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First International ECSA Conference 2016

Citizen Science –

Innovation in Open Science,
Society and Policy

19–21 May 2016 | Kulturbrauerei Berlin

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Citizen Science strategy and impact development in Germany

Aletta Bonn, Katrin Vohland, Anett Richter, Lisa Pettibone & GEWISS consortium
Helmholtz Centre for Environmental Research, German Center for integrative Biodiversity Research (iDiv), Museum für Naturkunde Berlin, Germany

Citizen Science is both an old and new field of citizen engagement in research, while not always acknowledged and supported as a strong pillar for science and society. To foster development, innovation and strategic support for citizen science, a Green Paper for a Citizen Science Strategy 2020 for Germany was developed. The framework outlines 10 major fields of activities e.g. related to data rights, training, and communication or funding, for actors in society, science and policy. These were developed in discussions in an open dialogue forum with a series of workshops from 2014-2016 and a nationwide online and written consultation process with more than 700 participants from over 350 organizations within the consortium project 'Citizens create knowledge – knowledge creates citizens' (GEWISS). Here, we report on the process of the strategy development and joint working towards capacity building in Germany and discuss outcomes to foster scientific and social impact of citizen science.

Citizen science –

innovation & inspiration for science

Rick Bonney
University of Cornell, USA

Engagement of the public in authentic scientific inquiry, often called citizen science, is a powerful research technique that can have many important outcomes for education, public understanding of science, influence on policy and conservation, and a closer science/society relationships. Sometimes forgotten, though, is that high-quality citizen science is truly good science, and that it can yield scientific outcomes equal to or even greater than conventional science working by itself. This talk will describe the evolution of a simple idea—that the public can and should have a role in science—and show how that idea is resulting in many kinds of scientific outcomes ranging from natural history observations to volunteer monitoring to hypothesis-driven research to large-scale data analysis.

Participatory Citizen Science

Muki Haklay
Faculty of Engineering Science, UK

The inaugural ECSA conference, we are exploring the intersection of innovation, open science, policy and society. We are exploring the ways in which we can established new collaborations for a common good. The terms participation and inclusion are especially important if we want to fulfil the high expectations from citizen science, as an harbinger of open science. In the talk, the conditions for participatory citizen science will be explored – the potential audience of different areas and activities of citizen science, and the theoretical frameworks, methodologies and techniques that can be used to make citizen science more participatory. The challenges of participation include designing projects and activities that fit with participants' daily life and practices, their interests,

skills, as well as the resources that they have, self-believes and more. Using lessons from EU FP7 projects such as EveryAware, Citizen Cyberlab, and UK EPSRC projects Extreme Citizen Science, and Street Mobility, the boundaries of participatory citizen science will be charted.

Co-designing research projects:
Citizen Science meets stakeholder involvement

Heribert Hofer
Leibniz Institute for Zoo & Wildlife Research (IZW), DE

Co-design or co-creation, the joint design of research projects by academic scientists and the public, is sometimes viewed as the most desirable level of citizen involvement in scientific research because it increases "relevance" and addresses "societal interest". Is the general public sufficiently interested (and perhaps knowledgeable) to participate when invited? Experience with disappointing responses to some such invitations suggests that this assumption may not always hold. I will argue that, rather than trying to involve the general public, targeting specific stakeholder groups will be more beneficial. This is because stakeholders are, from their own perspective, knowledgeable about the subject at hand and highly motivated; therefore they will overcome the "inhibition threshold" and make meaningful contributions. Biases towards specific stakeholder-driven assertions can be avoided by inviting all relevant interest groups.

By definition, stakeholders are societal groups whose interests are affected by a particular issue. I will use examples from the long-standing experience of the IZW to illustrate that both research scientists and society benefit if co-design involves such interest groups. For scientists, it will facilitate recruitment of participants, since groups who are affected are motivated to contribute their views and needs. Professional researchers will also obtain pertinent input, since stakeholders – in contrast to uninvolved members of the general public – have expert practical knowledge about the issue at hand. Finally, integrating stakeholder input in the design of the project will directly improve the practical relevance of the research. For stakeholders, the process of co-creation is rewarding, since they feel they make well-informed contributions, understand why the scientific research is undertaken and because they will benefit directly if the research addresses their specific needs. Lastly, I will show that projects with lower levels of involvement can evolve towards co-creation by increasing both the knowledge and interest of participants, effectively turning them into stakeholders.

