstrates how making as a participatory practice can help not only to democratize the laboratory but also demystify emerging technologies in the public

perception. From drawing board to functional prototype, not only experienced biohackers and makers but also interested pupils, students, pensioners, and other members of civil society were actively involved in the creation of "BeMap". Originally envisioned as a more power-efficient alternative for bicycle lights, the project quickly evolved. At the end of the tinkering process, which lasted several weeks, the result was a multifunctional low-price nano-tech instrument, "featuring GPS tracking, and sensors measuring pollution along (the) cycling route" [15], enabling cyclists to "gather pollution data about their surroundings in order to choose their path (…) according to pollution levels" [15].

Embracing Epistemic Diversity for the Future of Citizen Science

Hackteria's "BeMap" is just one of many examples of the thematic, educational, and practical strengths of *making* as epistemic practice. Since universities and funding organizations are keen to give "citizen science" or "participatory research" a more concrete and manageable form for the sake of their own institutionalization and professionalization, however, such forms of collaborative knowledge production may increasingly become overlooked. This is problematic not only on account of their bottom-up innovation potential, but also because they involve concrete communities and tangible practices that combine epistemic, lifeworld-oriented, and even artistic aspects and thus could make an important contribution to the democratization of knowledge production and the understanding of techno-scientific knowledge in the twenty-first century.

Of course, it is important to find ways to promote citizen science and other forms of participatory research and to set quality standards. However, the citizen science community's current efforts to adapt to the organizational structures, topics and hierarchies of institutionalized science, observable in its taxonomies and search for fixed definitions, threaten to exclude innovative perspectives and those involved in knowledge production. Consequently, it is important to critically monitor the institutionalization of the citizen sciences. As both a reviewer and evaluator of citizen science projects for several European funding lines, I strongly advocate not only a broader understanding of citizen science and a (re-)integration of local and bottom-up practices, but also believe that funding decisions should be based on a diversity of epistemic practices, including those which challenge or operate beyond the institutional boundaries of science.

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Declarations

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