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Citizen Science: Doing excellent research with citizen science – opportunities and challenges

Muki Haklay, Extreme Citizen Science group
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Twitter: @mhaklay / @ucl_excites

Overview

- Spectrum of activities in citizen science
- Example from Frontier Research (ERC) – ECSAnVis
- European policy support for citizen science
- Citizens interest in science – Eurobarometer 516

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Citizen Science

Long running Citizen Science

- Ecology & biodiversity
- Meteorology
- Archaeology

Citizen Cyberscience

- Volunteer computing
- Volunteer thinking
- Passive Sensing

Community Science

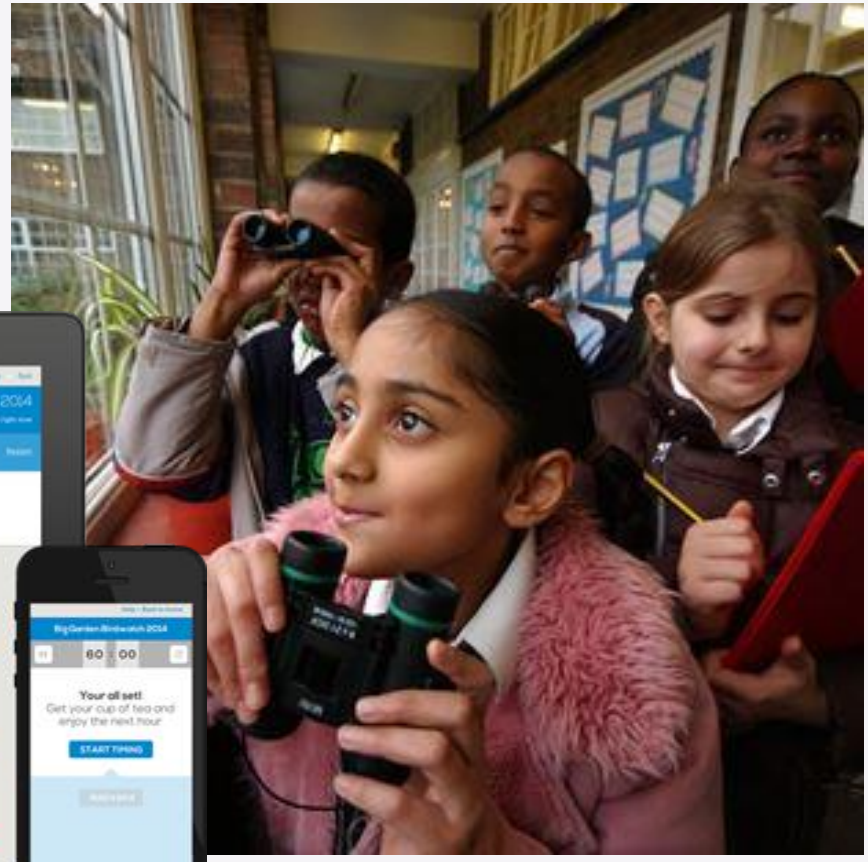
- Participatory sensing
- DIY Science
- Civic Science

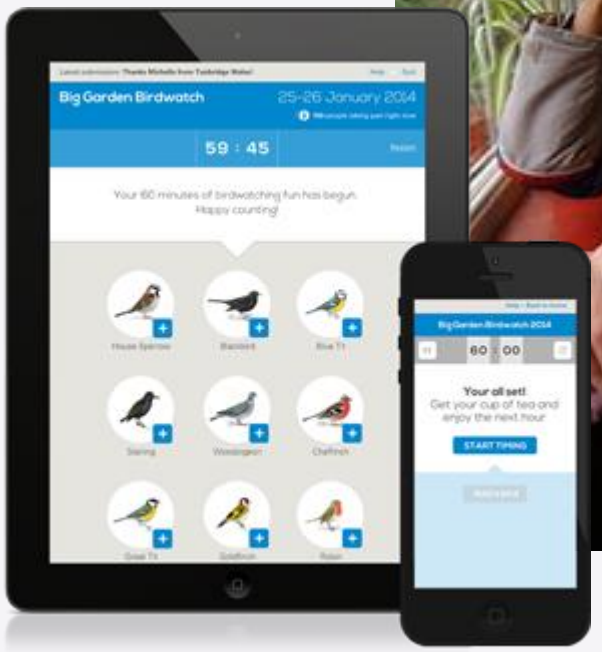
Haklay, Mazumdar & Wardlaw, 2018, Citizen Science for Observing and Understanding the Earth, *Earth Observation, Open Science, and Innovation*

Biodiversity/Ecology/Biological recording

- Ecological observations of plants and animals (esp. birds), continue to be popular
- A review in 2012 identified 234 projects in the UK
- Big Garden Birdwatch – 1 hour, end of January, structured reporting, and over million participants in 2021

Participating in Big Garden Birdwatch (source: RSPB)





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Volunteer computing

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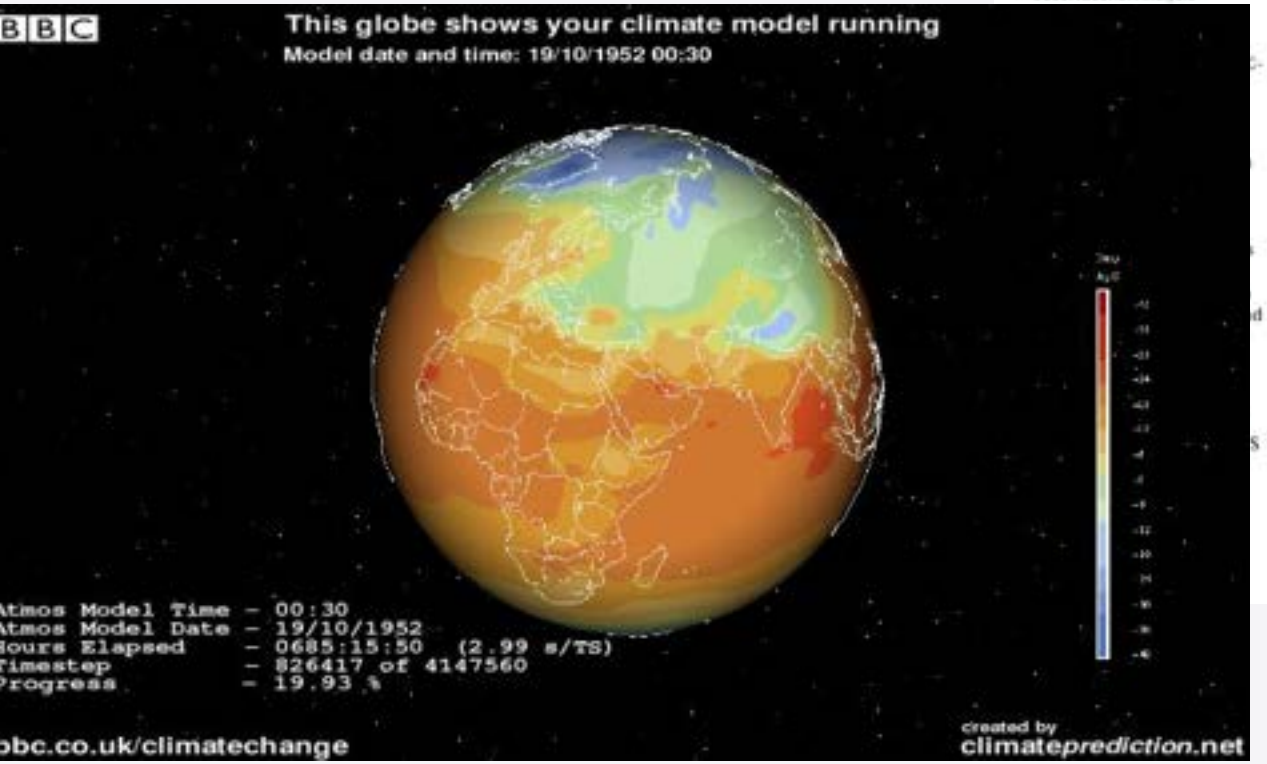