Citizen Science - Connecting to the Open Science Agenda

John Magan, José-Miguel Rubio-Iglesias

European Commission

Citizen Science has a long and distinguished history, yet its role is increasing even further now in the digital age. It is an important component of Europe's Open Science and research agenda, with the potential to transform how science is done and to narrow the gap between Europe's citizens, researchers and policy makers. This presentation will review the current situation and look forward to the next steps in both policy making and also in terms of practical support.

Open Citizen Science – Policy innovation & social impact

Roger Owen

Scottish Environment Protection Agency, UK

Citizen Science has an important role to play in how EPAs and other agencies of government gather evidence and intelligence on the environment. In addition, volunteer monitoring is seen as a significant way to engage citizens and to inform environmental policy. The EPA network has encouraged the setting up of a Task Group to take forward best practice and information exchange on citizen science.

Ten principles of citizen science

Lucy Robinson

The Natural History Museum London, UK

The rapid expansion of citizen science programmes globally presents us with incredible opportunities but also some challenges. Citizen science is a flexible concept which can be adapted and applied within diverse situations and disciplines. How do we create cohesion and identify a common purpose globally, whilst also supporting and enhancing the independence, creativity and bottom-up nature of citizen science?

Networks such as ECSA (Europe), CSA (global), ACSA (Australia) and others provide forums through which to exchange knowledge and ideas, identify shared goals and build partnerships together. In 2015, the ECSA working group on Sharing best practice and building capacity in citizen science developed a document outlining Ten Principles of Citizen Science – a series of statements that set out the key principles which, as a community, we believe underlie good practice in citizen science, regardless of the academic discipline or country in which it is applied. Utilised globally and available in over 13 languages, the Ten Principles provide a starting point for discussion and debate. Here, I introduce the Ten Principles, challenge them, and consider how they may challenge us and our current working practices. I also look to the future, examining how we as a network can build capacity and support one another to advance our citizen science programmes, maximising the benefits for science, for citizen scientists, and for wider society.

A vision for citizen science in Europe

Katrin Vohland

Museum für Naturkunde Berlin, Leibniz Institute for Evolution and Biodiversity Research

Citizen Science is becoming a global movement. Albeit there is a long history in the cooperation between lay persons and professionals only now its social benefits and transformative power are subjects of political and scientific debates. Citizen Science grows as a network of different players, and is in some kind of self-identification process, visible in the debates about quality criteria,

discussions about the role of humanities in citizen science, or the relationship to the concept of Responsible Research and Innovation (RRI). Citizen Science walks on the ridge to be inclusive in order to be meaningful for larger parts of the society and to be exclusive in order to build up advocative power on the policy level. All over the world, loose networks become institutionalized in order to exchange experience, enhance synergies with regard to infrastructure development, and to increase significance. Along with this, citizen science becomes professionalized; in the European Citizen Science Association ECSA, we have currently over 130 members from over 20 countries, and we developed and published 10 principles of citizen science. In Germany, with support from the Federal Ministry of Education and Research, we organized within the framework of the GEWISS project a strategic, deliberative process developing a citizen science strategy for Germany. Also self-reflection increases, more and more research on citizen science and its effects is conducted. At this first international ECSA conference, we address citizen science for policy, science, and society, and we further will enrich the vision developed within ECSA that citizen science becomes a meaningful and inspiring approach for sustainable development with all the examples, ideas, and thoughts exchanged at this conference.

