

// WORKSHOP REPORT

STS AND CITIZEN SCIENCE COLLOQUIUM

02.04.2024, University of Vienna, collaborative event to the ECSA/ÖCSK 2024 conference



Fig. 1: Group picture of workshop attendees featuring 18 persons at Vienna University main building.

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The workshop was organised by Katja Mayer and Claudia Göbel in collaboration with the Zentrum Soziale Innovation ZSI.

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// WORKSHOP IDEA & CONCEPTUAL FRAME

Engaging with participatory research, technology development and science communication has been a driving force in the development of Science and Technology Studies (STS). In the field of Citizen Science (CS), where these and other themes converge, the paths of many people involved with STS in one way or another are crossing. Already the inception of the field is closely linked to STS with Alan Irwin's (1995) concept of CS¹ as a reference point and there is a growing number of STS researchers studying CS as their research object. However, the boundaries between doing STS and doing CS have always been permeable giving rise to a rich tradition of mutual engagement. Scholars from other academic backgrounds and CS practitioners draw on STS concepts and methodologies, while STS researchers get involved with CS projects, platforms and organisations. These engagements have been and continue to be vital for shaping participatory practice, research and the field of CS. Yet, strikingly, this vibrant cross-pollination is conspicuously absent at mainstream STS and CS conferences. Despite frequent citations, STS research on CS seems content in its academic enclave, barely reaching the dynamic, hands-on realm of actual CS implementation.

We have used an international conference on CS, the European Citizen Science Association 2024 Conference (ECSA2024) in Vienna, as an opportunity to come together and discuss STS research on, with and through CS, and vice versa. We asked, which current initiatives are underway? Are there common empirical, conceptual or methodological themes and challenges? What are the difficulties of working across research/practice and disciplinary boundaries? The call was distributed to both STS and CS networks and invited participants to an informal exchange on their work-in-progress at this interface.

The workshop was organised by Katja Mayer, University of Vienna, and Center for Social Innovation ZSI, and Claudia Göbel, University of Mainz. It was built on two previous workshops at the intersection of CS and STS (Mahr et al. 2018, Göbel et al. 2019).

Making and doing STS in CS and vice versa

The aim of this workshop report is to summarise key debates at this encounter and offer an overview of relations between STS and CS drawn by the initiatives presented. In this, we link to scholarship on research-practice relations, reflexive practice and engaged scholarship.

Abby Kinchy (forthcoming), in her outline of the different dimensions of interplay between STS and CS, highlights the shifting landscape of public participation in policymaking and decision-making. She underscores the need to appreciate the evolving relationships between scientific domains and their societal embeddedness. Moreover, Kinchy points out that the field of STS is increasingly engaging directly with its fields of study, which in turn enhances reflexive approaches within CS.

¹ Alan Irwin's concept of "scientific citizenship" highlights the role of citizens as active participants in science policy and decision-making, advocating for a society where individuals are informed about, engaged with, and have input into science and technology issues that impact their lives. This model seeks to expand the dialogue between science and society, promoting inclusivity, accountability, and transparency in scientific research.

In STS, researchers adopt two main perspectives on CS. Some consider it a broad analytical category that encompasses both historical and current forms of public involvement in science. Others focus specifically on the contemporary surge in activities explicitly labelled as "Citizen Science" by various stakeholders. This latter approach views CS as an actors' category, aimed at understanding its recent prominence and its relevance to the participants. The main actors in CS are described inline with Gabrys (2022) as *political subjects* who emerge through the processes of systematically producing knowledge and collaboratively tackling observed issues. The term 'citizens' is thus used more broadly than 'member of a nation state'.

Kinchy writes about how, historically, STS has been closely linked with activist engagement, and this interactive approach has recently been highlighted under the theme of 'making and doing' STS (Downey and Zuiderent-Jerak 2016). These initiatives aim to forge practices that extend STS perspectives into diverse arenas beyond academic debates, emphasising the importance of power dynamics, networks, and institutional influences in shaping scientific knowledge and its implications for politics and culture. We link to this concept to explore the multi-directional exchanges on producing and using knowledge when STS and CS meet.

STS making and doing is understood as "a mode of scholarship that involves attending not only to what the scholar makes and does but also to how the scholar and the scholarship get made and done in the process" (Downey & Zuiderent-Jerak 2016: 225). Thereby such practices are situated in a tradition of critically studying linear models of knowledge production and dissemination that are turned back at STS itself. How does STS engage with the contexts it studies? What are the aims and consequences of such exchanges? Such practices of engaged STS can be found in contexts of policy, design, art, education and training as well as organisation and technology development.

We consider CS as one important contemporary site where such practices of *making and doing STS* are applied and developed further. It needs to be emphasised that we do not assume that there is only "one" CS, but instead there are fluid boundaries between CS and STS as well as between CS and all the other domains of participatory and open research, which is the core of the idea of "transdisciplinarity" and new modes of knowledge production. This dual interaction of CS and STS often extends beyond academic boundaries, affecting practices and methodologies in both fields. Therefore, "making and doing" should be seen not merely as scholarly activities but as practices that involve both STS and CS practitioners and their environments.