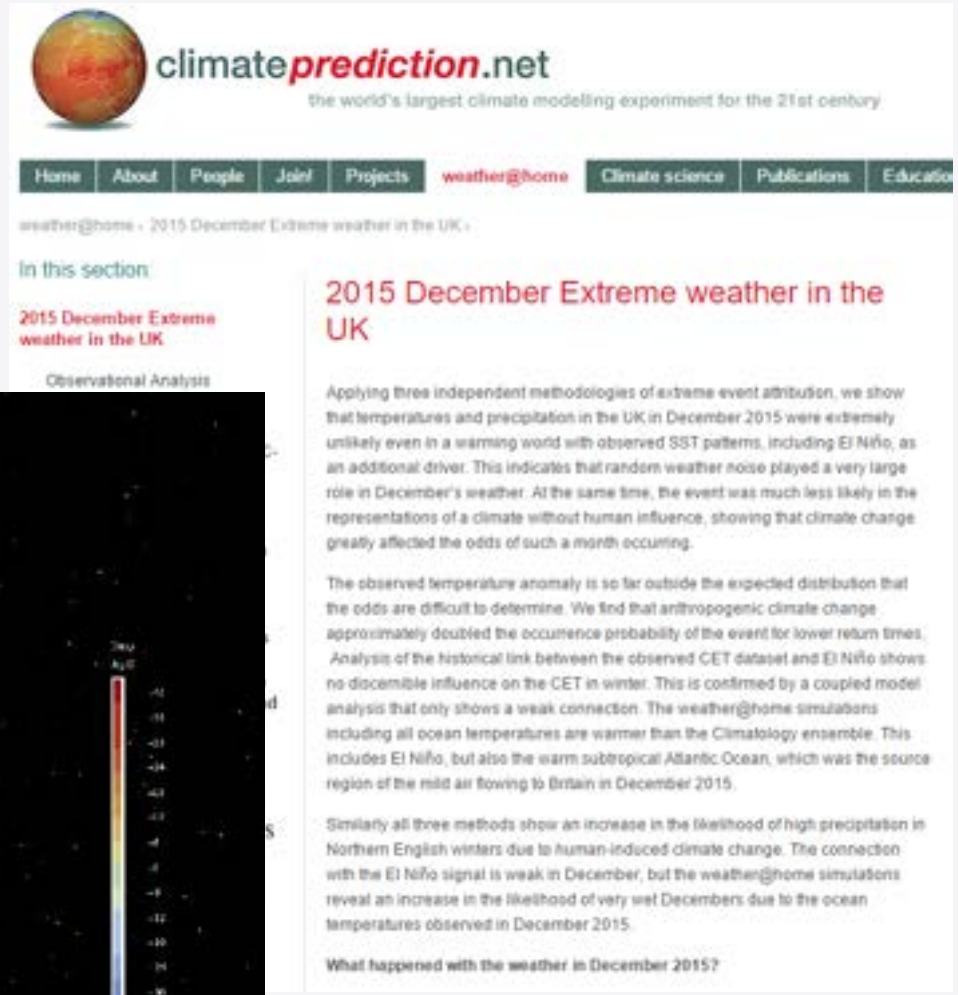

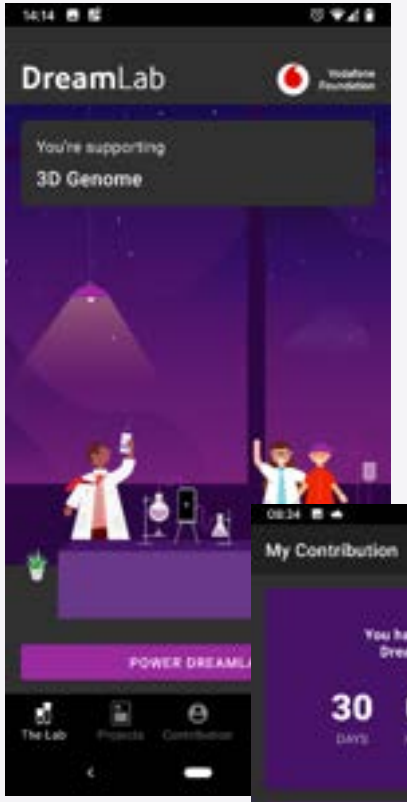

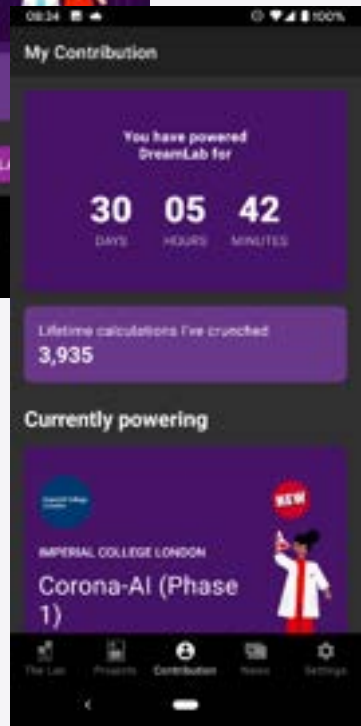

Volunteer thinking

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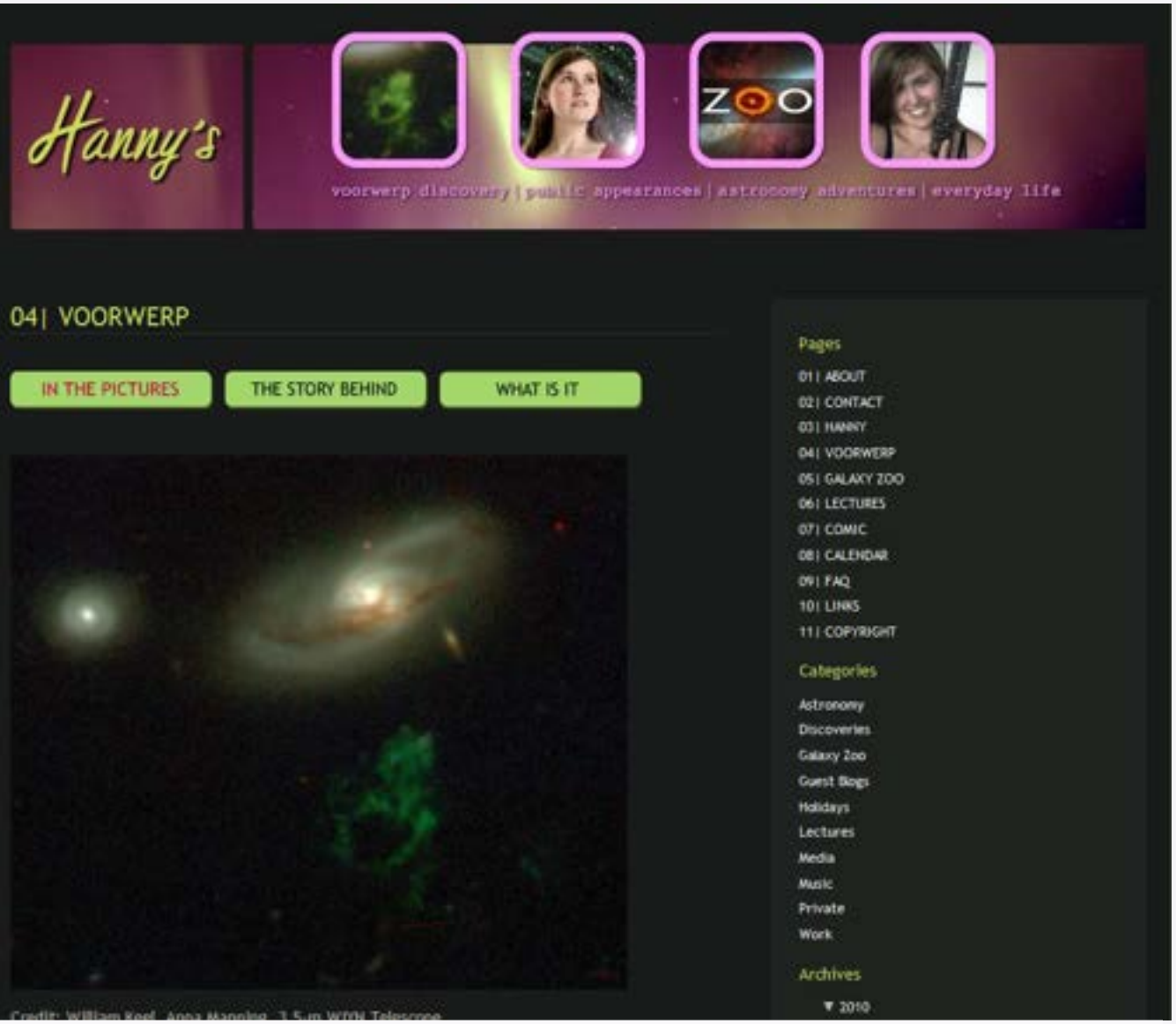

Hanny van Arkel. "The Dutch schoolteacher and Queen admirer who discovered Hanny's Voorwerp".

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DIY Science

Imane Baiz, CRI Paris

MyOpenPCR Workshop @ BioTehna Lab – Ljubljana (SI)

By gaudi
Wednesday November 9, 2016

Finally back in Ljubljana Urs, Oli and Aurelio gave a workshop on how to build your own wild OpenPCR at BioTehna Lab.

http://www.hackteria.org/wordpress/projects/biotehna/biotehna/

The participants, all with solid biotech background, learned about resistive heaters, thermoelectric cooling using peltier elements and thermo sensors. After 4 hours and heavy soldering actions we had 2 complete PCR machines up and running. The next days the participants kind of took over the workshop and the mentors had to undergo strict instructions on lab practice and pipetting. The evening program with a science café was already in course when the first results of the electrophoresis gel came in. The reference machine (also DIY) and one of the newly build device showed amplification while no lines where to be seen on the tests for the second device. We assume that this is due to the not so well applied heated lid, as we saw quite some evaporation during the runs. This should be easy to fix with building a proper case.

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Modes of Citizen Science

Mode 4 ‘Extreme’

- Collaborative Science – problem definition, data collection and analysis

Mode 3 ‘Participatory science’

- Participation in problem definition and data collection

Mode 2 ‘Distributed Intelligence’

- Citizens as basic interpreters

Mode 1 ‘Crowdsourcing’

- Citizens as sensors

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PART II EXTREME CITIZEN SCIENCE: ANALYSIS AND VISUALISATION (ECSANVIS)

This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (Grant agreement No. 694767)

Extreme Citizen Science

Extreme Citizen Science (ExCiteS) is a situated, bottom-up practice that takes into account local needs, practices and culture and works with broad networks of people to design and build new devices and knowledge creation processes that can transform the world.

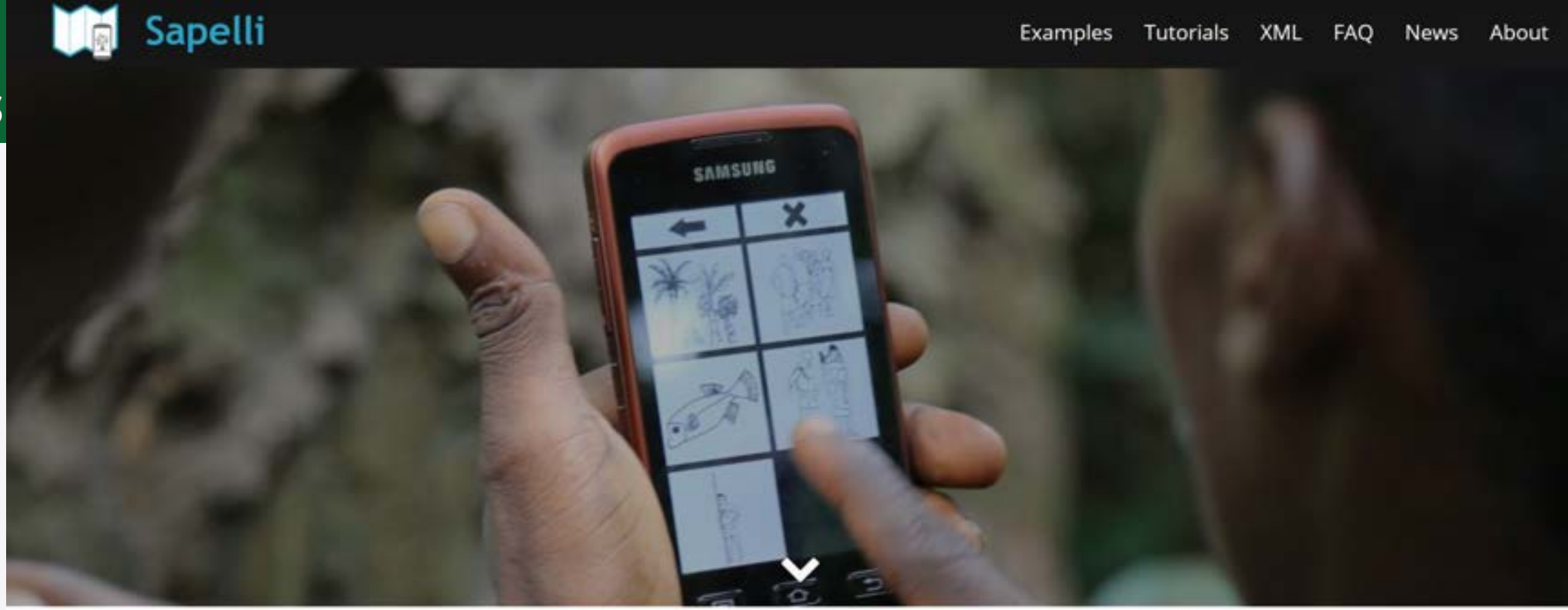
Engagement: Free, Prior Informed Consent (FPIC)

Participatory software design

ExCiteS

Sapelli

Examples Tutorials XML FAQ News About



Sapelli is an open-source project that facilitates data collection across language or literacy barriers through highly configurable icon-driven user interfaces. We encourage people to download the app from the Google Play store, or from our GitHub repository and deploy it for their own purposes.

The sequence of interfaces that will be presented to the user in the project is described in the project's XML file. The transmission of complete records is handled autonomously by the Sapelli platform, which periodically checks for connectivity and determines the most appropriate means by which to transmit the compressed data to another phone or a GeoKey web server.

This website should help to get started with creating bespoke data collection apps that meet individual requirements.

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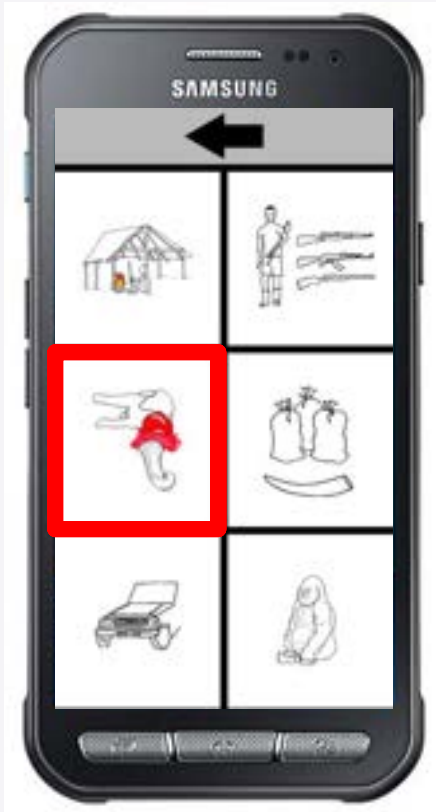

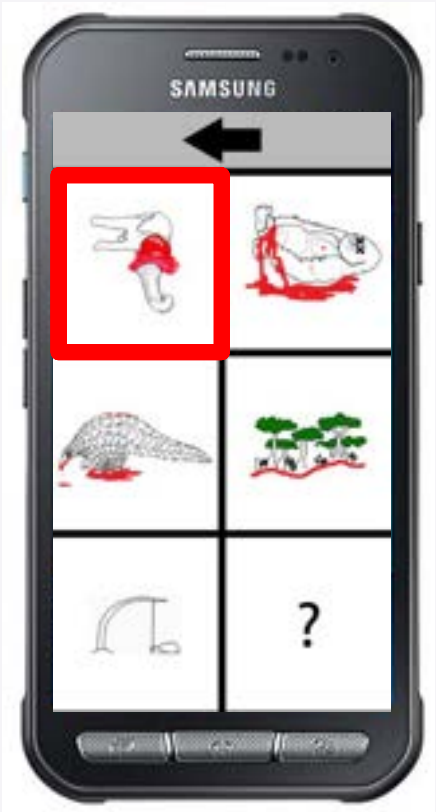

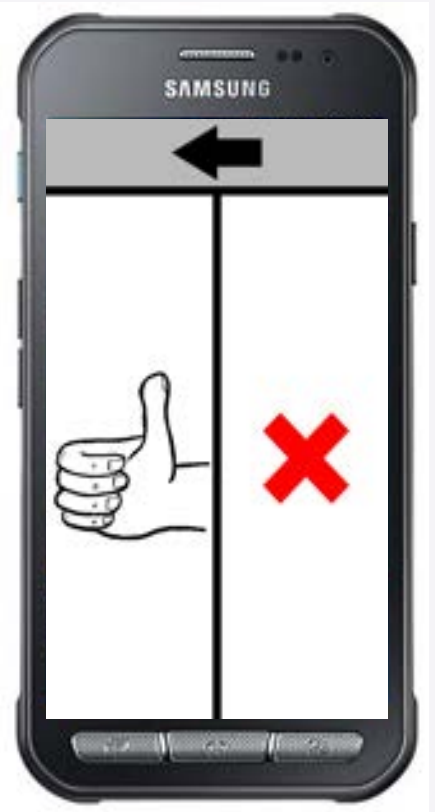

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Training and support

Data collection

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Sapelli Viewer

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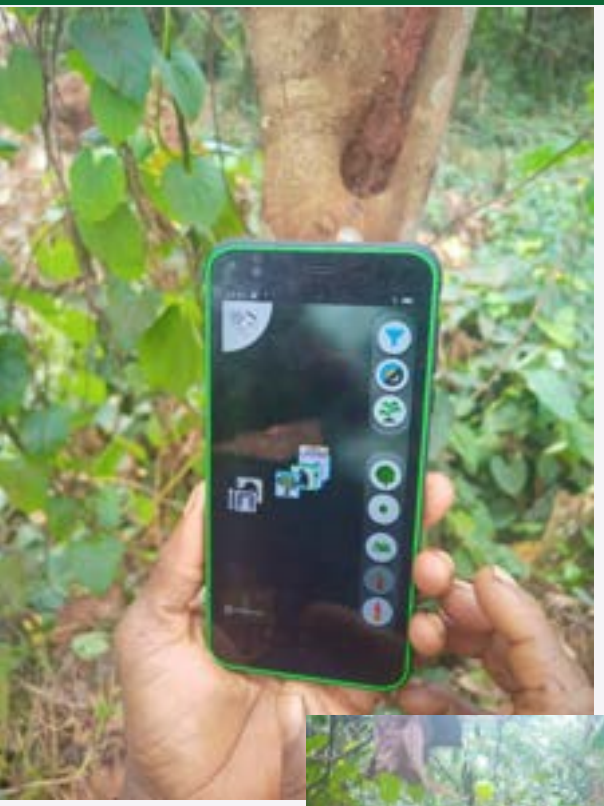

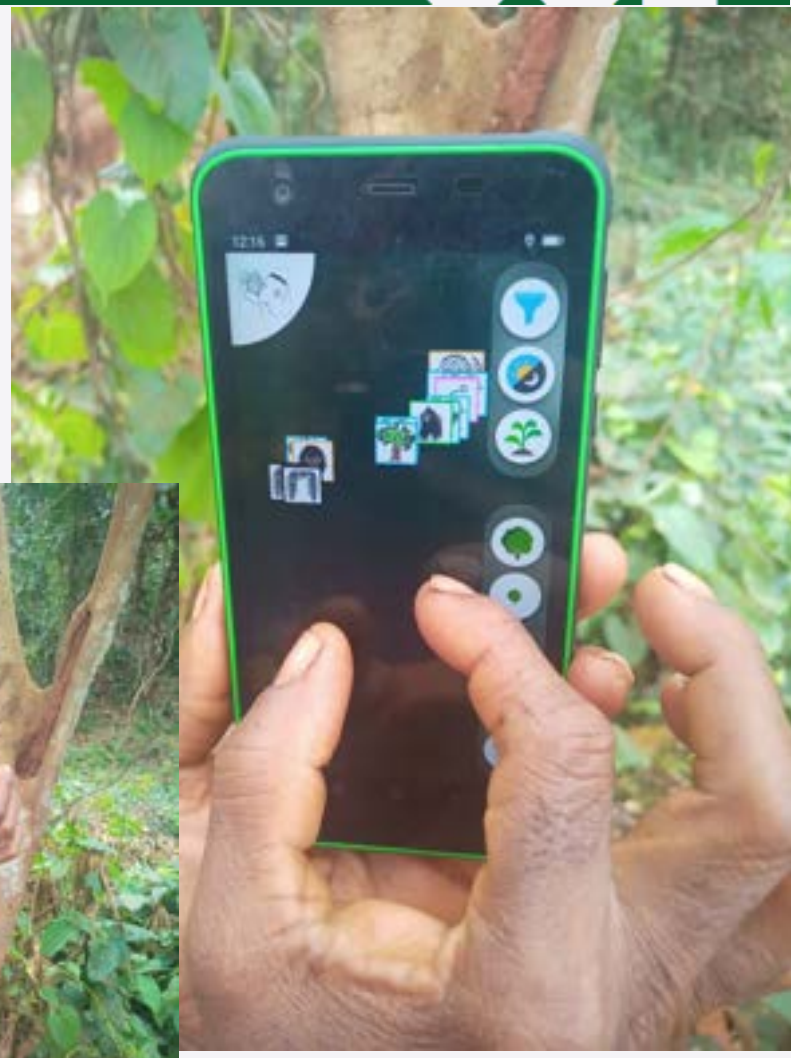

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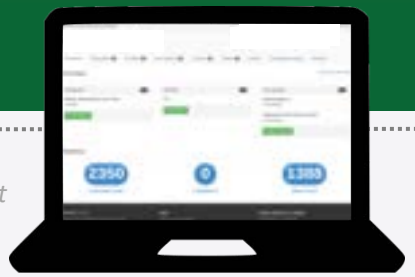
Sapelli Viewer (beta)
(online & offline)

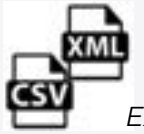
Under development



GeoKey (server-side components)

Community Maps Visualisation
(online)

Sapelli Collector



Export to CSV/XML formats

Sapelli

Sapelli Project (.sap file)

(XML) Code Editor

Sapelli Documentation

Sapelli Designer

Methodologies and tools

UCL ECSAfrica Project

Extreme Citizen Science

THE PROCESS OF SETTING UP A SAPELLI PROJECT

We're now going to describe 4 steps we take in ExCiteS projects when we collaborate with local and indigenous people who want to use citizen science to tackle some of the issues they face.