Citizen Science - Demonstrating Success

Chair/Organiser: Susanne Hecker
Helmholtz Centre for Environmental Research/iDiv, Germany

The international ECSA conference offers the opportunity to highlight, demonstrate and debate the innovation potential of citizen science for science, society and policy and its role within open science and innovation. Through active collaboration of citizens and scientists in research, citizen science programmes can contribute valuable information that can be used to develop and deliver policies, improve understanding and respond to many of the challenges facing society today.

In this panel "Citizen Science – Demonstrating success" we want to share experiences with citizen science projects and initiatives from divers fields and different focus to showcase the innovational potential of citizen science to science and society.

The diversity of citizen-science technologies: traditional and new opportunities for interactive participation in scientific research

Chair/organiser : Franz Hölker
IGB, Luigi Ceccaroni, 1000001labs & Jaume Piera, Institut de Ciències del Mar

When coupled with emerging technologies, citizen science has the potential to expand the frontiers of education, scientific research and public engagement, because new developments in technology, data processing and visualization, and communication of ideas and results are creating a wide range of opportunities for interactive participation in scientific research. While citizen science can be successfully conducted in a traditional, analog environment, the increasing availability of information technologies has made it easier to interact with more people and to expand the scale and scope of data collection and information delivery. Especially, the widespread use of mobile internet provides an opportunity for mass participation in projects contributing to scientific research. These projects make citizen-science data available, and offer tools to visualize and analyze the measurements, thus allowing citizen scientists to take new active roles beyond collecting data.

Innovative approaches to civic engagement, learning and education

Chair/organizer: Taru Peltola
French National Institute for Environmental and Agricultural Science and Research

The panel addresses the transformative nature and potential of collaborative research to generate new ideas and innovation in a broad sense. It discusses citizen participation from the perspective of education, sharing and learning, and enlarges the perspective from factual and instrumental learning outcomes to the redistribution of knowledge, skills and roles within extended research collectives. It introduces challenges of civic engagement, and demonstrates techniques and tools to encourage various different citizen groups from school children to specialists to volunteer and to take responsibility for the challenges that humankind is facing. The panel also highlights how scientists can engage with volunteers in new ways, and widen the forms of inquiry by challenging established knowledge and methods.

Citizen Science as an input for better policy formulation and implementation

Chairs/organisers: Jose Miguel Rubio & Susana Nascimento
European Commission

Citizen science, powered by online and computing tools, offers an effective way to connect EU citizens and policy. Citizens can get involved by taking part in science-related processes and by understanding and directing the changes taking place around them. Such practices have the potential to significantly impact local and national decision-making, empowering citizens and leading to a better and more transparent government. But how can citizens' knowledge and these novel inflows of data practically enhance the policy-making and implementation processes? Studies in UK and Germany[1] demonstrate that there is a vast potential that remains largely untapped, despite Europe having been at the very forefront of Citizen Science. The session presents successful experiences at national, regional and local level that can serve as an inspiration for a more integrated approach at EU level. This process not only helps to re-engage citizens but also empowers them in an era when the bond of trust between civil society, science and policy-making needs to be strengthened.

[1]Among others: Open Air Laboratories – OPAL (2013) "OPAL Community Environment Report – Exploring Nature Together";

BRAMER, R (2010) "Natur: Vergessen? Erste Befunde des Jugendreports Natur 2010".

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Conservation of saproxylic insects and Citizen Science –
The Life project MIPP is testing a new frontier

Alessandro Campanaro[1], Marco Bardiani (IT), Sonke Hardersen (DE), Michela Maura, Emanuela Maurizi, Fabio Mosconi, Lara Re-dolfi De Zan, Emanuele Toscano, Livia Zapponi, Agnese Zauli, Paolo Audisio, Marco Alberto Bologna, Giuseppe Maria Carpaneto, Pio Federico Roversi, Giuseppino Sabbatini Peverieri, Franco Mason (IT)

[1]CFS-CNBF & CREA-ABP, IT

One of the challenges of citizen science projects is to recruit volunteers for collecting data of endangered species, including also "less charismatic" ones such as certain species of insects. The EU Life project "MIPP – Monitoring Insects with Public Participation" (LIFE11 NAT/IT/000252) is the first Italian project to involve citizens in the collection of nine threatened insects species listed in the Habitats Directive. Five of these species are saproxylic beetles (Osmoderma eremita, Lucanus cervus, Cerambyx cerdo, Rosalia alpina and Morimus asper/funereus), three are butterflies (Lopinga achine, Parnassius apollo and Zerynthia polyxena) and one is a grasshopper (Saga pedo).