We picked two key notions from the concept of *making and doing* to underpin the discussion at our workshop: (1) the one of *engagement* - reaching out beyond one's own circles of reference and building relations to others; and (2) the one of *reflexivity* - coming back a little bit different and changing something also back home. Importantly, we would like to not only focus on *who* engages whom and *what* is reflected. But especially *HOW* this is done – through which *concrete practices, methods* and *boundary objects*. With this focus on the *how* and the practices of exchange we do not only cater towards an academic question, but hope that we also create discussions with practical relevance. The CS activities workshop participants are linked to are very diverse. Thus, we borrowed the notions of *engagement* and *reflexivity* as a reflection tool from STS to create a common ground giving us insights on how we and others work, getting ideas for potential collaborations and asking what could be

done otherwise. Through mapping practices at this intersection, we can start finding words for describing this work better and potentially also exchange with other communities involved in *making and doing*. So, how is STS made and done in CS and vice versa?

Collective mapping

During the workshop we employed a collaborative approach to map the interconnections between STS and CS concepts, tools, and challenges, utilising a Miro board prepared specifically for this event. The board was pre-structured around the presentations. Throughout the workshop, attendees actively populated the Miro board with virtual post-its, detailing critical points and innovative ideas raised during talks and collaborative sessions. This interactive process not only facilitated a comprehensive visual map of the key elements and their interrelations within STS and CS across the presentations but also highlighted the practical challenges and methodological tools discussed. This visual and textual amalgamation from the Miro board guided our synthesis as the basis for this report.

// SITUATING THE GROUP

We started to present ourselves to each other by asking - Where do we stand? Between CS and STS as well as between research and practice. The initial exercise revealed that among the 14 participants—though not all placed themselves on the canvas—about half identified predominantly with one field or practice area, while the others positioned themselves at the intersection of fields and practices. While attendees that framed themselves as STS researchers or as CS practitioners positioned themselves further away from the intersection, those that identified as STS practitioners and CS researchers located closer to the latter. One could speculate that within these non-prototypical role combinations (e.g., STS researcher is more common than STS practitioner) we already find a certain degree of hybridity. Overall, there were more people identifying as researchers - as one would expect for a STS & CS colloquium at a university linked to a scientific conference. However engagement in practice contexts was also considerable for those positioning as researchers, which will be outlined below. We thus found that our meeting attracted, on the one hand, attendees with a dominant positioning in either STS or CS, who are somehow involved with - or interested in getting involved more with - the other field. On the other hand, several participants even identify as hybrids, which denotes intense interweaving of STS and CS in their work.

// PRESENTATIONS

The colloquium included a call for participation inviting researchers and practitioners to present on their work in progress drawing on CS and STS. To draw out joint themes of 'making and doing', participants were asked to respond to two questions in addition to their presentation:

1. *Could you please elaborate on the practical aspects of your work?* (e.g., what do you actually do, which methods/concepts of STS or CS do you use, which communities do you engage in or with, how do you bring things back to your own practice, where are the valuable intersections between STS and CS)
2. *What challenges do you encounter at the intersection between STS and CS?* (e.g., are there any gaps, obstacles, what would you wish for?)

Most of the presentations demonstrated how researchers are integrating STS methodologies or concepts within CS initiatives in various ways. Some projects focused on observing, analysing, and critiquing CS as their research object through STS methodologies. However, rather than representing merely detached academic initiatives, this *research on CS* had close connections to CS practice contexts, e.g. through integration in a larger project or organisation that implements CS. In this way, STS was used for the reflection and extension of CS initiatives. Another group included researchers, both STS and from other disciplinary contexts, implemented CS projects themselves and drew on STS as a way of critiquing and designing their practices.

In addition, there was a group of projects that mainly engaged with CS as a way of extending STS concepts and methodologies. This was done through STS research on science communication and policy-engagement practices, conceptual analysis of CS and other participatory approaches as well as through institution-building. In the last case, STS capacity and pathways for linking to practise context was not only challenged on an epistemological level but also regarding the ways and cultures of work as well as its institutionalisation in research institutes.

Overall, we thus found that in the work of attendees, *engagement* with CS was done to achieve greater *reflexivity* in both CS practice contexts as well as STS research. Several participants also worked the other way around, *engaging* with STS from what they consider as their primary base in CS for critiquing and extending concepts and methodologies (*reflexivity*) in both contexts.

How to Use Actor Network Theory to Research Human and Non-Human Actors in Citizen Science-Driven Interventions - Rina Vijayasundaram, Aarhus University & the City of Aarhus

Rina Vijayasundaram, Industrial PhD student from Aarhus University and the City of Aarhus, demonstrated the application of Actor-Network Theory (ANT) in analysing the roles of human and non-human actors in CS, particularly through [DivAirCity](#), a H2020 project, in which the City of Aarhus assesses air quality variations for different urban commuters. Her approach utilised ANT, Situational Analysis, and ethnographic methods to explore and map smart city ecosystems and the integration of citizen input in environmental monitoring. She focused on how wheelchair users and cyclists are involved in the project, doing not just the data collection, but helping with the planning, design, dissemination, and more. For this particular case, her goal is to help improve the city's use of Citizen Science in future projects.



Fig. 2: Pictures with participants in CS from the research context of the presenter.