Each of these steps is essential to each project, but we present four different case studies to illustrate these steps below.

Step 1 - Free, Prior and Informed Consent

Working with local and indigenous communities involves ethical considerations. With examples from **Kenyan** case studies with **Maasai** and **small-scale farmers**, we illustrate the implementation of a Free, Prior and Informed Consent process, and the establishment of community protocols to help harmonise and equalize relationships between groups of different power and means (Lewis, 2012).

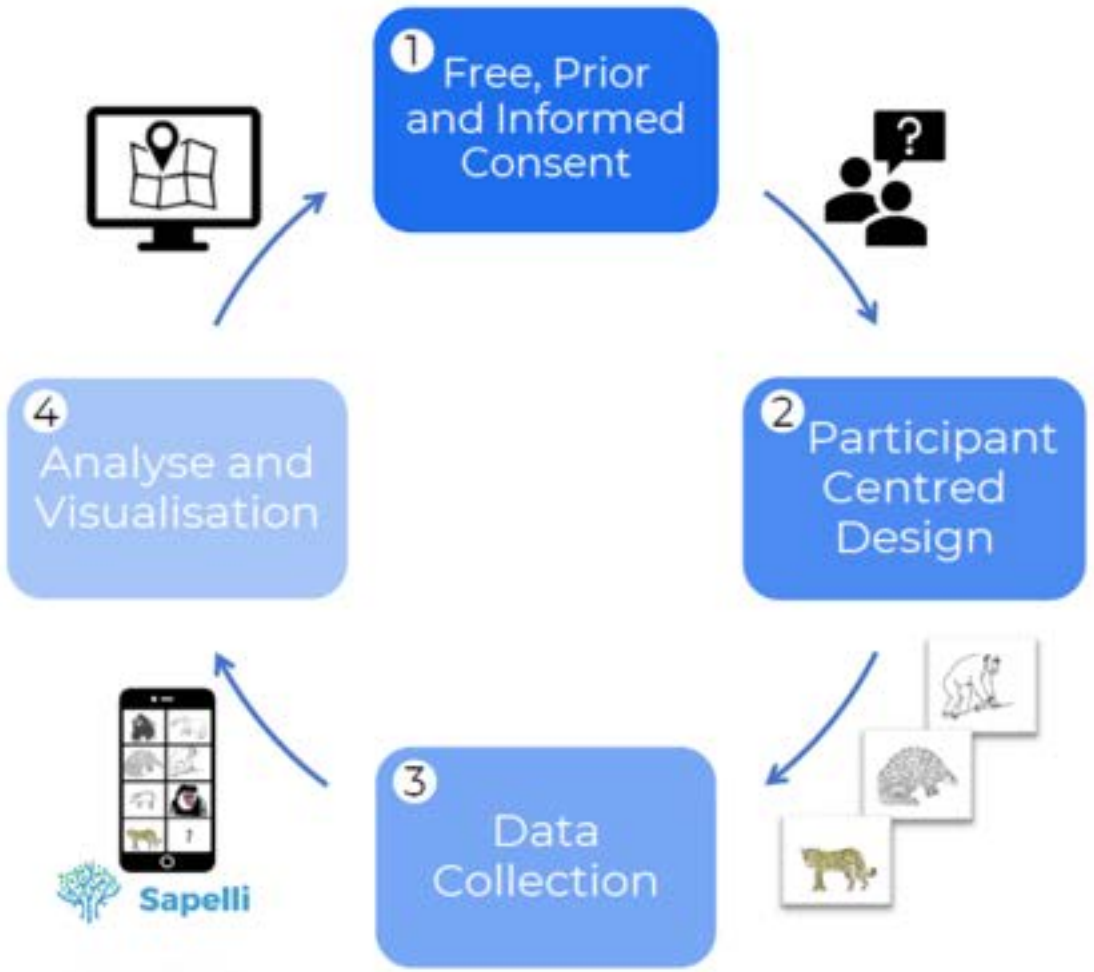
Step 2 - Participant Centred Design

To make Sapelli technology relevant to indigenous users, it is necessary to focus on the participants, their experiences and their concerns to design a Sapelli project. To illustrate this process we will move to **Brazil - Amazon** where the **Ashaninka** community monitors poaching and logging.

Step 3 - Data Collection

When technology is adapted to the users, they can collect data according to their definition of the problem and their routines. We will see how **Mbendjele BaYaka Pygmies** collect data about poaching and logging issues in the **Republic of the Congo**.

Step 4 - Analyse and Visualisation



frontiers in Ecology and Evolution | Conservation and Restoration Ecology

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THIS ARTICLE IS PART OF THE RESEARCH TOPIC
Open Citizen Science Data and Methods View all 28 Articles >

...and tools

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METHODS article
Front. Ecol. Evol., 01 July 2021 | https://doi.org/10.3389/fevo.2021.638870

Using Sapelli in the Field: Methods and Data for an Inclusive Citizen Science

Fabien Moustard[1*], Muki Haklay[1], Jerome Lewis[1], Alexandra Albert[1], Marcos Moreu[1], Rafael Chiaravalloti[1,2], Simon Hoyte[1], Artemis Skarlatidou[1], Alice Vittoria[1], Carolina Comandulli[1], Emmanuel Nyadzi[3], Michalis Vitos[1], Julia Altenbuchner[1], Megan Laws[1], Raffaella Fryer-Moreira[1] and Daniel Artus[1]

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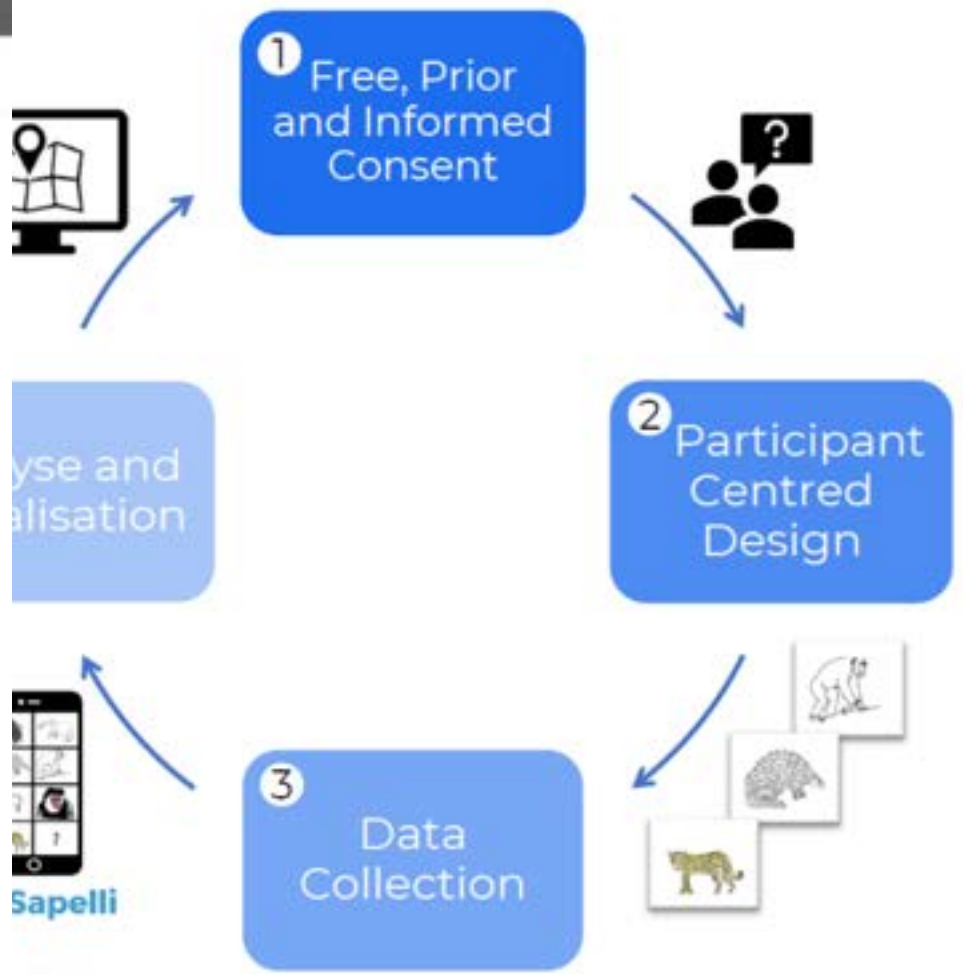
[2]Smithsonian Conservation Biology Institute, Conservation Ecology Center, Washington, DC, United States
[3]Department of Environmental Science, Wageningen University and Research, Wageningen, Netherlands

The Sapelli smartphone application aims to support any community to engage in citizen science activities to address local concerns and needs. However, Sapelli was designed and developed not as a piece of technology without a context, but as the technical part of a socio-technical approach to establish a participatory science process. This paper provides the methodological framework for implementing and using Sapelli in the field. Specifically, we present the role of Sapelli within the framework of an "Extreme Citizen Science" (ECS) methodology that is based on participatory design. This approach enables Sapelli's users to decide, with the help of professional scientists, which challenges they wish to address, what data to collect, how best to collect and analyse it, and how to use it to address the problems identified. The process depends on the consent of participants and that the project is shaped by their decisions. We argue that leaving ample space for co-design, local leadership and keeping Sapelli deployment open-ended is crucial to give all people, and in particular non-literate people who we have found are often the most ecologically literate, access to the power of the scientific process to document and represent their concerns to outsiders in a way that all can understand, and to develop advocacy strategies that address the problems they identify.

