Issues of democratisation in citizen science for urban climate services

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1 Introduction

Volunteer participation in data collection and scientific research has a long tradition (Clavero and Revila, 2014; Clavero, 2017; Irwin, 2018). At least since the beginning of the 17th century, European scientific institutions relied on the many observations reported by volunteers from different geographical locations (Strasser and Haklay, 2018). In Austria, PhenoWatch collects weather data since 1851 (GeoSphere Austria, 2023). It is comparatively new to consider volunteer participation in data collection and scientific research in general as a democratisation of science (e.g., ECSA, 2023; European Commission, 2019; European Commission, 2020; Resnik et al., 2015).

The concept of "democratisation" is not self-explanatory. The Merriam-Webster dictionary explains "democratic" as "relating to, appealing to, or available to the broad masses of the people" (Merriam-Webster, 2023). According to the Cambridge Dictionary, democratisation is understood as institutions becoming democratic in their decision-making (Cambridge Dictionary, 2023). It also is far from being obvious what the term "citizen science" (CS) refers to. There is no consensus on the meaning of this term (Strähle and Urban, 2022a). From the very beginning of its use, CS has been conceptualised very differently: on the one hand, as some kind of auxiliary service for scientists (e.g., Bonney, 1996; Bonney et al., 2009), and, on the other hand, as taking public concerns seriously into account in scientific research (Irwin, 1995). Some years ago, the conceptualisation of the term was broadened to an extent that it includes science education projects at schools, public participation in science policy-making, do-it-yourself activities in fab labs ["local labs, enabling invention by providing access to tools for digital fabrication" (The Fab Charter, 2012)], action research, a wide range of science communication, and other activities (e.g., European Commission, 2018).

Due to a lack of a widespread consensus on what CS exactly is, the authors built on the very broad description by the European Commission (European Commission, 2018) to create an overview of the multiple meanings of the term CS, the Activities & Dimensions Grid of Citizen Science (Strähle and Urban, 2021; Strähle and Urban, 2022b). The Grid distinguishes roughly between four areas of CS and combine them with a long list of dimensions where activities can vary significantly. The **first area** is connected to citizen deliberations in research policy. The **second area** is about contributing unpaid work to a concrete research activity in the widest sense. The **third area** comprises development and innovation by citizens, while the **fourth area** encompasses any CS activity of the first three areas in the context of school education, because the children's right to the best possible education outweighs any other goal of the respective CS activity. We have chosen these four areas

because they demonstrate that CS often is not only about science but also other competence areas.

Instead of generalising that CS *per se* democratises science—if it means more than appealing to society at large—one has to assess each specific CS activity separately. If CS is understood as a means to democratise science, whatever this means, it is safe to assume that this understanding implies that CS activities should be organised in a way to ensure a high degree of democracy.

2 Citizen science for urban climate services

In accordance with the World Meteorological Organization and the European Environmental Agency, we consider a climate service as "the provision of climate information to help end-users make climate smart decisions. (…) Climate services (…) must address user needs, and may be co-designed by end-users and providers to enable uptake" (European Climate Adaptation Platform Climate-ADAPT, 2023). If citizen science takes place in the context of climate service activities which are linked to policy making, issues of democracy and inclusion are pivotal.

To minimize the danger of instrumentalising CS activities, it is necessary to evaluate what strong interests might exist among those involved, whether their influence could be eliminated or mitigated. In the best case, CS activities can contribute to improve the climate situation in poorer neighbourhoods. In the worst case, inequalities can rise, real estate owners increase their profits, wealthy people upgrade their neighbourhoods. The opposite of democratisation can happen if no or too weak precautions are taken.

Some CS activities explicitly aim at participatory decision-making (Area 1), which make them a form of political citizen participation. Here it would be rather tricky to decide, which citizens should express their concerns and opinions, who could be affected by the decisions in question, in what form and to what extent. How is it determined who is relevant and who is not, and who is authorised to decide it? Much thought on democratic standards for deliberation is necessary to avoid any perpetuation of existing power relations, which is a hard and complicated task.

For other forms of CS, it is doubtful whether democratic participation should be targeted. For example, volunteering can and should only be done by those who have the necessary resources. In the case of joining a research project (Area 2), equal opportunities and inclusion only play a role if participants can have a more tangible benefit from participating than the personal satisfaction of doing something good or satisfying one's own curiosity. In extremis, such personal benefits could be a change of property value or rents. If there are any such conflicts of interests, democratic processes and inclusion can become relevant to other activities than those in Area 1, because it cannot be ruled out that citizen scientists are biased to deliver those results that favour certain policy decisions.