Citizen Science, Invasive Species, and Collaborative Discoveries - Yaela Golumbic, The Steinhardt Museum of Natural History, Tel Aviv University

Yaela Golumbic of the Steinhardt Museum of Natural History discussed the importance of CS for early detection of invasive species in Israel, considering three discoveries of invasive species facilitated by distinct platforms for data collection - iNaturalist, facebook and museum collections. Her presentation focused on the advantages and disadvantages of each platform and the multifarious scepticism of professional knowledge workers towards citizen science engagement. A number of tensions were highlighted between citizen science's contribution to science and its contribution to society. For example the advantage of having many people contributing data vs. the concern for data reliability, or the need to make contributors feel comfortable and work within well known platforms vs. the need to systematically collect and store the data and also dealing with trust issues.

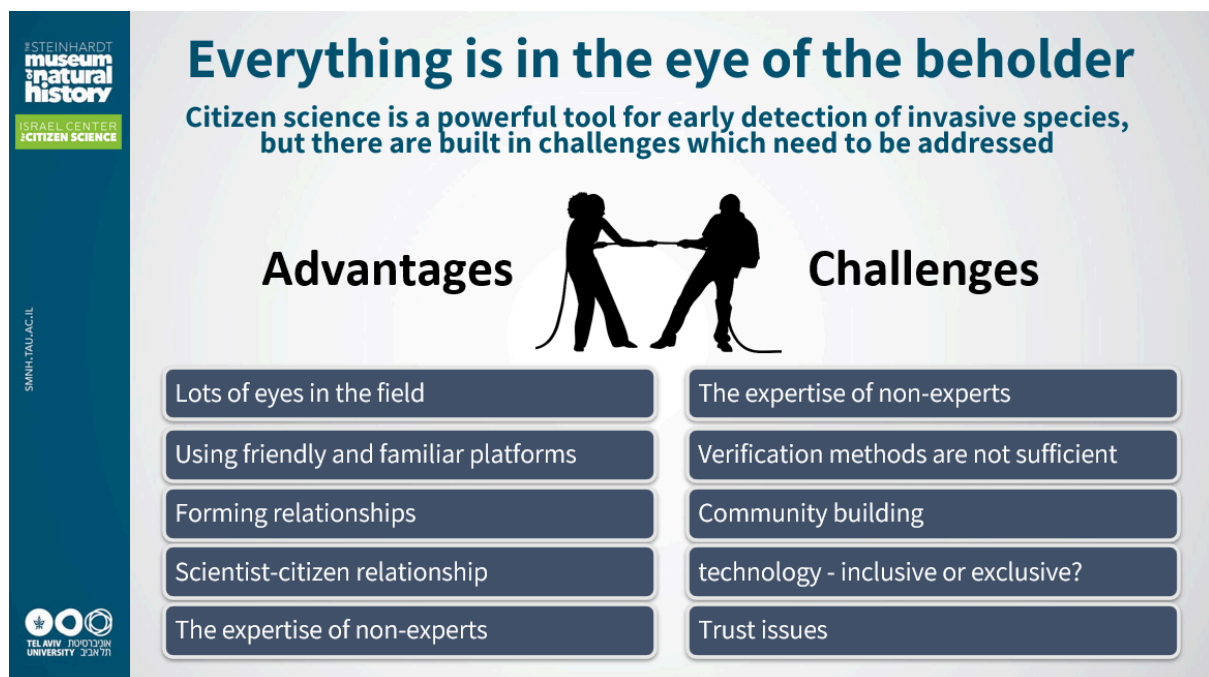


Fig. 3: Infographic on advantages and challenges of CS based on research by the presenter.

Practical aspects of this work - This study was conducted using qualitative research methods such as interviews with scientists, content analysis of articles and analysis of citizen science platforms. It engaged scientists involved in citizen science, aiming to understand their perspectives towards citizen science and public engagement in science and understand how to best support them. It also contributes practically to the development of citizen science projects in the future. STS perspectives allowed a critical appraisal of the CS practice, looking not only at the positive outcome (detection of invasive species), but also at the challenges scientists have encountered doing the process, to the extent they may wonder - is it worth it?

Challenges encountered at the intersection between STS and CS - My main challenge was applying STS concepts which I find quite abstract and theoretical to the practical work done within CS projects.

Experimentation Spaces for Citizen Science and Social Innovation - Karina Maldonado-Mariscal, Technical University Dortmund

Karina Maldonado-Mariscal from the TU Dortmund University, sozialforschungsstelle (sfs) addressed the intersection of CS and social innovation, particularly through the lens of 'experimentation spaces' like science shops. Her presentation highlighted the challenges and opportunities in bridging CS with social innovation practices, underscoring the need for enhanced dialogue and integration between the two fields. She stated that more experimentation and infrastructure is needed in both Citizen Science (Mayer et al., 2022) and social innovation (Howaldt, Maldonado-Mariscal et al., 2022) and presented some examples of science shops in Germany.

Practical aspects of this work: This study is exploratory. It uses interdisciplinary research, participatory research to involve citizens, and mapping tools. It integrates social innovation (SI) and CS concepts and encourages further dialogue between SI and CS communities.