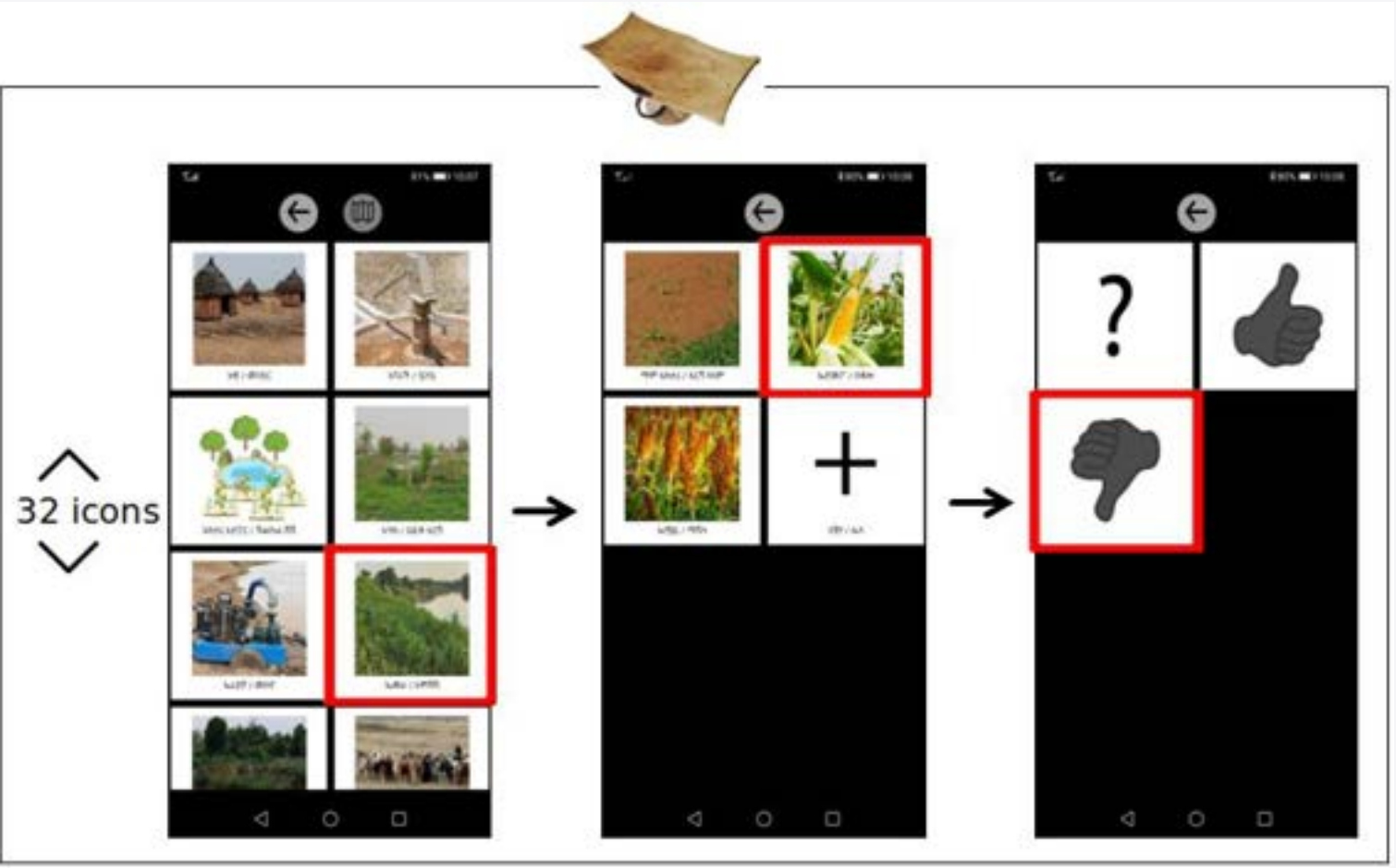


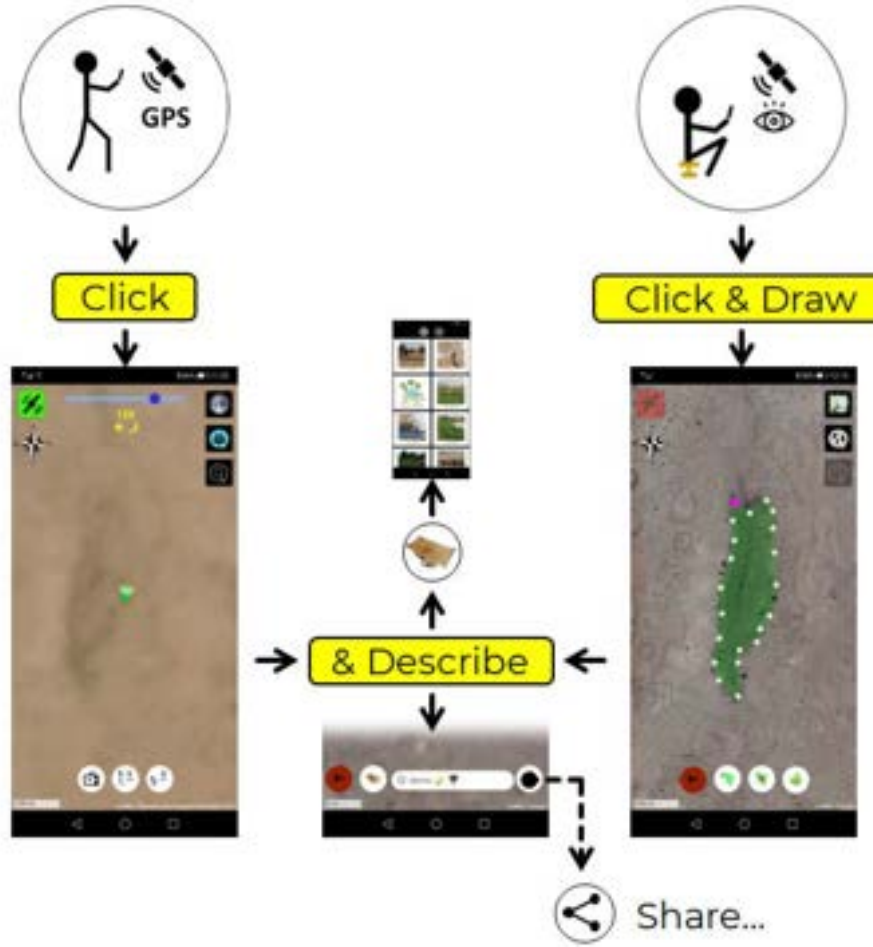
The power of citizen science

- With appropriate support, anyone can co-create citizen science

The power of citizen science

- Co-production can include sophisticated and complex data collection





Extreme Citizen Science (ExCiteS) is a situated, bottom-up practice that takes into account local needs, practices and culture and works with broad networks of people to design and build new devices and knowledge creation processes that can transform the world.

Ghana: Combining Indigenous Weather Forecasting with Satellite Forecasts Local farmers developed a project to collect indigenous ecological indicators and forecasts towards the development of climate services that combine indigenous and scientific forecasts.

Cameroon: Anti-poaching and wildlife monitoring As poaching and exclusion from conservation are key concerns of Baka and Nzime/Pang communities, Sapelli projects empower local people to report activities and monitor the forest around them.

Cameroon: Recognising Indigenous Territories The Sapelli digital tool supports the recognition of the key role of Baka hunter-gatherers indigenous people in protecting forests.

Central African Republic: Resource protection during logging Bayaka and Sangha Sangha Indigenous People developed a Sapelli project to protect their key forest and aquatic resources from damage during logging operations.

Ethiopia: Crisis mapping by affected agro-pastoralists for food security Agro-pastoralists communities in the Lower Omo, co-designed a project to map their natural resources to address issues related to food insecurity, water inaccessibility and conflict.

India: Monitoring human-forest relations Nayaka people together with local environmentalists, are developing a Sapelli project to monitor human-animal conflict, forest resources and landslide and floods-related damage in the forest.

Cambodia: Monitoring illegal logging This Sapelli-inspired forest monitoring tool supports the advocacy of indigenous Kuy and Khmer communities and their efforts to protect their forest and livelihoods (The Prey Lang app).

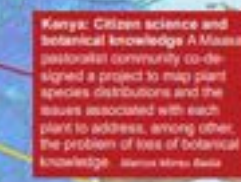
Brazil Amazon: Mapping land invasions on Indigenous territory Asháninka developed a Sapelli project to record illegal invasions by loggers, drug traffickers and poachers on their territory.

Brazil Pantanal: Mapping fishers' territories Pantanal fishers developed this version of Sapelli to allow them to represent their traditional areas of fishing to claim tenure rights.

Brazil Pantanal: Mapping restoration areas Pantaneiros are helping to monitor restoration initiatives in the Pantanal. They use their local knowledge to inform about the effectiveness of the restoration activities.

Brazil: Mapping violence Developing a Sapelli project with Guarani and Kaiowá communities who don't separate nature from culture - showed us that environmental monitoring involves social and humanitarian monitoring too.

Kenya: Citizen science for sustainable agricultural futures Smallholder farmers in Western Kenya co-designed a project to map cropping patterns and challenges and share local knowledge about sustainable farming practices.



Kenya: Citizen science and botanical knowledge A Maasai pastoralist community co-designed a project to map plant species distributions and the issues associated with each plant to address, among other, the problem of loss of botanical knowledge.

Nigeria: Land use messaging & mapping for collaborative Climate-smart Agriculture Smallholders co-designed a project to map their farms and report farming issues through WhatsApp to receive timely advice from agricultural extension officers and other farmers.

Namibia: Protecting water holes for wild animals from damage by cattle herds A Ju/hoansi effort to identify cattle herders invading their conservancy by photographing ear tags on cattle, with time, date and geotag to provide evidence to police.

Namibia: Monitoring and reporting on the health of wildlife Ju/'hoan rangers using Sapelli to monitor and report on the health of wildlife in the conservancy for the purposes of setting quotas for sustainable hunting.

Republic of the Congo: Human - Wildlife conflicts Local communities suffering crop damage caused by elephants, buffalo and apes developed a project to record the damage and report it to the relevant authorities in order to receive compensation.

Zambia: Mapping urban flooding and supporting rural livelihoods Mapping urban flooding and Chikanda orchids to support sustainable livelihoods for women and improve Community Forest management.

Republic of the Congo: Conservation - IPLC conflicts BaYaka hunter-gatherers developed a Sapelli project to record abuses against them by Eco-guards, to report on poachers and animal slings.

Republic of the Congo: Participatory forest management BaYaka hunting and gathering communities designed a Sapelli project to map key forest resources and community areas in an effort to participate in forest management within a logging concession.

Collaborators:
Locacorra project, Arba Minch University, British Institute in Eastern Africa, Maasai Mara University, University of Eldoret, Procol Kenya, Environmental and Economic Resource Centre, Nyae Nyae Conservancy (NNC), Ju|'hoan Traditional Authority Namibia (JUTA), Nyae Nyae Development Fund Namibia (NNDFN), Association Sanguia Baka Burna'a Kpodé (ASBABUK), World Wild Fund (WWF), The Minister of Forests and Wildlife (MINFOF), London Zoological Society (ZSL), Wageningen University, University for development studies, HydroSense Lab, Indian Institute of Technology Delhi (IITD), Keystone Foundation, National Biodiversity Authority (NBA), Danmission, Copenhagen University, Forest & Peoples Organization, Ecology and Action (ecoa), brazilian agency for protected areas (Icmbio), brazilian ministry for the environment (funbio), Kunangue Aty Guasu, Mapping for Change, Congolaise Industrielle des Bois (CIB), PALF-Congo, World Resources Institute, African Parks, Wildlife Conservation Society, Congolese Human Rights Observatory, Ndima-Kali.

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Acknowledgements:
We wish to acknowledge all the community members around the world who collaborate with us. They play a central role in helping to shape the implementation of Sapelli.

This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (Grant agreement No. 694767 and ERC-2015-AdG).

PART III – CURRENT POLICY INTEREST IN CITIZEN SCIENCE

This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (Grant agreement No. 694767)

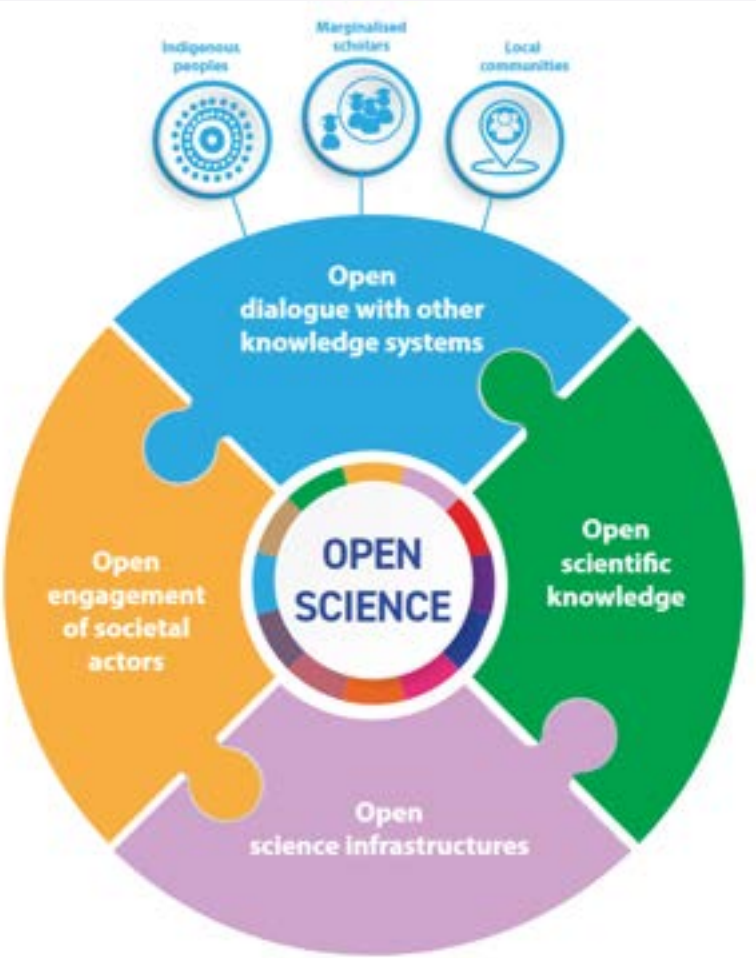
Defining citizen science

Citizen Science is part of Open Science in the EU policy framing.

"citizen science can be described as the voluntary participation of non-professional scientists in research and innovation at different stages of the process and at different levels of engagement, from shaping research agendas and policies, to gathering, processing and analysing data, and assessing the outcomes of research." (Citizen Science factsheet 2020)

European Commission

UNESCO Recommendation on Open Science



MLE Citizen science

European Commission

Search

Home > ... > Policy Support Facility > PSF Challenge/ Mutual Learning Exercises > Mutual Learning Exercise on Citizen Science Initiatives- Policy and Practice

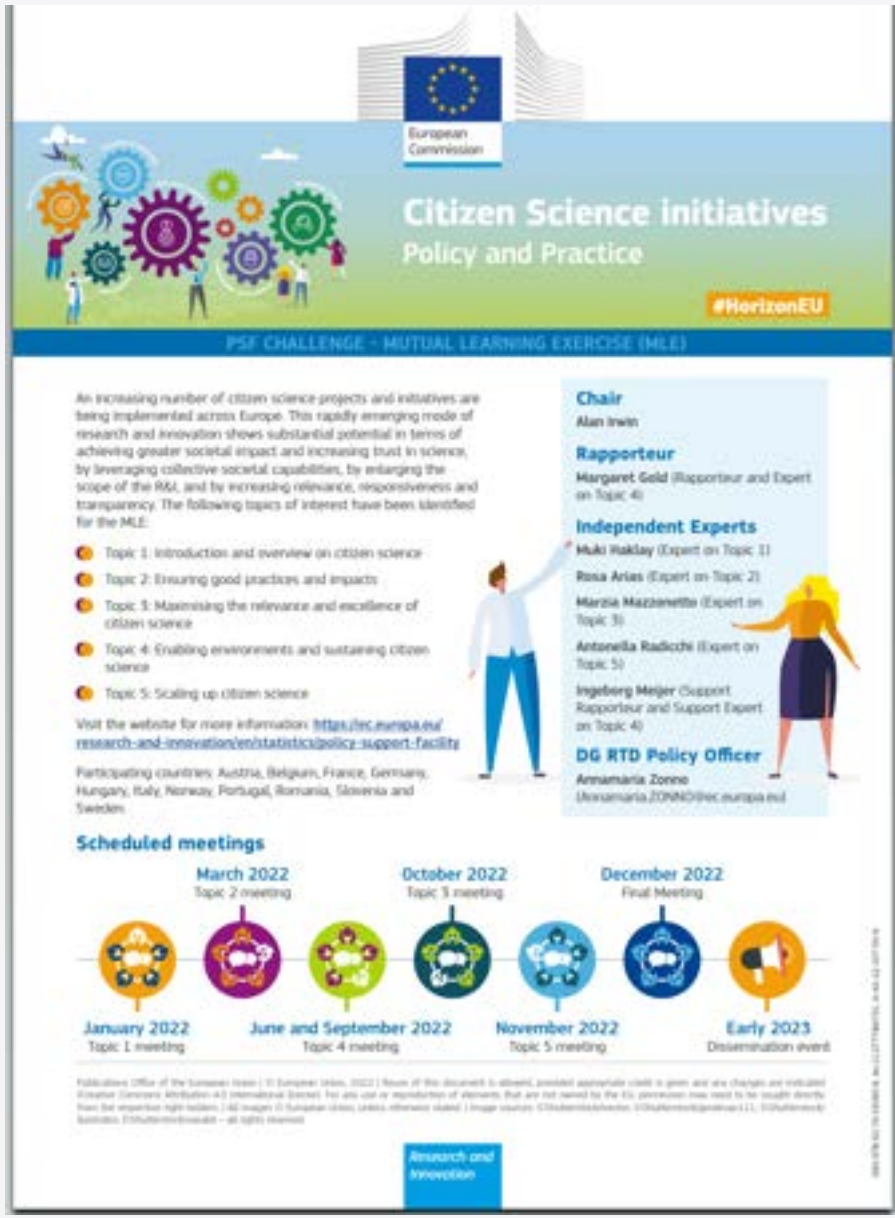
Mutual Learning Exercise on Citizen Science Initiatives- Policy and Practice

An increasing number of citizen science projects and initiatives are being implemented across Europe – mostly taking place at local or national levels, but some also being co-ordinated internationally. This rapidly emerging mode of research and innovation shows substantial potential in terms of achieving greater societal impact and increasing trust in science, by leveraging collective societal capabilities, by enlarging the scope of the R&I, and by increasing relevance, responsiveness and transparency. However, national or regional policies to support and mainstream them, if they exist, are in many countries at an early stage of development. Europe would benefit from greater attention to promoting citizen science within Member States and regions, and from greater cooperation and shared approaches across the European Research Area as a whole.

