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DEMOCRATISING SCIENCE BY "DOING IT TOGETHER"

We are coming to the end of three years of Doing It Together Science, a coordination and support action to widen and deepen public participation in science across Europe. This article explores our efforts to expose half a million people to a wide variety of types and depths of citizen science, and how to bring together people from science, industry, policy making and the general public to share information and ideas and bring us closer to the democratisation of science.

As we celebrate the conclusion of BigPicnic, we also take a look at its "sister" project, Doing It Together Science or DITOs for short. It was funded in the same call from the European Commission Horizon 2020 programme, and ran for the same period. The call was part of the focus on *Science with and for Society* that aims to link the Horizon 2020 programme with ordinary people. Like BigPicnic, DITOs has been collecting and sharing best practices for public participation in science.

We saw in May's 2018 issue of Roots how constructivist or sociocultural learning can happen in an informal learning environment such as a botanic garden. DITOs takes members of the public - from all walks of life - a step beyond informal learning and into discussion, decision-making, and even the production of scientific knowledge. This has occurred through over 700 events, which engaged over 500,000 people across Europe (and many more online).

↑ *A BioBlitz run by DITOs, as part of our >700 events ©Waag Society (DITOs partner)*
Top: Making a seedbomb at a DITOs workshop ©DITOs consortium

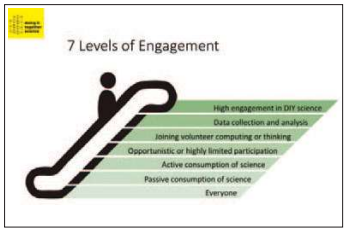
Citizen science is a process where research or scientific processes happen outside traditional scientific institutions, or is undertaken by people who are not working scientists. Citizen science is enormously varied, ranging from using phone apps to record light levels all the way up to the citizens defining the problem to research, carrying it out, analysing it and disseminating the findings. DITOs runs a variety of events aimed at introducing people to a wider range of scientific activities in which they can participate. Examples are exhibitions that encourage people to make observations of nature in their homes, discussion groups about films that show how people use science to solve problems, and bioblitzes where people join professional scientists in recording nature.

DITOs addresses the major role citizens have to play in creating a sustainable future, by raising awareness and building capacity for citizens to study their environment and new innovations such as DIYBio - Do-It-Yourself Biology - in which people experience the ability to analyse and manipulate DNA and other molecules. The project also runs roundtables for policy makers to meet and work with citizen scientists, and think about their needs. Like BigPicnic, DITOs brings people from policy, science and industry together with the public, to promote dialogue and collaboration and ensure that future policy is informed by a broad range of perspectives - including that of citizen scientists, who may be aware of local issues that academic scientists are not. Such issues may be instances of pollution, or of the growing field of biotechnology, the latter of which is a subject of excitement and suspicion (DITOs consortium, 2017) but also an activity often undertaken outside the professional laboratory. Our areas of focus, therefore, include both people and science: engagement with the public; engagement with policy makers; Biodesign (DIYBio and biotechnology) and environmental sustainability (nature and wider environmental observations and analysis). All the events we hold are a cross-section of at least two of these four areas.

One of our most enjoyable - and best remembered - DITOs creations was the Together Science Bus, which toured Europe over the summer and early autumn of 2017. This bus transformed into an open scientific laboratory, similar to the XperiLab bus developed by the Natural History Museum in Belgium, which has been visiting schools all over Belgium since. The Together Science Bus visited multiple locations in nine countries, stopping at locations chosen for their lack of easy access to scientific activity but accessible by the public. For example, outside community centres. We ran friendly workshops that asked people to make things: sunscreen, pH meters, phone chargers. These not only demonstrated scientific principles, but also empowered people to use their hands and simple ingredients to observe or make small changes to the world around them.

← *A Together Science Bus workshop: discussion ©UCL Extreme Citizen Science*

"Common conceptualisations of participation assume high-level participation is good and low-level participation is bad. However, examining participation in terms of high and low levels of knowledge and engagement reveals different types of value in each case."
Muki Haklay, Citizen Science: Innovation in Open Science, Safety and Policy



↑ *The "escalator" envisioned by DITOs, in which participation in science can exist at different levels ©Muki Haklay*

"Citizen science projects actively involve citizens in scientific endeavour that generates new knowledge or understanding."
Lucy Robinson, 10 Principles of Citizen Science

↑ *The Together Science Bus ©UCL Extreme Citizen Science*

← A Together Science Bus workshop: making sunscreen ©UCL Extreme Citizen Science

The bus was driven and workshops run by 'bus captains', nearly all of whom were students with an interest in science communication. As well as talking to the public, however, the bus captains listened to them. They built up a collection of 'life hacks' and 'folk remedies' (roughly translated from the traditional Dutch phrase for 'garden and kitchen wisdom' or 'grandmother's wisdom') as told to them by people from different areas, and these and all the experiments from the workshops were shared on social media and the bus's website for people to use and compare.

Of course, sharing a life hack about how to keep your basil plant alive or a folk remedy for curing bee stings is very different from informing policy makers about gene editing or pollution recording. This variety is deliberate. One of DITOs's aims is to introduce people to both a variety of types of citizen science as well as different levels of participation.

The study of public participation in science has been compared to Arnstein's ladder of public participation (Arnstein, 1969; Haklay, 2018), which compares proper citizen-led involvement in public decision-making to unsatisfactory appearances of involvement, such as tokenism and placation. It is true that many citizen science projects are top-down, set by the scientist, and have a specific and often simple task for the citizen scientist, who has no say in the problem definition, evaluation, or any of the many other steps (Robinson, 2018). However, this is not necessarily a problem. Many people come to citizen science facing many barriers, including prior education, time, equipment, access and confidence, and are therefore not ready for a high level of participation (Krebs, 2010; Newman *et al,* 2012).

DITOs thus visualises an "escalator model" of participation in citizen science, with the general public. From the bottom, a large number will step onto the lowest step, where people might read or watch the science bulletins on the news or visit a science museum. As people move to higher levels, they might reach a point where they are ready to classify galaxies on Galaxy Zoo, download the World Community Grid, or be members of the British Trust for Ornithology. At the very top, a small number remain, and they are participating at an extremely high level, such as DIY Biology. Such people are currently likely to have a very high level of education and access to collaboration and equipment.

Importantly, it should not be assumed that any level has any higher value than another. DITOs offers people entry to whichever level each individual feels comfortable. From attending an exhibition to taking part in a wetlab, for example. By exposing them to both higher and lower levels (they might wish to move a level up - or they might face some new barrier, such as having less time, and need to move a level down to keep participating) people can find their own niche. This then allows for a process by which individuals can gain experience and confidence, and then become more ready to reach the level of decision-making in science, such as by meeting policy makers.

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