In literature, sometimes passive CS is mentioned where citizens do not perform any tasks but only contribute locations, for instance. If citizens only allow setting up of devices at home, obviously this cannot be counted as active CS. If they have no possibility whatsoever to interfere in research, for example, by manipulating these devices, then democratisation is not an issue.

In our view, when CS includes citizens developing technical measuring devices or software (Area 3), maybe questions of intellectual property rights are more important than those of democracy and inclusion. Nevertheless, when such devices and software are publicly funded, fair access must be guaranteed for everybody.

Locality can play an important role, too. When citizens, for example, measure temperature or humidity in a city, does this happen at their centres of life (homes, workplaces, neighbourhoods, etc.) or at distant public places? In the latter case, conflicts of interest may be less likely than in the former. Performing research or measurements in a personal environment can make it more difficult to remain neutral about the results.

Globally regarded, it matters if urban climate services take place in a country or region where prosperity and democracy prevail and citizens' rights are secured. In Scandinavian countries, it is unlikely that citizens risk much by providing measurement data or suggest policies. In some countries, however, citizen scientists may be at risk, because such activities are interpreted as a threat to the powerful. Maybe the deeper the involvement, the greater the risk. The criticism that participation in climate services mainly takes place in countries that cause climate change rather than suffer from it is certainly worth considering (Williams and Jacob, 2021). However, in some regions, profound knowledge and experience in development cooperation would be required. In countries and regions with dubious governance and/or civil rights, only such experts can assess whether planned CS activities are ethical.

The question of anonymity can be important especially in settings, where people know each other and research results could have real impacts. Without anonymity, group dynamic effects could occur, for example, if data provided by influential persons are (unconsciously) given disproportionate weight or determine what to examine closely or not so closely. On the other hand, in some situations, anonymity can prevent that conflicts of interest of participating individuals are revealed. Someone with a fake online identity, if not multiple or even countless identities, could influence research. If one can participate anonymously online and no safeguards are taken against this, (e.g., through individual tokens), people, who want to steer research in a particular direction or create confusion, could participate secretly.

There is a danger that the services will not benefit those who suffer the most from the consequences of climate change and due to their income, have to live in poor residential surroundings. Even if we assume that everyone can come or that citizens selected by lot, much more is needed to make the process democratic. At the very least, more resourceful citizens must not disproportionately be involved. This means offering financial or other support for taking time off, ensuring childcare and the like.

Also, to name a few examples, the image of the organising institution, the attitudes of the moderator, the interpretations of "rapporteurs" are influencing factors. And even the best moderation cannot eliminate power relations in real life, Therefore, it would have to be avoided that participants discuss with others on whom they are existentially dependent or whom they perceive as an authority. Such strong hierarchies exist, for example, between tenants and flat owners, business owners and residents seeking employment.

3 Discussion

The process of identifying issues of urban climate services offers many targets for unbalanced influence. Motorists and road builders may be opposed to measuring weather data that affect air quality—in general or on specific roads. Property owners will not be interested in seeing their assets impaired by unfavourable climate data. All of them may all consciously or unconsciously dismiss certain measurements by pushing other issues that are more harmless for them.

A key question is: How much can results impact on individuals' living context? Ideally, researchers would work primarily to find fact-based scientific answers. But if research aims at policy interventions, it risks to turn into mere political opinion-making. The stronger the interests that can be affected, the more one has to think about democracy. If citizens do research on how well rain soaks into the soil on their own property, this can create sentiment for or against a building project in the neighbourhood. Even if it is not directly a matter of having a say, this could possibly even influence whether or not some building projects or reconstructions are approved by authorities.

"Democratisation" can become a signal word to emphasise that CS is in principle a responsible and socially valuable activity. This can lead to an immunisation effect against criticism of CS activities. A close link between research and activism can put researchers in a comfortable position: If their research is criticised, they can refer to the social value of their activities. If they are criticised for social effects of research, they retreat to their position as a researcher.

Citizen participation does not *per se* lead to democratisation, and the question is why it always should. Volunteering cannot and should not be democratic because resources are not equally distributed. Democratic procedures would require huge efforts. The challenge to establish or maintain democratic structures is not specific to CS but pertains to all human spheres. Neither in CS discourse or practice, this seems to receive the attention it deserves.

We doubt in most cases a democratic or inclusive design of participation is even possible. People can have different incomes, educational backgrounds, gender or age, but they can be quite homogeneous in hundreds of other respects. A high diversity of socio-economic characteristics among participants does not make them "representative" of a specific group or replace elections or choosing participants randomly by lot. To our knowledge, such an approach is rare and not always practicable.