The MLE thus aims to facilitate an exchange of information, experiences and lessons learned, as well as to identify good practices, policies and programmes in relation to the various approaches at local, regional and national levels, towards supporting and scaling up citizen science. In addition, the objective is to identify citizen science campaigns that have high potential to be implemented in a collaborative way across the European Research Area.

01 DEC 2021	28 FEB 2023

PSF Geo coverage	Norway, Austria, Belgium, France, Germany, Hungary, Italy, Portugal, Romania, Slovenia, Sweden
PSF Exercise type	Challenge/ MLEs



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Key features for citizen and societal engagement in Horizon Europe

Open science is the *modus operandi* of the entire programme

Societal engagement considered part of the excellence criterion under methodology during **proposal evaluation**

Co-design and co-creation, and engagement of citizens and civil society organisations, are **mainstreamed** across the programme

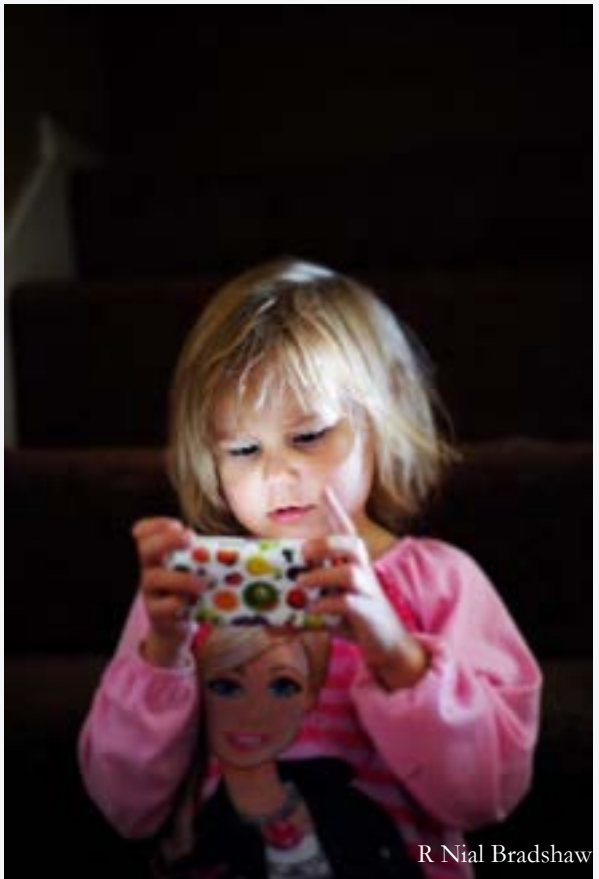
One of the nine **pathways to impact** (KIP6) starts with citizens and end-users co-creating knowledge and innovations, with the goal of developing solutions and knowledge that are taken up by society

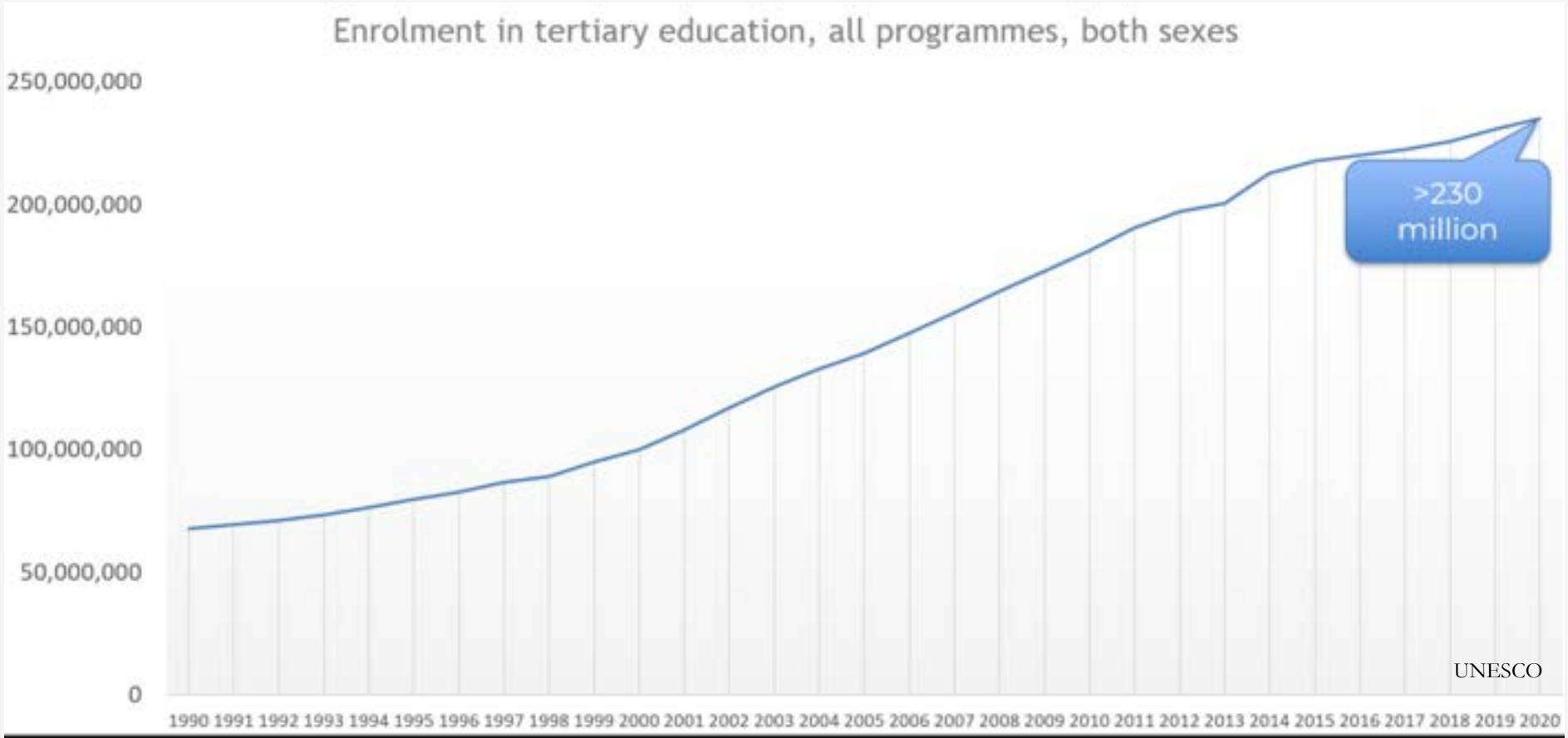
PART IV: CITIZENS INTERACTION WITH SCIENCE

European Commission

Underlying trends

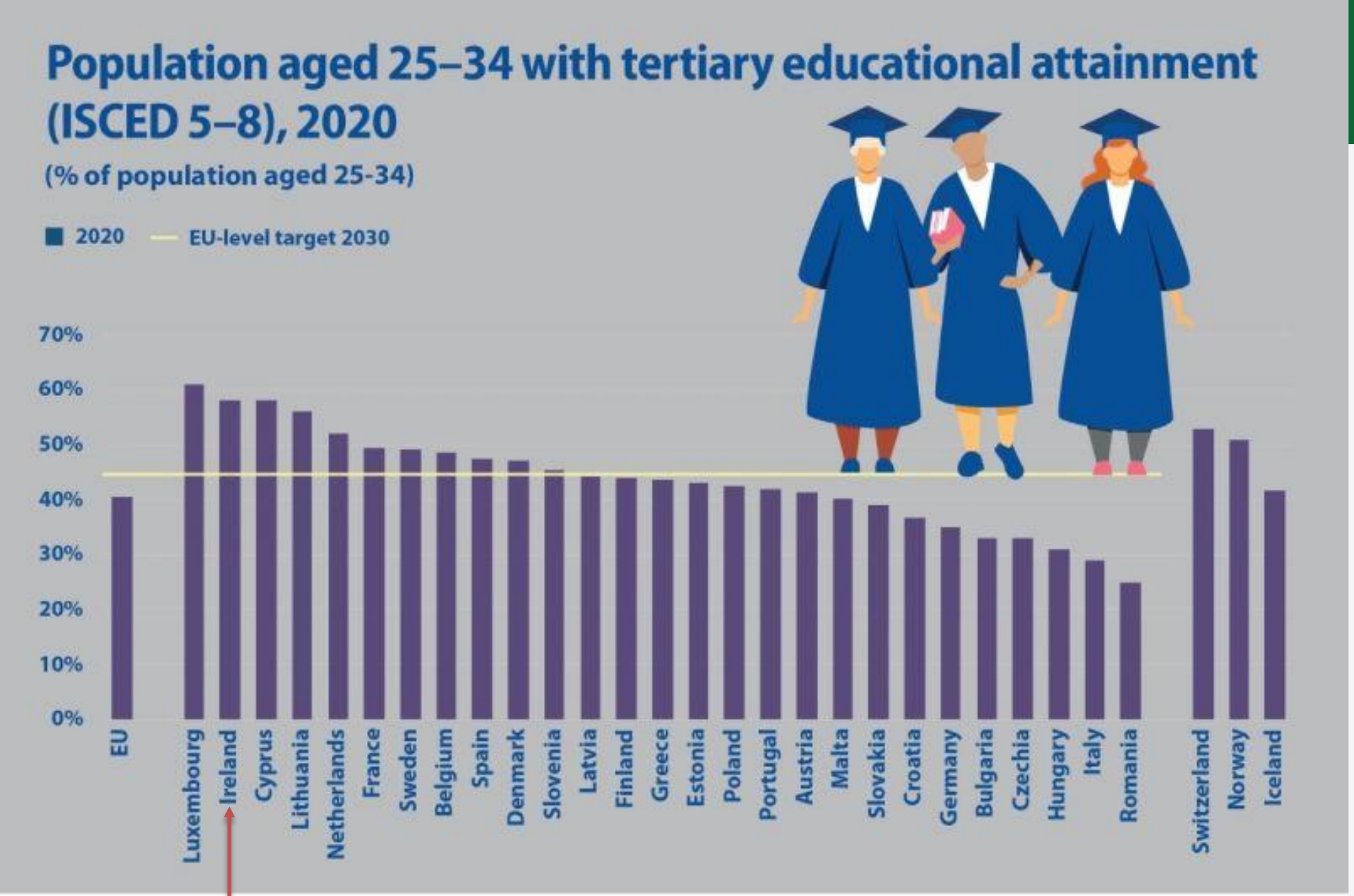
- Levels of education (esp. rise in higher education)
- Technological developments (Web, mobile phones, broadband)





Population aged 25–34 with tertiary educational attainment (ISCED 5–8), 2020

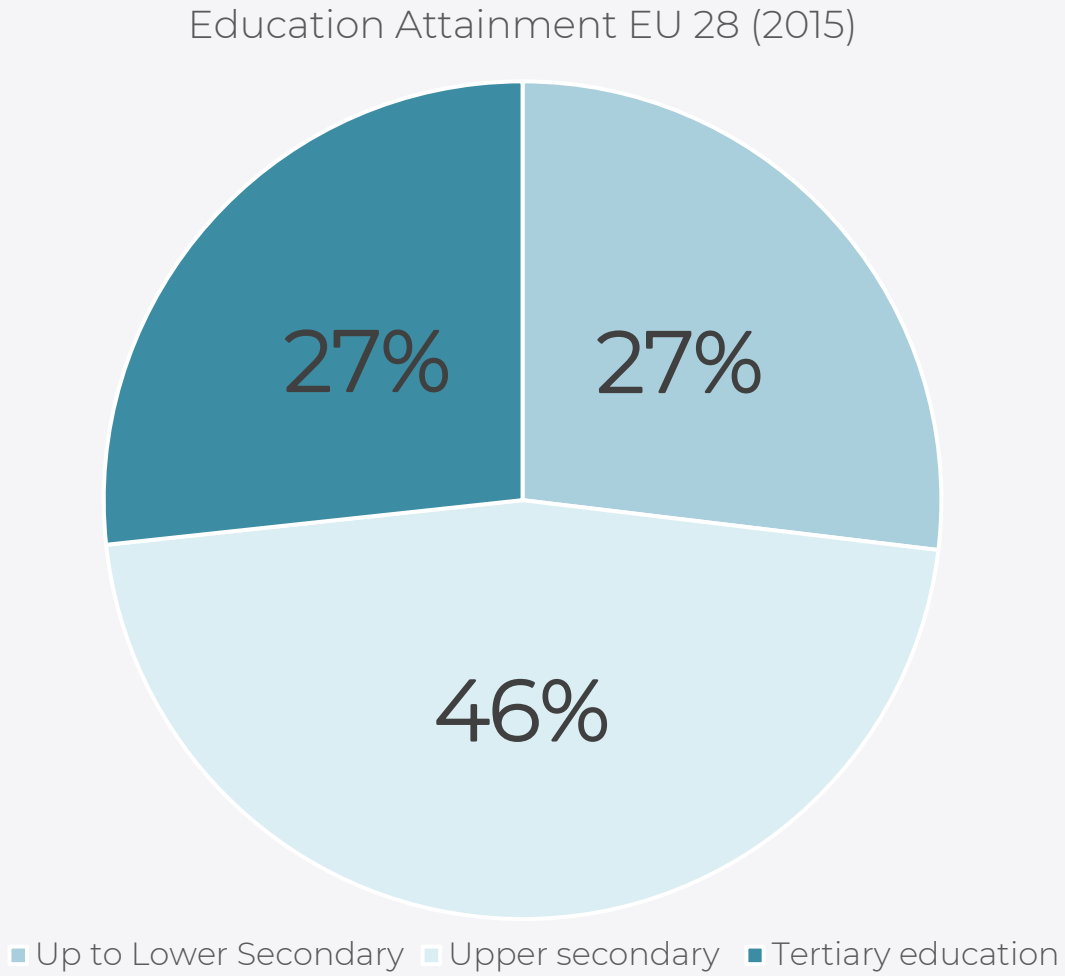
(% of population aged 25-34)