It seeks to integrate a critical approach to (social) innovation processes with an STS perspective and it looks for overlaps and potential contributions from CS.

Challenges encountered at the intersection between STS and CS: My main challenge is to implement a more comprehensive link between theory and practice that also recognises the contribution of social innovation as a concept and as a process; to integrate research and collaboration between universities, SI labs and science transfer spaces to create synergies at local level using learnings from CS approaches.

Allies of expertise: how citizens defend the epistemic authority of science - Katharina Berr, Weizenbaum Institute, Berlin

Katharina Berr explores how citizens in online communities aim to uphold the epistemic authority of science online. Contrary to previously studied forms of public engagement with science such as citizen science (both in the sense of Bonney, 1996 and Irwin, 1995) or lay expertise (Epstein, 1995), in this case people do not claim insight or participation in expert work. Instead, they understand their role in defending (what they regard as) scientific expertise against (what they regard as) "post-truth" phenomena on social media platforms – not always in ways that would be deemed appropriate for scientists themselves. To connect this case with previous work from STS and CS research, three metaphors were introduced

that frame citizens as (1) guests in the house of science, (2) protesters claiming a seat at the table, or (3) allies guarding the gates.

	Guests in the house of science	Protesters claiming a seat at the table	Allies guarding the gates
What is at stake?	Public understanding of science	Societal relevance of science	Epistemic authority of science
What motivates laypeople to engage with science?	Individual preference and interest in science	Personal or political stakes in specific research fields	Post-truth threats to democracy
How do laypeople relate to scientific expertise?	Volunteers	Contributors and corrective	Epistemic subordinates
How do laypeople contribute to science?	Supporting scientific work with data and labor	Informing scientific work with lay expertise	Disseminating and defending scientific expertise

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Fig. 4: Metaphors used to frame citizens based on research of the presenter, further literature that is not visible on the screenshot but informed the metaphors and overview: Bogner, 2012; Mayes, 2023; Shapin, 1992; Wenninger & Dickel, 2019.

Practical aspects of this work: This study draws on a two-year digital ethnography during the Covid-19 pandemic. This methodological approach allowed for in-depth insights into the perceptions and practices of citizens who put themselves in the service of science without understanding themselves as citizen scientists. This observation was then further informed by STS literature that emphasises how citizens engage with science in different ways and for different reasons; and not always in accordance with the expectations of academic discourse or science policy programs (see for example Chilvers & Kearnes, 2020; Horst & Michael, 2011; Mendel & Riesch, 2017).

Challenges encountered at the intersection between STS and CS: While STS provides valuable, critical lenses to reflect on the realities of public engagement with science, it is harder to translate this critique back into practical guidance for those citizens engaging with science. In other words: How could citizens who aim to defend science against “post-truth” phenomena benefit from STS knowledge?

Citizen science and post-normal science: mapping how participation disrupts decision making - Muki Haklay, UCL, London & Learning Planet Institute, Paris

Muki Haklay of UCL and the Learning Planet Institute argued how in the framework of Post Normal Science (Ravetz and Funtowicz 1992), the mapping of CS typologies show that most CS aligns with applied science and professional consultancy (Haklay et al. 2023). These are within the realm of Normal Science and not Post-Normal Science. This means that the idea of an extended-peer community can operate within both Normal and Post-Normal Science, but in the former it is much more restricted in the role and activities that non-professional can play.

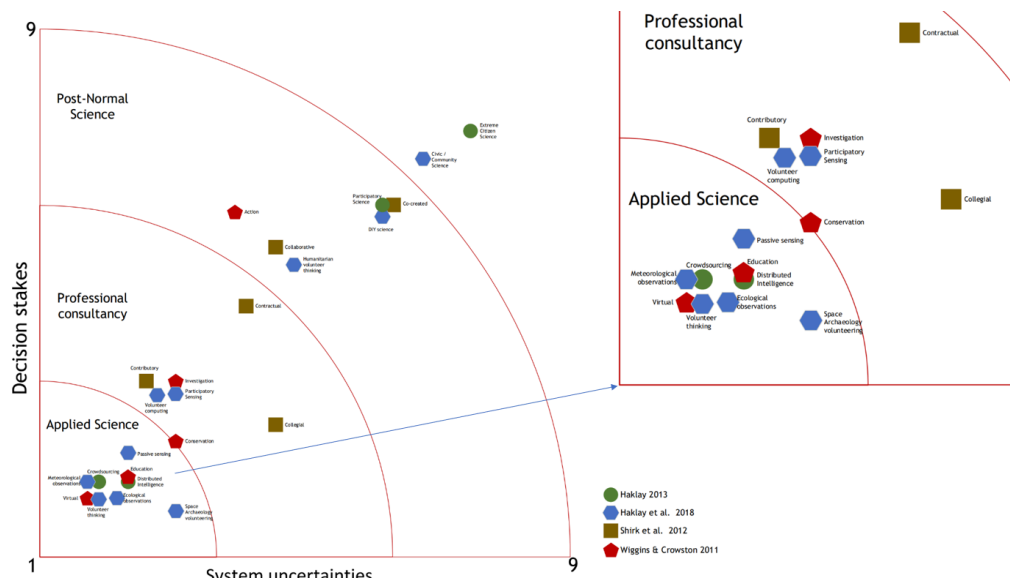


Fig. 5: Infographic mapping CS typologies in a PNS framework based on research by the presenter.