In the period 2014-2015, 450 citizen scientists provided 1.300 records (rate of confirmed records: 75 %) to the MIPP project, using the website or a mobile app.

Our first aim was to assess the potential of citizen science to map the distributions of species. Thus, i) we selected the three species with the highest number of records Lucanus cervus, Morimus asper/funereus and Rosalia alpina; ii) we compared the data gathered by citizens with those from the official Italian species inventory, CKmap. We found for all species an increase in the distributional ranges of up to one third. The extent of occurrence was comparable when considering 10 years of records obtained from CKmap and the two years of records from the MIPP project.

These findings are testimony that citizen science projects are suitable for providing reliable and rapid distribution data for neglected species. We plan to test if the data collected by the citizen scientists also allow to analyze the species' phenology and variability in morphology. Future analysis will focus on the suitability of the applied dissemination strategies, and a sociological study will investigate the attitude of the public towards these species of high conservation priority.

Citizen science contributions to species occurrence data in GBIF.org

Kyle Copas

GBIF Secretariat, DK

Theobald et al. (2015) (doi:10.1016/j.biocon.2014.10.021) recently suggested that biodiversity-related citizen science "currently provides a valuable, albeit underutilized, resource for global change research." Using exhaustive keyword searches of scientific literature, they produced a large-scale quantitative assessment of biodiversity citizen science and a recommendation that "citizen science projects should focus on data quantity, covering large spatial and temporal scales, if they wish to be used in peer-reviewed scientific publications."

However, this literature-based approach overlooked the significant contributions that citizen scientists already make to species occurrence data available through GBIF (the Global Biodiversity Information Facility) and its network. Its open-access, near real-time research infrastructure, GBIF.org, is widely used within biodiversity-related research, in 2015 supporting more than 400 research papers with GBIF-mediated data. The GBIF Secretariat is currently updating a preliminary 2014 analysis of datasets published through GBIF.org believed to contain species occurrence records drawn at least in part from 'volunteer(s), who are not necessarily experts, collect and/or process data as part of scientific enquiry'. This analysis will serve as a case study for understanding the contributions that citizen scientists may have already made toward GEO BON's Essential Biodiversity Variables.

GBIF and its co-authors expect that this analysis will offer clear signals about the current proportion and scope of biodiversity citizen science across different spatial scales as well as across taxa. By sharing the results, we also hope of encouraging wider engagement from citizen science projects, as considerable amounts of potentially useful citizen science data remains inaccessible to international biodiversity research and monitoring efforts. Finally, the results may help guide citizen science activities toward specific regions or taxa where improving data coverage can enhance scientific research and policy, thus providing a means of linking local efforts to global data needs.

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Maximizing conservation outcomes through multi-scale stakeholder engagement in citizen science

Jenny Cousins
Earthwatch, GB

For coastal communities, such as those living around Gazi Bay in Kenya, mangrove ecosystems provide key services such firewood and building poles, nursery provision for fish, coastal protection and opportunities for tourism. Mangrove forests are also recognised for their role in mitigating climate change due to their ability to capture and store significant amounts of carbon dioxide. Despite these benefits, the continued destruction of these forests has become a huge cause for concern. Finding new ways to value these services offers the potential to engage stakeholders in their long-term conservation.

Since 2004, Earthwatch has worked with Professor Mark Huxham of Edinburgh Napier University and his team on a community-led mangrove research and restoration project in Gazi Bay. The project has engaged a range of stakeholders (local communities, local students and teachers, policy makers, and international business employees) as citizen scientists (approx. 300) in pioneering mangrove plantation experiments and restoration work. Participants typically join the project for 2 weeks for an intensive and immersive programme of education, data collection and mangrove restoration, with tailored learning sessions for the participants. The data collected has informed our knowledge of how best to restore mangrove forests, and has allowed the team to pioneer the use of carbon credits as a way to fund mangrove conservation and social development in the area.