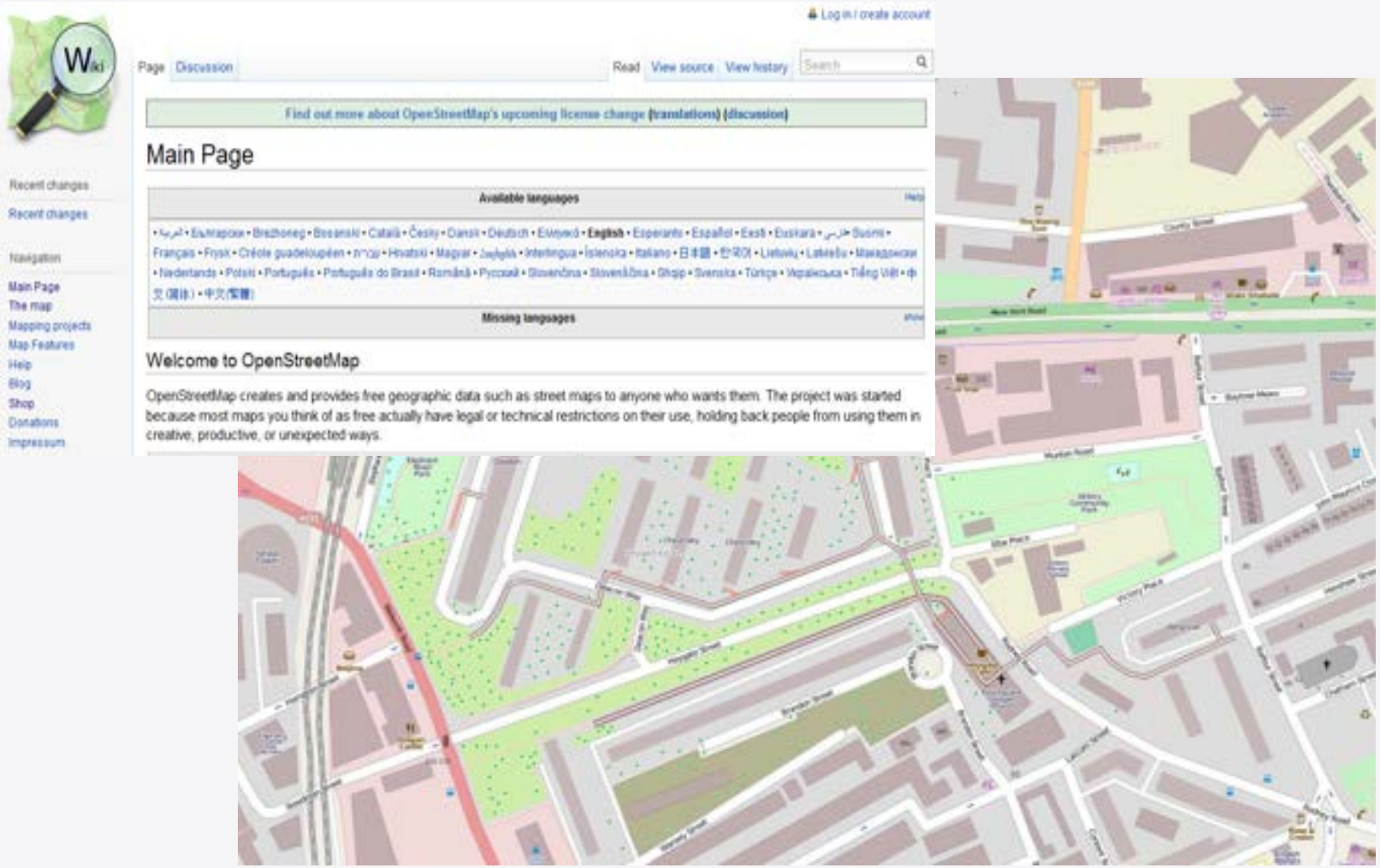
ec.europa.eu/**eurostat**

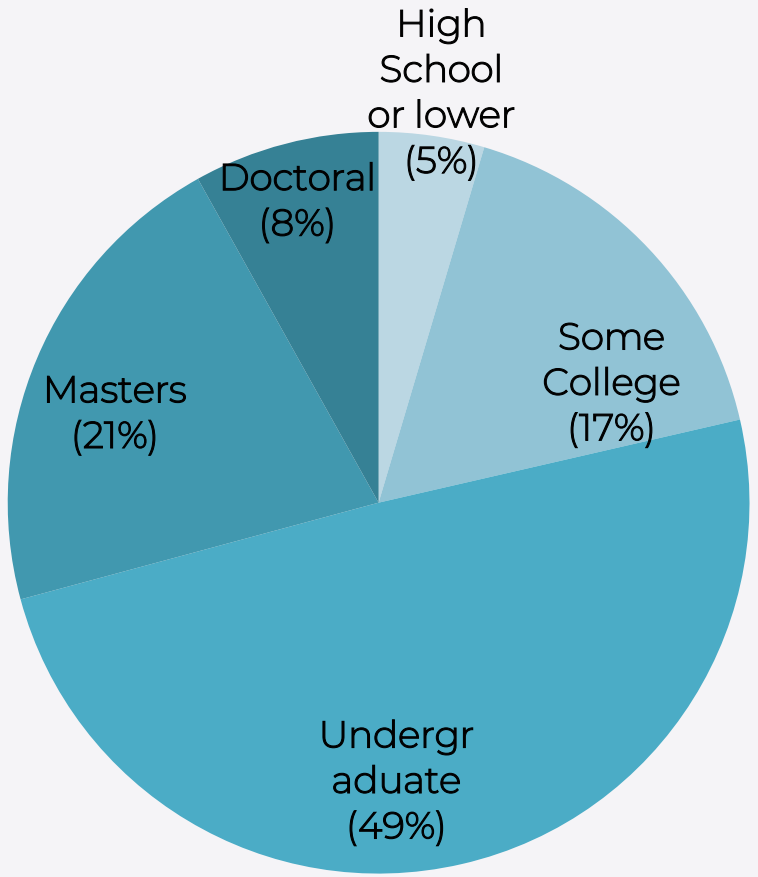
Educational attainment

- In 2015 among the general population of EU 28, the **educational attainment** is 27% in tertiary education (university).



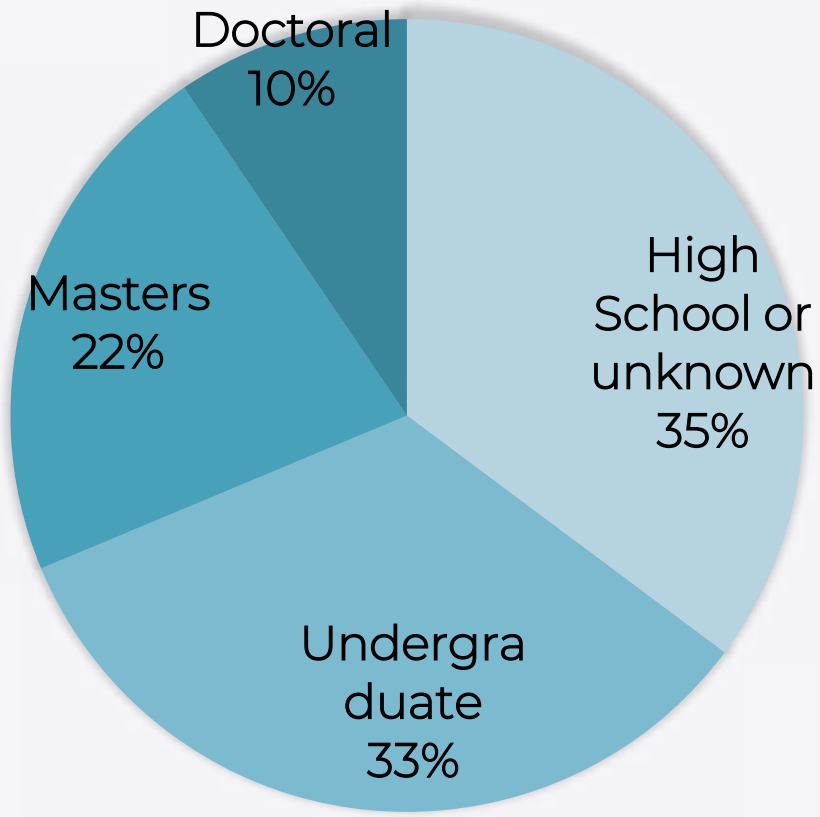
OpenStreetMap (2010)





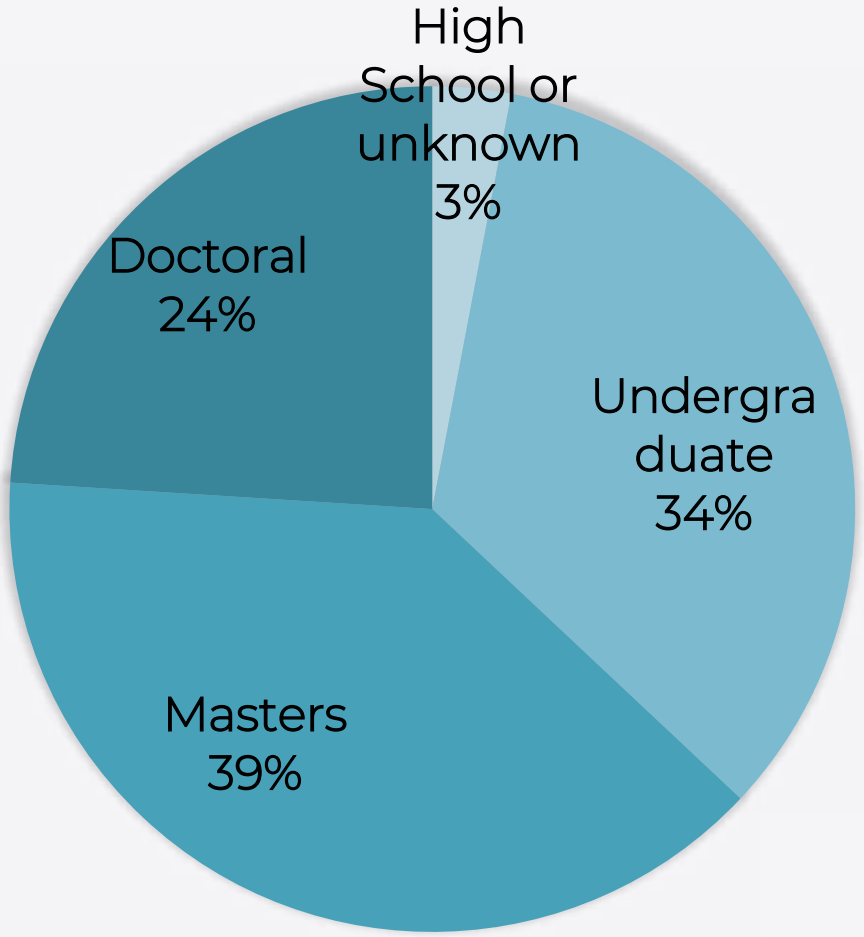
Budhathoki, N.R. and Haythornthwaite, C., 2013. Motivation for open collaboration crowd and community models and the case of OpenStreetMap. *American Behavioral Scientist*, *57*(5), pp.548-575.

Galaxy Zoo (2013)



Raddick, M.J., Bracey, G., Gay, P.L., Lintott, C.J., Cardamone, C., Murray, P., Schawinski, K., Szalay, A.S. and Vandenberg, J., 2013. Galaxy Zoo: Motivations of citizen scientists. *arXiv preprint arXiv:1303.6886*.

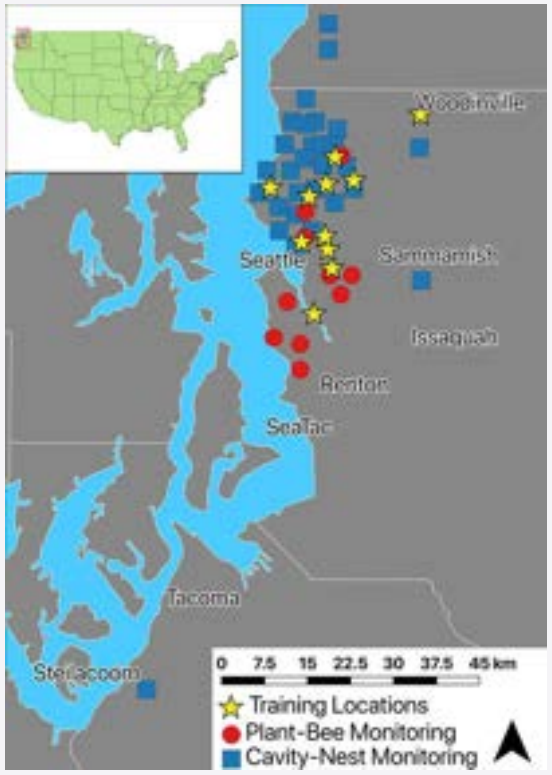
Transcribe Bentham (2012)