He outlined, however, how, by tracing a specific citizen science project along a similar analysis and the zone of problem solving that Post-Normal Science literature offers, CS can disrupt traditional trajectories and challenge established regulatory frameworks. The potential of CS to shift issues back into the realm of PNS and influence policy illustrates its disruptive capacity within the science-policy interface.

Building a Ping Pong Team in an Institute designed for Golf - the case of the Citizen Science Lab at CWTS - Margaret Gold, CS Lab at Leiden University

Margaret Gold discussed the structural adaptations required to foster CS within traditional research institutions, using her work at the Citizen Science Lab at CWTS, Leiden University, as a case study. Her insights into the 'ping pong team in a golf-designed institute' metaphor highlighted the frictions and flexibility needed in academic settings (also STS!) to accommodate participatory research practices effectively.

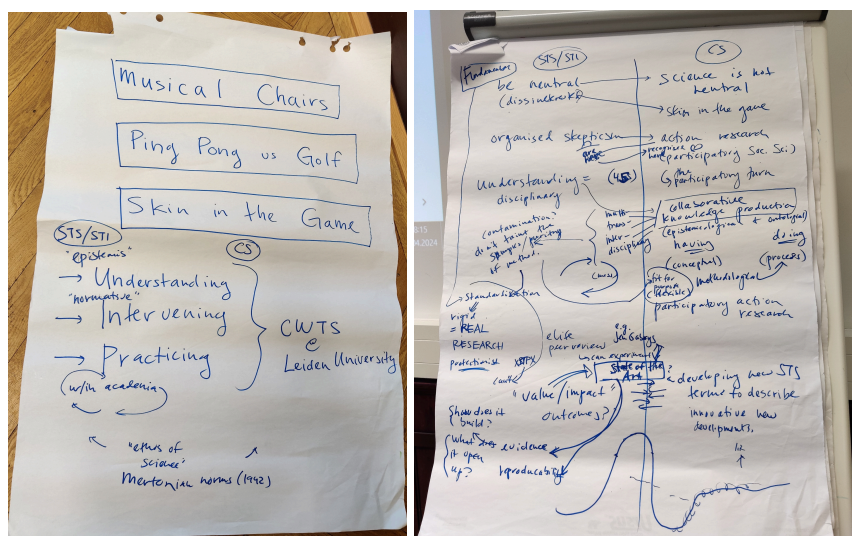


Fig. 6: Illustration of central questions for discussion based on the presented case.

Science and technology studies on critical data analysis and - literacy by and with Citizens in Citizen Sciences - Disapproved (Data) Sciences? - Sophia Segler & Julia Gantenberg, University Bremen

Sophia Segler from University Bremen presented on enhancing approaches of co-interpreting data and to what extent critical data literacy among citizens is possible through the citizen science project "[Exploring society together](#)" (GINGER) at University Bremen. They piloted the format [Public Data Sprints](#) to analyse digital political information networks on Twitter (now X) -datasets within a two-day event, similar to hackathons (Venturini et al. 2018, Segler & Gantenberg 2023). By doing so they collaborated with and applied the digital learning and research platform "[Exploration of Political Information Networks](#)" (EPINetz). Their focus was on developing methodologies that enable critical and productive co-interpretation of big data sets with citizen scientists. While on the one hand citizen scientists can learn central analytical and critical methods by participating in the interpretation of data, on the other hand the contribution of citizen scientists' lifeworld experiences is an yet underestimated factor for data analysis in terms of the triangulation of methods and so of perspectives on data. However, the question of appropriate ways and approaches of co-interpretation of data in citizen science is still a relatively unaddressed research discipline for the field of science and technology studies that is worth to be further examined and simultaneously elaborated in practice.

Combining voices with youth citizen scientists and youth citizen social scientists? - Claire Murray, Freelance Scientist and Science Communicator

Claire Murray, a freelance scientist and communicator, presented her work on equity and respect in integrating marginalised voices of participants in CS projects. Her approach emphasised ethical engagement and the valorisation of contributions from all participants, particularly in projects involving underserved communities. Conceptual frameworks from STS can be useful in tackling these issues.

// DISCUSSION GROUPS

In addition to a format of academic presentations, we wanted to open a space for exchanging on more practical aspects of realising work across CS and STS. How can engagement and reflexivity be done (better)? What is needed and what are obstacles? How do people address such themes in their work?

(1) Effective Communication of Co-Creation and Participation Approaches to Peer Reviewers for Successful Research Proposals? - Rafaela Cavalcanti de Alcântara & Doris Allhutter, ITA Austrian Academy of Sciences, Stefanie Schürz, ZSI



Fig. 7: Discussion group 1 in action.

In this breakout group we discussed strategies to communicate the objectives and implementation of a 'co-design research' design to reviewers. Parts of a project proposal that usually help a reviewer to assess the feasibility of a project, e.g. detailed research questions and methods used, may be developed as elements of the co-research process with citizens. What guidelines do we have in citizen science to be as specific as possible in our proposals for reviewers to be able to evaluate the expected outcomes of a project that they have to argue for in a funding committee?