Hopefully, more thoughtful approaches will replace a tendency to idealise citizen science and give citizens a say in research or research policy. Healthy scepticism does not necessarily lead to denying the potentials of citizen science for developing society.

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References

Bonney, R. (1996). Citizen science: a lab tradition. *Living Bird.* 15 (4), 7–15.

Bonney, R., Cooper, C. B., Dickinson, J., Kelling, S., Phillips, T., Rosenberg, K. V., et al. (2009). Citizen science: a developing tool for expanding science knowledge and scientific literacy. *BioScience* 59 (11), 977–984. doi:10.1525/bio.2009.59.11.9

Cambridge Dictionary (2023). "democratize.". Available at: https://dictionary.cambridge.org/de/worterbuch/englisch/democratize (Accessed October 26, 2023).

Clavero, Ninyerola, M., Hermoso, V., Filipe, A. F., Pla, M., Villero, D., et al. (2017). Historical citizen science to understand and predict climate-driven trout decline. *Proc. R. Soc. B Biol. Sci.* 284, 20161979. doi:10.1098/rspb.2016.1979

Clavero, M., and Revilla, E. (2014). Mine centuries-old citizen science. *Nature* 510, 35. doi:10.1038/510035c

ECSA (2023). Vision and mission. Available at: https://ecsa.citizen-science.net/about-us/ (Accessed October 26, 2023).

European Climate Adaptation Platform Climate-ADAPT (2023). Climate services. Available at: https://climate-adapt.eea.europa.eu/en/knowledge/adaptation-information/climate-services (Accessed October 26, 2023).

European Commission (2018). Horizon 2020: work programme 2018–2020: 16. Science with and for society. Available at: https://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-swfs_en.pdf (Accessed October 26, 2023).

European Commission (2019). Competence centre on foresight: S&T democracy. Available at: https://knowledge4policy.ec.europa.eu/foresight/topic/accelerating-technological-change-hyperconnectivity/si-democracy_en (Accessed October 26, 2023).

European Commission (2020). "Citizen science and citizen engagement: achievements in Horizon 2020 and recommendations on the way forward". 26, doi:10.2777/05286

GeoSphere Austria (2023). Phänologie an der ZAMG/GeoSphere Austria. Available at: https://www.phenowatch.at/ueber-phaenologie/phaenologie-in-oesterreich (Accessed October 26, 2023).

Irwin, A. (1995). *Citizen science: a study of people, expertise and sustainable development*. London: Routledge.

Irwin, A. (2018). No PhDs needed: how citizen science is transforming research. *Nature* 562 (25 October 2018), 480–482. doi:10.1038/d41586-018-07106-5

Merriam-Webster (2023). democratic. Available at: https://www.merriam-webster.com/dictionary/democratic (Accessed October 26, 2023).

Resnik, D. B., Elliott, K. C., and Miller, A. K. (2015). A framework for addressing ethical issues in citizen science. *Environ. Sci. Policy* 54, 475–481. doi:10.1016/j.envsci.2015.05.008

Strähle, M., and Urban, Ch. (2022b). The activities & dimensions Grid of citizen science. Proceedings of science PoS(CitSci2022)087. Available at: https://pos.sissa.it/418/087/.

Strähle, M., and Urban, Ch. (2023). Why citizen science cannot answer the question of the democratisation of science. Proceedings of Science PoS(ACSC2022)001. Available at: https://pos.sissa.it/407/001/.

Strähle, M., Urban, Ch., et al. (2021). Framework conceptual model. *Zenodo*. doi:10.5281/zenodo.5589618

Strähle, M., Urban, Ch., et al. (2022a). Conceptual framework for analytics tools. *Zenodo*. doi:10.5281/zenodo.6045638

Strasser, B., and Haklay, M. (2018). Citizen science: expertise, democracy, and public participation. Swiss science council. Available at: https://www.swir.ch/images/stories/pdf/de/Policy_Analysis_SSC_1_2018_Citizen_Science_WEB.pdf.

The Fab Charter (2012). The fab charter. Available at: https://fab.cba.mit.edu/about/charter/ (Accessed March 2, 2024).

Williams, D. S., and Jacob, D. (2021). From participatory to inclusive climate services for enhancing societal uptake. *Clim. Serv.* 24, 100266. doi:10.1016/j.cliser.2021.100266

World Meteorological Organization (2013). What do we mean by climate services? Bulletin 62 (special issue). Available at: https://public.wmo.int/en/bulletin/what-do-we-mean-climate-services.