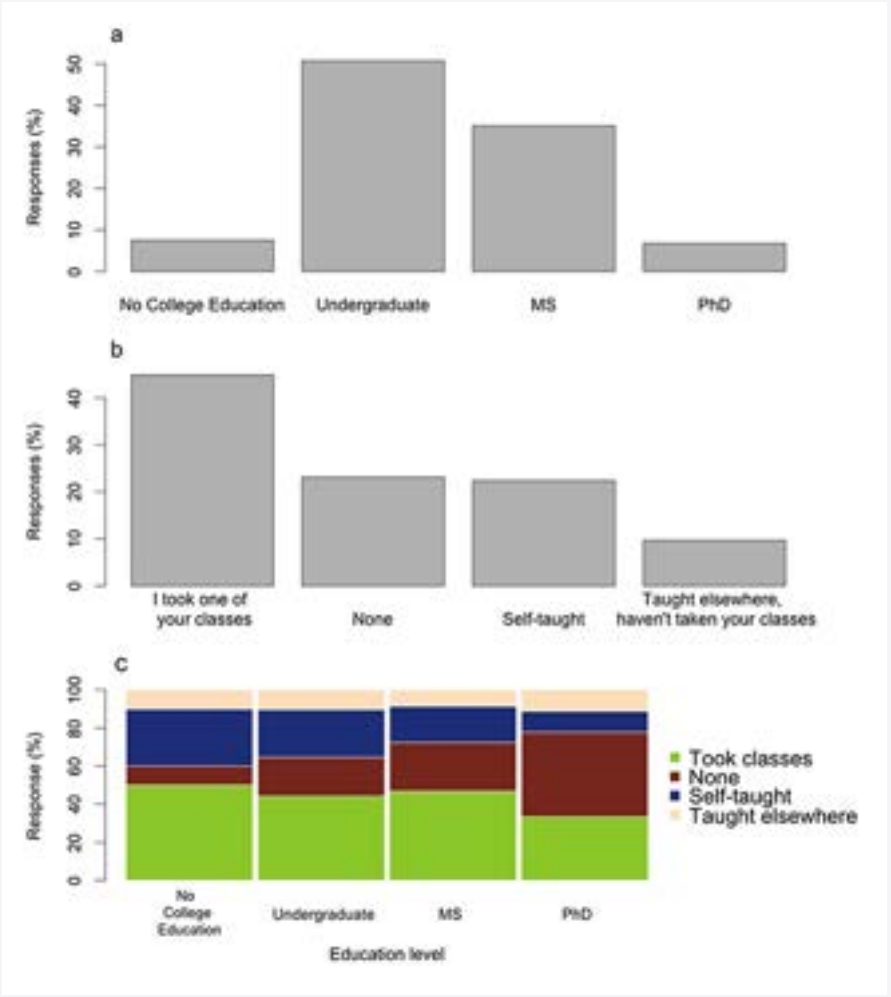


Causer, T, and Wallace, V., 2012. Building a volunteer community: results and findings from Transcribe Bentham. *Digital Humanities Quarterly* , 6

Pollinator monitoring project (2020)

- Bee monitoring project in Washington state US 2015 and 2017
- 128 participants

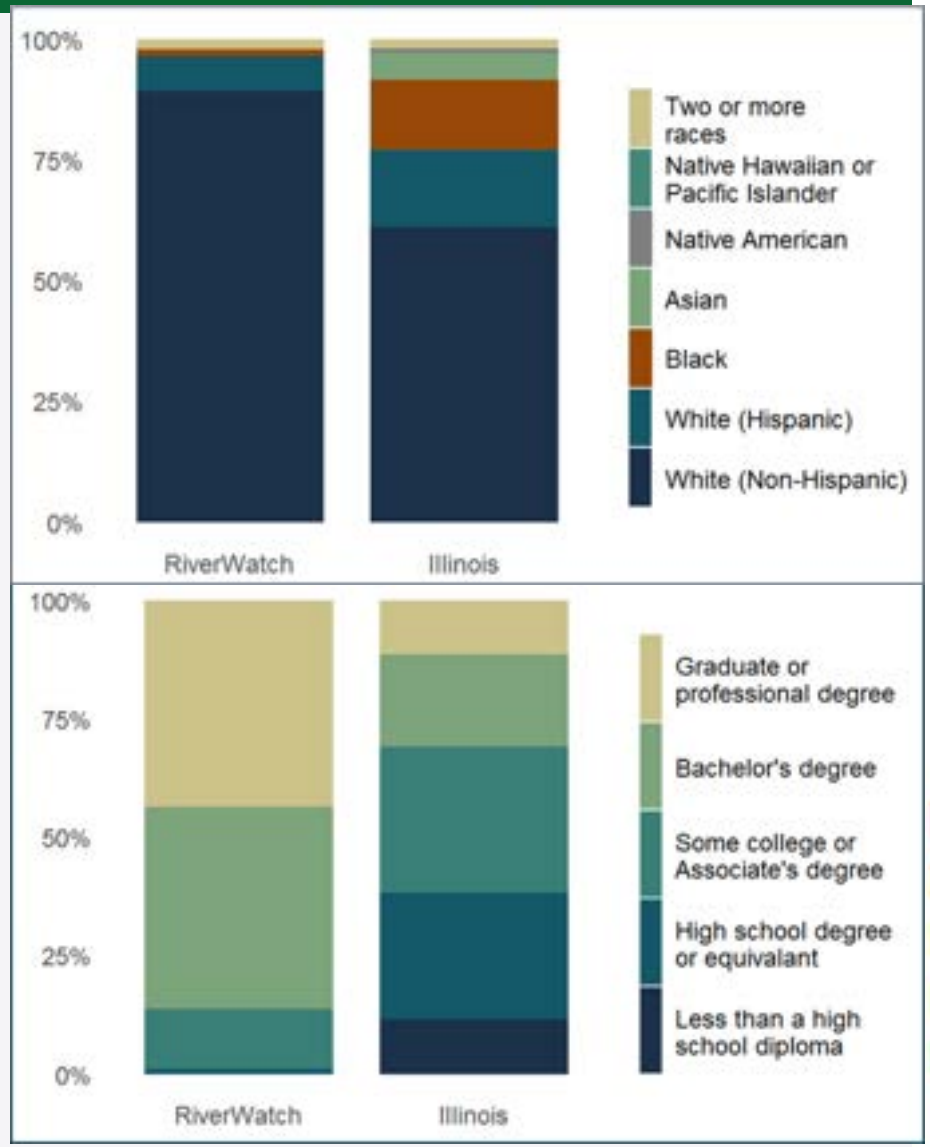


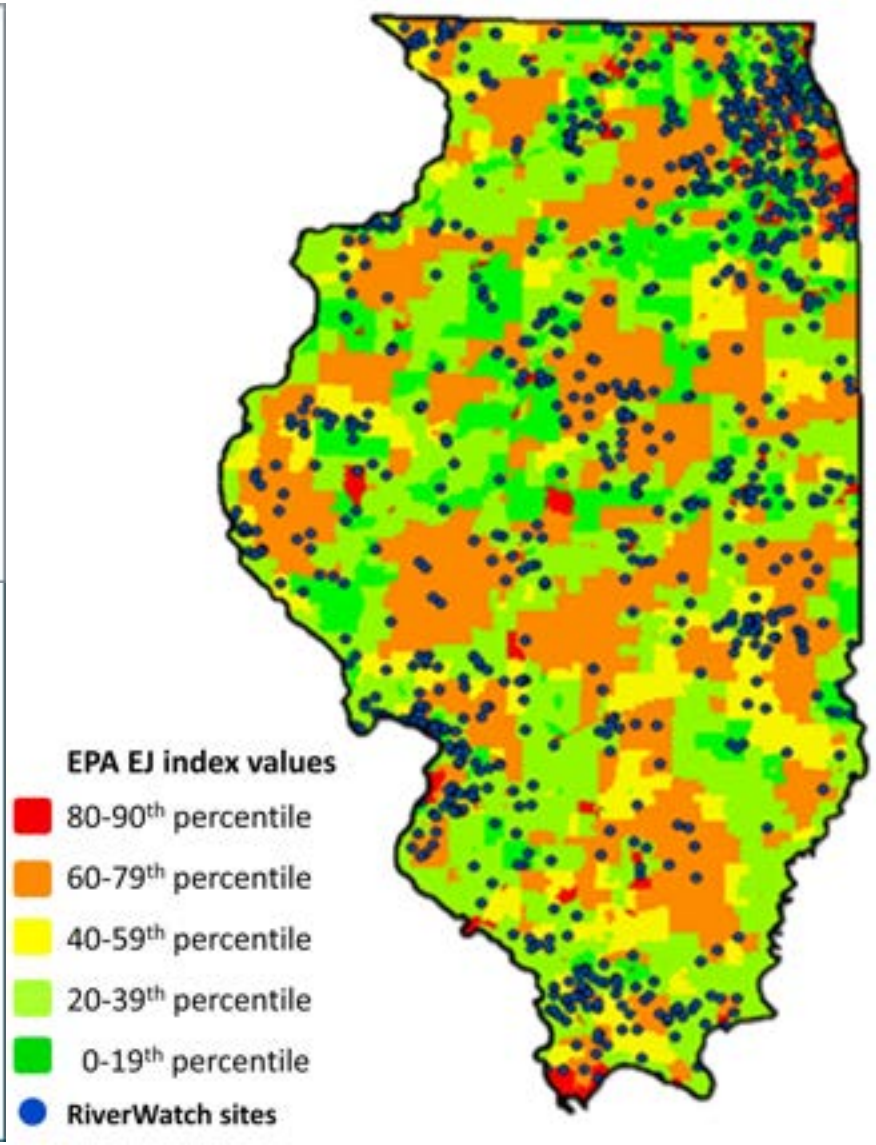


Bloom, E.H. and Crowder, D.W., 2020. Promoting Data Collection in Pollinator Citizen Science Projects. *Citizen Science: Theory and Practice*, 5(1), p.3. DOI: http://doi.org/10.5334/cstp.217

RiverWatch Illinois (2020)

- Volunteer stream monitoring
- Around 70 responses





Blake, C., Rhanor, A. and Pajic, C., 2020. The Demographics of Citizen Science Participation and Its Implications for Data Quality and Environmental Justice. *Citizen Science: Theory and Practice*, 5(1), p.21. DOI: http://doi.org/10.5334/cstp.320

KNOWLEDGE SOCIETY

- **Citizen science provides a way to capitalise on the societal investment in increasing levels of education to high levels**

It also provides a way to gain access and engage the high number of people with PhDs who are outside the formal R&D system

European Commission

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Impact of science and views about science

Opinions on the role of scientists in society

68% say that **scientists should intervene in political debate** to ensure that decisions take into account scientific evidence

51% say that scientists **do not spend sufficient time meeting people** to explain their work

45% say that scientists **should be held accountable for the misuse** of their discoveries

The benefits of science and technology

86% respondents think the **overall influence of science and technology on society is positive**

57% think that science and technology mostly **improve the lives of people** who are already better off

53% of EU citizens think that science and technology benefit **their lives**

Views on the impacts of science and technology

Areas where science and technology can make a difference

47% Health and medical care

40% The fight against climate change

32% Energy supply

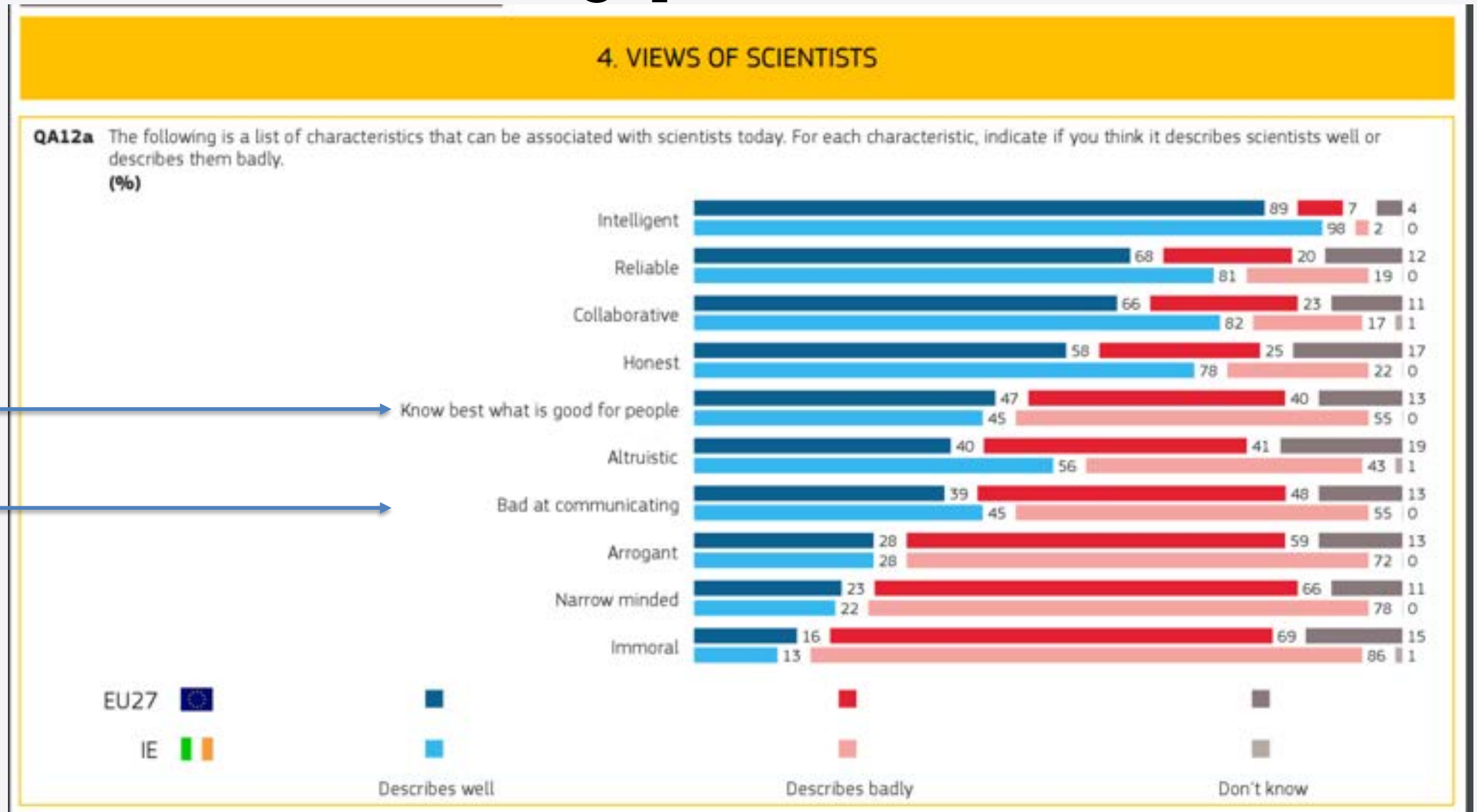
25% Protection of the environment

19% Availability and quality of food

19% Education and skills

Respondents think that **health and medical** care and the **fight against climate change** are the areas where science and technology **can make the most difference.**