This pioneering project can be seen as a triple win for community livelihoods/ capacity development, biodiversity conservation and climate change mitigation, and has been showcased by the Kenyan Government as an example of local responses to climate change. A survey of citizen scientist participant outcomes highlights both learning and behaviour change outcomes locally and internationally. Contributions to the Sustainable Development Goals include opportunities for training and higher education; inclusion of women in decision making; sustainable management of natural resources; and climate change mitigation.

Does citizen engagement matter conservation outcomes? – Natura 2000 practices

Małgorzata Grodzińska-Jurczak
Jagiellonian University, PL

Local communities engagement in nature conservation has been widely recognized as improving conservation outcomes. In practice however, representation of general public in shaping nature policy still remains low. The following paper presents how usage of novel methodologies of engaging people into decision making processes may positively affect managing their surrounding nature. Local governments of four municipalities situated at the Natura 2000 site - the Dolinki Jurajskie in Poland, decided performing development of management plans with a high representation of local communities. In 2014 they adopted a combination of a British approach to public education, based on home advisors and Public Participation GIS (PP GIS). Over 60 students selected from the local gymnasiums and lyceums were trained by academic experts on public participation and surveying by using GIS software. Then, they visited as many households as possible, informing residents about the management plans and providing people with educational materials. Each visited inhabitant was asked to select places/habitats in their locality of any, in his/her opinion, natural/cultural value and subsequently assign given places with a spatial reference on a map. To ease the process, respondents were guided by additional questions and provided with a GIS software with predefined polygons based on natural habitats distribution and land cover. Using GIS software, a map of preferred by local communities habitats, was developed. Residents valued the home advisors and appreciated the voluntarily involvement of young people in the action. The education campaign also impacted positively upon the students' knowledge about nature, and provided opportunities for local community to become more environmentally conscious, through the process of intergenerational communication and influence. Additionally, we showed how participatory nature/spatial management, may enrich final format of management plans for Natura 2000 sites, mainly due to different understanding and perception of nature by various parties.

Grassroots citizen science: community-led eco restoration In New Zealand

Monica Peters, David Hamilton, Chris Eames
University of Waikato, NZ

Citizen science can provide best practices for project design and delivery, although in New Zealand, the grassroots nature of community conservation has its own complexities, stemming, for example, from the autonomous nature of groups. Throughout New Zealand, more than 540 community environmental groups are currently restoring, enhancing and protecting diverse ecosystems, largely in response to ongoing threats to indigenous biodiversity and habitat decline. At the same time, the reliance on volunteers

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to assist with the conservation effort is increasing, as agency budgets decline. What exactly do these groups contribute and how are their contributions measured? What are this issues and how can we progress? A recent nationwide study that included groups (n=296), and a range of their project partners indicates that groups' contributions to improving conservation outcomes are likely to be significant. This can be inferred from the combined land area covered by groups' projects and the types of activities undertaken (e.g., weed and pest control along with native species revegetation). Although monitoring is carried out by nearly one-half of groups, a strong focus lies on monitoring restoration management outputs (e.g., number of rodents trapped), rather than outcomes (e.g., increases in desirable avifauna species), hindering the quantification of community-led conservation gains. In addition, the results of groups' monitoring are poorly known beyond the scope of their own projects. Both groups and their project partners identified a wide range of barriers for setting up and sustaining monitoring programmes, and for sharing the results. Diverse solutions were also identified which, when actioned, will help to measure progress toward the ultimate goals of halting, and reversing biodiversity decline in New Zealand.