(2) Getting a better understanding of Ping Pong and Golf by mapping STS/STI and CS - Margaret Gold, CS Lab at Leiden University



Fig. 8: Discussion group 2 in action.

In this breakout group discussion we were starting to explore how to effectively integrate CS into research organisations traditionally unaccustomed to such participatory approaches,

using Ping Pong and Golf as metaphors for the practices established in CS as compared to a large research organisation. Ping Pong - or later preferably the metaphor of ultimate frisbee - represents the idea of smaller scale, flexible and adaptive (in scope) processes that might need to be frequently changed because of co-created needs of the players, emphasising quick, responsive interactions. On the other hand, Golf symbolises the more traditional, planned, and paced approach of research within established academic institutions. In the discussion we were beginning to chart the relationship and interactions between traditional STS/STI (Science, Technology & Innovation) ideas and the emerging practices of CS, with the goal to identify areas of potential synergy and but also resistance. It became clear that institutionalising CS in a big research organisation requires a transformation of organisational culture, policies, and processes to accommodate collaborative, participatory research methods.

Creating Understanding:

- Initially, there's a need to build a comprehensive understanding of CS within the organisation, educating stakeholders on its value, principles, and potential impact on research quality and relevance.

Modes of Intervention:

- Developing interventions would involve creating strategies and tools to facilitate the incorporation of CS. This could mean designing pilot projects, adapting methodologies, or modifying existing frameworks, and taking part in national and international networking activities.

New Modes of Collaboration:

- Lastly, establishing new forms of collaboration is crucial. This might involve rethinking hierarchical structures.

The goal is to find a balance that integrates the iterative, inclusive nature of CS (Ping Pong) with the strategic, structured research approach characteristic of traditional institutions (Golf), ultimately enhancing both the scientific and social process through diverse contributions.

(3) How to combine voices by framing each other in more equitable ways? - Claire Murray, Freelance Scientist & Science Communicator & Katharina Berr, Weizenbaum Institute



Fig. 9: Discussion group 3 in action.

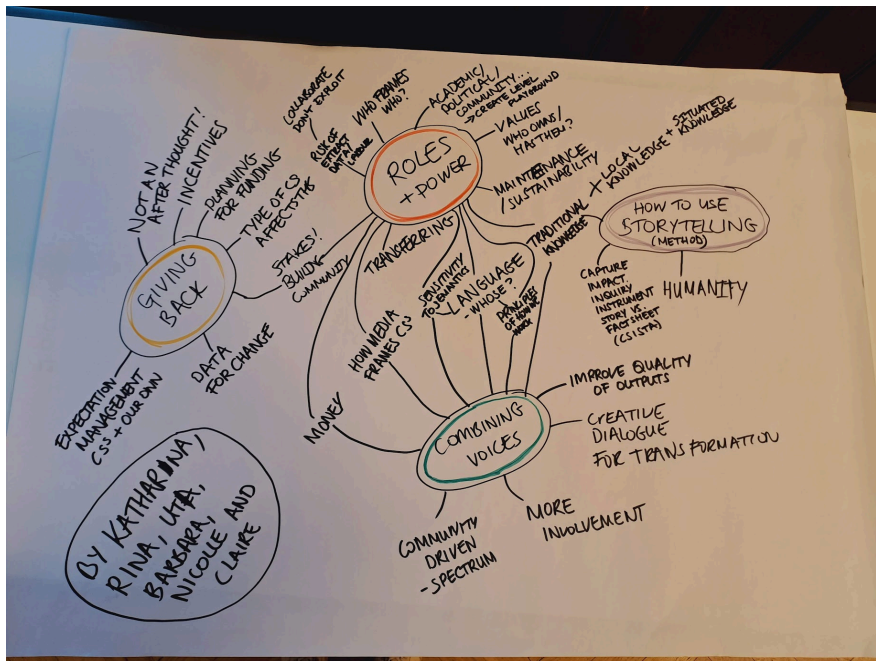


Fig. 10: Summary of main topics of discussion on combining voices in more equitable ways.

In this group discussion we reflected on how different actors involved in citizen science research and practice can think about and interact with each other in more equitable ways. This included reflections about roles and power dynamics, notions of “giving back” to citizens who support or participate in science, the idea of “combining voices”, and the potentials of storytelling as a method.

At the centre of our groups’ visualisation (maybe by chance, maybe not) lies the question of whose language ought to be used in citizen science projects. We agreed upon the importance of finding a shared and inclusive language.

// MAPPING THE MUTUAL MAKING & DOING OF STS & CS



Fig. 11: Screenshot of collective notes taken during presentations.

During our workshop, two distinct approaches of STS to CS emerged: The active practice of “making and doing” STS through engaging with CS practice as well as the STS-inspired study of CS. The latter again co-shapes CS by influencing the discourse on its practices, norms, and impacts. This work was thus generally in line with the relationship between STS and CS as delineated by Kinchy (forthcoming). In addition, we found people primarily involved with CS engaging with STS concepts and methodologies to remake both their own participatory research practices as well as to contribute back to enrich and challenge STS concepts and even institutional settings and ways of working. Such approaches go beyond what is currently discussed as STS making and doing because the impulse for engagement and reflexivity emerges not from STS itself but from practice contexts.