Country profile: Ireland

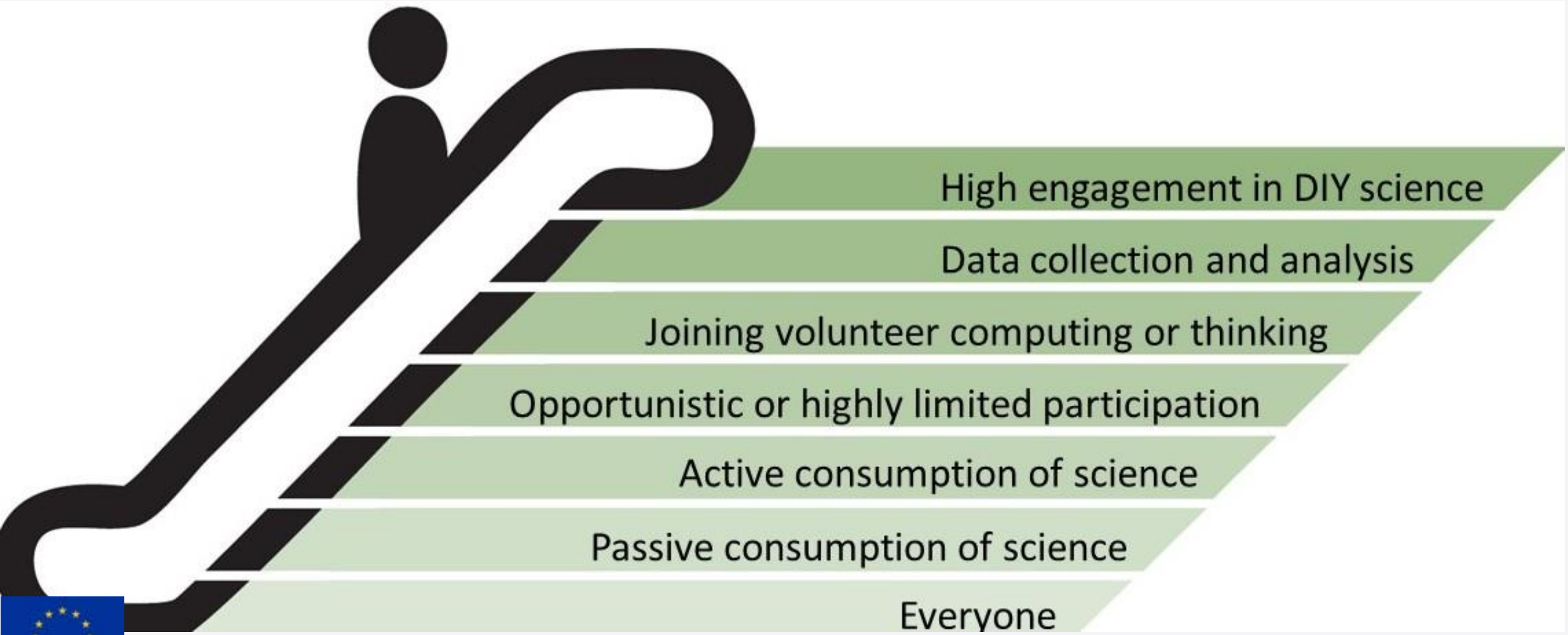


doing it together science

Extreme Citizen Science

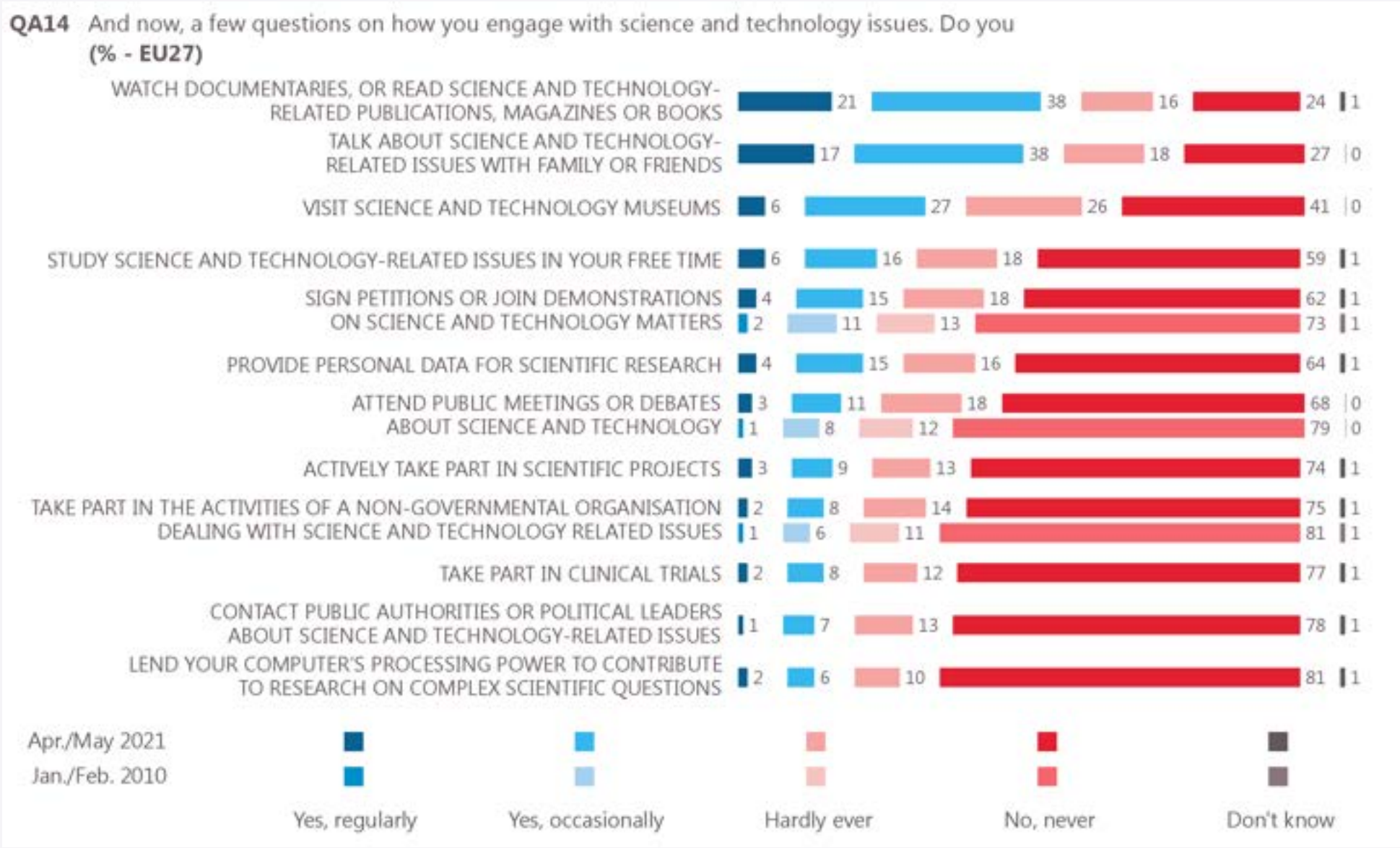
UCL

Citizen Science with public engagement



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 709443

Impressive engagement



Source: Special Eurobarometer 516 – "European citizens' knowledge and attitudes towards science and technology". Fieldwork: April – May 2021, sample: EU27 data (26,827 respondents)

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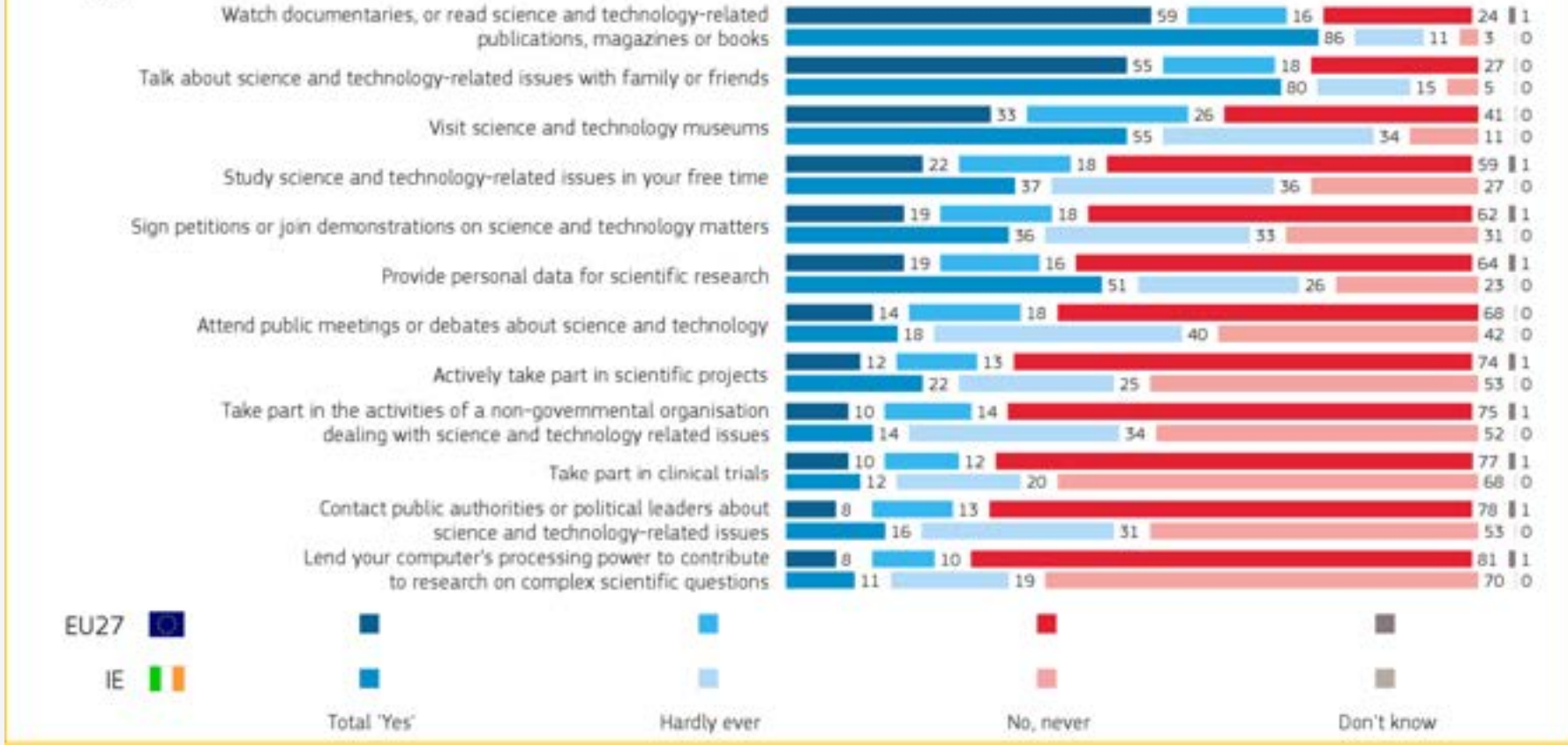
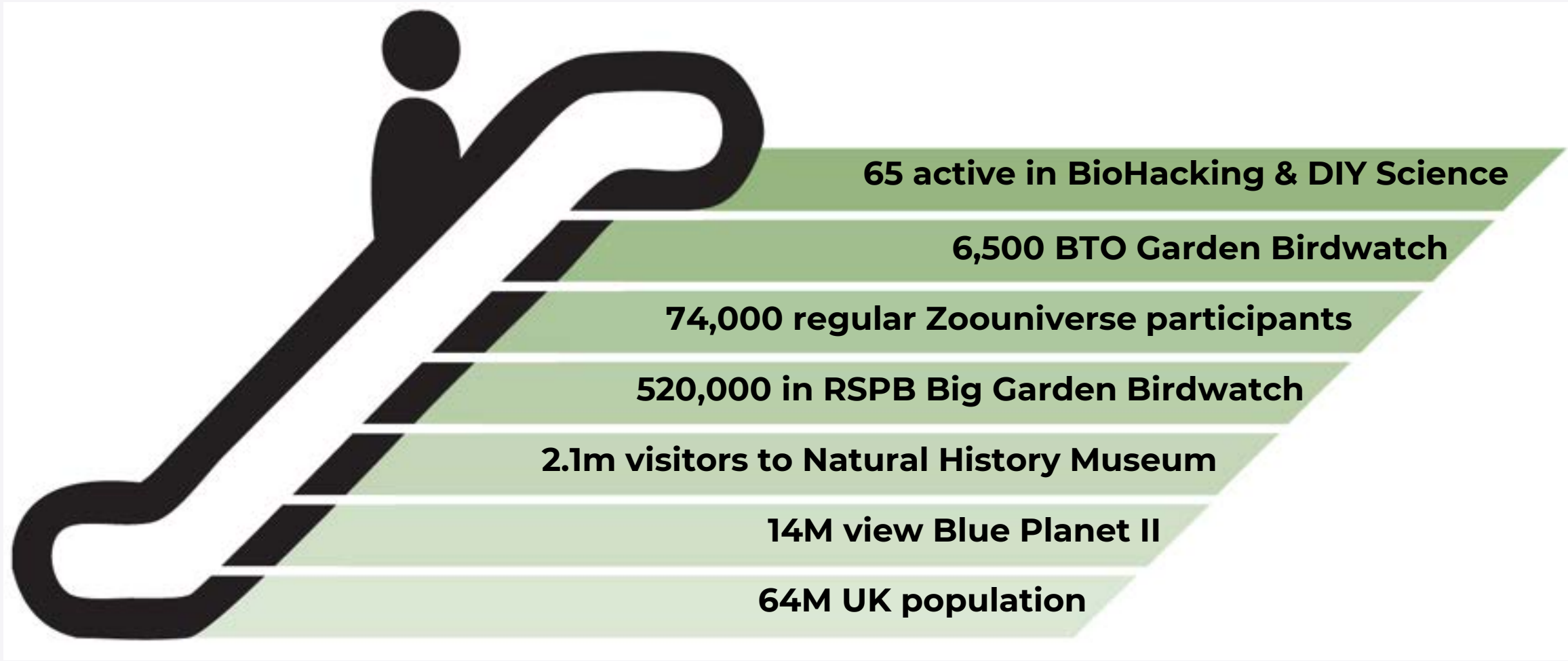
Country profile: Ireland

5. CITIZEN'S ENGAGEMENT IN SCIENCE AND TECHNOLOGY

QA14 And now, a few questions on how you engage with science and technology issues. Do you... **(%)**



UK Engagement Escalator



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 709443

Summary

- Citizen science has a potential at all levels of research – from applied to frontier
- Increasing policy attention and public potential
- Projects like ECSAnVis demonstrate that with appropriate support, any community can engage in citizen science – science is too important to be only for scientists
- As citizen science gains its place within science, we should consider when to use it, how, and ensure that it remains inclusive and open