In these mutual ways of ‘making and doing’ STS and CS the following central themes emerged from the collaborative mapping:

Trust

In the realm of CS, trust emerges not only as a foundational element for successful collaboration, but also as a starting point for some CS initiatives: such as those trying to create more trust in scientific knowledge in general by means of participatory research. This last aspect was not central in our discussion. However issues such as difficulty in working with volunteers due to trust deficits, and the strained relationships between citizen scientists and traditional researchers or archivists highlight the necessity for robust trust-building measures to enhance cooperation and achieve collective goals. We also learned that instrumentalising trust into technical platforms or standards is often not sufficient.

Cooperation: Trust significantly influences the dynamics of participation and hence collaboration, affecting volunteer / citizen / co-researcher reliability, but also the building of community and their cohesion. There is evidence that the embrace of epistemic diversity while ensuring theory-informed practices helps to support trust-building and hence community action.

Institutional Aspects: Institutional trust impacts how CS is integrated within or aside of traditional research settings, affecting everything from changes in the merit systems to the integration of participatory approaches in curricula, up to the general institutionalisation of CS practices. Establishing institutional trust and reliability is also important so that CS can be harnessed in regard to the third mission of universities, and effective quality management up to questions of research integrity and the training of institutional review boards.

Knowledge Production: Trust shapes the contours of knowledge production by being a fundamental aspect of co-creation and decision making in terms of who is given the power to generate and disseminate knowledge. Discussions around making science more visible and understandable, and co-authorship with citizen scientists, underscore the role of trust in redefining authority and expertise in knowledge production and promoting inclusive research.

Expertise

As we can see in the virtual post-it landscape, there are overlapping issues of trust and expertise, respective to the authority of knowledge. At the intersection of STS and CS, the

expertise of participants as co-researchers presents both an advantage and a challenge, making a re-evaluation of what constitutes authoritative knowledge necessary. This shift has led many to discussions on the symmetry of science and anti-science stances especially in times of extreme politics and the “post-factual”.

In the workshop presentations and discussion, the shifting boundaries of expertise and the role of authority in knowledge production within the CS community are recognised. The discussion reflected the ongoing negotiation around the credibility and cultural authority of science as well as active efforts to redefine scientific expertise. The notion of “post-expertise” suggests a re-evaluation of the role of experts in a context where knowledge is co-produced by scientists and citizens.

In this context it was often mentioned that we should listen more to our research participants regarding how they define themselves, and how they describe their positions. This means also being careful not using terms like “vulnerable” without prior joint reflection.

Institutionalisation

Institutionalisation in the context of CS as gleaned from the MIRO board refers to how CS is being integrated into established organisations and systems. Above, we have already mentioned how important it is to establish institutional trust. Changes in reward systems and the incorporation of CS activities into museums and natural history collections indicate a shift towards embracing CS as an integral part of the cultural ecosystem. Additionally, the reference to the “third mission of universities” (as a way to “sell CS to the decision makers”) underscores the drive to extend the role of higher education beyond teaching and research to include community engagement, which is a key aspect of CS.

In the last years there have been several efforts around the world to institutionalise CS, such as the European Science Association, numerous regional or domain specific associations, and many dedicated conferences. And there are efforts by the [European Citizen Science Academy](#) to create a modular curriculum available also for adaptation by education and research organisations. We also see more funding programmes, and more push on the side of policy makers to mainstream CS into long-term programmes. However, we hear from workshop participants that especially funders, but also institutional review boards, will need more training in evaluating CS activities.

STS Theory and Method

The presentations and discussion at the workshop indicated that STS theories and methodologies are actively informing the practice and conceptualization of CS. Actor-Network Theory, for instance, is used to understand the roles of various human and non-human actors in CS projects. Mapping techniques and situational analysis are being applied to visualise and analyse the complex relationships and contexts within which CS operates. The framework of post-normal science reflects a STS-inflected understanding of the role of science in society, but also the logics of the science system particularly in situations where there is high uncertainty and decision stakes are significant. Accounts of imagining and re:making publics in participatory activities are used to inform own project designs and as tools of engaging in community discussions. These references show that

STS frameworks are deeply integrated into the thinking and practices of those engaged in CS and adapt it to the needs of their cross-disciplinary practices.

CS Practice and Theory

In addition to STS serving as a resource for getting a better understanding of and extending CS regarding knowledge, social constellations, institutionalisation and power dynamics, we also observed various ways in which CS is used as a resource for STS. CS does not confine itself to established frameworks of policy-engagement and at times prompts a refinement of analytical concepts as well as institutional channels for fostering public participation. Implementing CS may also challenge how STS is made and done in its academic homebase calling for self-reflexivity and 'making and doing' to not only happen on special occasions designated by STS scholars but as a more integral part of STS culture. Also, CS projects relying strongly on data analysis at times push beyond being categorised as merely contributory and extractive, as certain STS discussions have done in a generalising way, and work towards realising a more emancipatory vision of CS as critical data science. STS frameworks are also translated and expanded beyond their at times highly theoretical and technical contents to be more widely usable as tools for reflection in practice contexts. Finally, the CS community reflects itself in journals, handbooks, discussion circles or collaborative research endeavours on the diversity of CS practices, building own frameworks and theoretical concepts deeply ingrained in the various contexts of doing participation, organising and policy-making that go beyond STS attempts to systematise and evaluate the emerging approach of CS from afar. Such kind of work can also be read as CS emancipating itself from being merely a research object of STS or a practice context that benefits from theoretically-informed reflexivity. As our experiences from the workshop show, STS scholarship and practice can find both a welcoming and epistemologically inspiring contexts of collaboration here.

// SYNTHESIS



Fig. 12: Screenshot of collective notes taken during synthesis session.

At the end of our half-day multifaceted conversation on the vehicles, impacts, and challenges of bringing STS and CS together, we asked for feedback and what participants regarded as common themes. From the feedback we conclude that the "making and doing" approach was effective, as it was indeed possible to highlight capacities for engagement beyond scholarly conversation and fostering reflexivity that reshapes our academic and practical environments. Our exploration into the projects revealed CS' significance as a field where STS practices are applied but STS refinements might happen elsewhere.

However, the perspective of "making and doing" is very much at home in STS and treats STS research objects' and fields' as external and somewhat residual. For our purposes, the concept of 'making and doing' needed to be adapted to adequately grasp the two-way relationship between STS and CS. We wanted to understand how STS is made and done in CS and vice versa. Joint focus of the initiatives presented at the workshop was the field of CS. Here, we find various scholarly initiatives of doing STS research on, with and through CS that could be described in the proposed terminology of making and doing. What STS sees as reaching out and bringing back in, however, from a perspective of someone primarily engaged in CS might rather feel like reaching in or even intruding, contributing or grabbing something and doing all sorts of things back outside that might backfire. At the same time, we also find CS research that draws on, works with and through STS notions and methods. There is thus a dual motion of exchange reaching across boundaries, *engaging others* (along with their tools, conceptual and methodological repertoires) and *becoming reflexive* in the sense of bringing something back to transform oneself or one's home context (e.g., make a better practice or theory). Our perspective thus needed to be grounded on two legs – STS and CS. Imagined in this way, *making and doing* is not only a mode of scholarship, but rather a mode of practice going beyond scholarship. It thus attends to what STS and CS practitioners do and how they are made in the process.

We all could see the fluidity that exists between CS, STS, and the wider sphere of participatory research. This dynamic interplay, with STS reaching into CS and CS enriching STS, was guiding our focus towards the concepts, and the tangible practices and methods that underpin this exchange. The workshop showcased the potential of STS and CS reflective tools to uncover insights for collaboration, or even inspire innovation in science, and elevate the visibility, relevance and usability of these practices across communities.

Engagement

Critical STS scholars have long advocated for broader participation and recognition of diverse forms of expertise in science, aiming to counteract discriminating (colonial, racist, patriarchal, and capitalist) practices in scientific knowledge production. Despite the rise of CS within mainstream institutions, there is ongoing debate about its effectiveness in transforming scientific practice and complex power dynamics by creating multiple forms of authoritative knowledge through inclusive participation (see also Kinchy, forthcoming). The experiences from the workshop in that regard are very positive, even though many state that it is indeed a slow process, which does not fit in the project - or institutional logics of the science system. The same is true for STS research engaging with CS contexts and seeking to both enrich public engagement practice and STS analysis. Some participants claimed that STS should make more room for more practice-oriented work. Others were simply pursuing their innovative practices of merging the analysis and critical reflection of science and technology in society outside of STS circles, perhaps at times borrowing something that

seems useful. We uncovered that this work has the potential to also bring something back to STS, if spaces of exchange that allow for multiple ways of knowing and working are created.

Reflexivity

Reflexivity is integral to all projects presented and discussed, as researchers apply the same analytical methods to their own work as they would to other scientific practices. This self-reflection and analysis help uncover broader social dynamics that may perpetuate the very issues the projects aim to address.

Our workshop highlighted the ongoing challenges of integrating established scientific knowledge criteria with knowledge produced by citizens and the difficulty of embedding these collaborative forms of knowledge production within traditional scientific institutions. Some workshop participants felt that despite STS being very interesting, they feel more at home in CS, as there is broader social impact and STS is still too “academic”, meaning that research is done from a distance instead of engaging with the fields of study. The concern was stated that while working interdisciplinarily it becomes even more evident how the different silos are constantly “reinventing the wheels”. Social Innovation, Science Shops, and many other forms of knowledge production that aim to transform society in a participatory manner are failing to synergize with other domains of participatory knowledge practices. STS could and should be a place where this knowledge comes together, creating a foundation of knowledge about (public) participation in science and policy, and indeed how those publics are coming into existence and are sustainable in their impact.

One final key takeaway from our discussions was the need for additional spaces that foster exchange between STS, social innovation, CS, and other participatory knowledge domains. Such collaborative spaces would facilitate mutual learning from each field’s unique or similar practices. Beyond traditional academic publishing, these spaces could pioneer innovative, dialogue-focused formats that leverage online environments for more dynamic and interactive knowledge sharing.

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