Usability engineering for successful participatory sensing in citizen science applications

Thomas Bartoschek, Jan Wirwahn, Angela Schwering, Sergey Mukhametov, Mario Pesch & Björn Guntermann
University of Muenster, DE

In a majority of citizen science projects the data to be collected by citizens is geospatial (84% of the projects on the german citizen science platform "Bürgerschaffenwissen"1) and is being presented on maps. If the data is about environmental observations, this approach is often referred to as participatory sensing (Burke et al. 2006). A novel approach in this field is to equip citizens with DIY-environmental sensor stations and to establish citizen driven sensor networks. This approach leads to a better data coverage but also contains motivational aspects, as the citizens build up their own devices. Most existing DIY sensor stations are not fully open in terms of source code, data collection, hardware or extensibility (Uckelmann et al. 2011) and are complicated to set up and maintain. That's why they lack transparency and usability for citizens with little technological experience.

senseBox is a fully open DIY citizen science toolkit for building web-enabled sensor stations for environmental phenomena. With senseBox:home citizens build their own Internet-of-Things enabled sensor station to collect environmental data (temperature, humidity, air pressure, loudness, VIS-/UV-light). The data is being published and visualized on a web based and extensible platform, the openSenseMap.

In a pre-study, we deployed 50 senseBox:home to citizens in Germany. Some participants had problems in the building and registration process of the senseBox, others disconnected their senseBox after some time. Based on this experience we redesigned the setup instructions and the registration process on openSenseMap. In a user study we evaluated the usability of (a) building the senseBox:home, (b) registration and visualisation on openSenseMap and (c) the setup instructions.

The results were analyzed to enhance the setup instructions, the hardware design and openSenseMap user interface to a more user friendly version. In a final step, a questionnaire was used as an evaluation for the user study.

Smartphone tools for coast- and ocean science and citizen´s observatories

Julia A. Busch[1], Anna Friedrichs[2], Oliver Zielinski[2], Marcel Wernand[3], Hans van der Woerd[4], Peter Thijsse[5], Julia Schnetzer[6], Renzo Kottmann[6], Anna Kopf[6], Sandra Nowack[6], Frank Oliver Glöckner[6]
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Natural as well as anthropogenic processes can put pressure on the marine environment and result in harmful conditions that affect human society. While several aspects, such as overfishing or plastic pollution, are well anchored in people´s minds and may lead to self-initiated citizen science projects others, like microbes as crucial formers of our ocean and climate are not commonly known. With the aim to raise awareness on aquatic ecosystems and their major drivers, and to enhance existing scientific datasets in spatial and temporal dimensions, tools for citizens science have been developed in the two EU-FP7 funded projects Citclops (Citizens' observatories for coast and ocean optical monitoring) and Micro B3 (Marine Microbial Biodiversity, Bioinformatics, Biotechnology). Here, three of these tools for coast- and ocean (and other aquatic) ecosystem monitoring are presented. These tools hold different requirements on design and usability to reach different groups of the public, and were designed with strong focus on open access and interoperability to combine professional and lay persons´ datasets and secure long-term availability.

1) EyeOnWater colour app to collect data on the colour of fresh and saline waters; compatible to space- borne measurements and historical in situ datasets (http://eyeonwater.org/color/welcome.php)

2) SmartFluo smart phone device for algal fluorescence; comparable to state of the art fluorescence measurements (http://citclops.eu/fluorescence-/measuring-water-fluorescence)

3) OSD (Ocean Sampling Day) Citizen App and MyOSD sampling kits to discover marine microbial diversity and contextual data; complying with standardised measurement systems of professional researchers (www.my-osd.org)

These tools showcase a broad range of possibilities that citizen science offers to explore the yet unknown but crucial functions of aquatic ecosystems. They provide a new means for different groups of the public to be informed and to eventually get engaged in environmental stewardship.

MammalWeb – Developing generalised technological tools for a user-led citizen science web platform

Pen-Yuan Hsing[1], Steven Bradley[1], Lorraine Coghill[1], Vivien Kent[2], Russell Hill[1], Mark Whittingham[3] & Philip Stephens[1]
[1]Durham University, GB
[2]Durham Wildlife Trust, GB
[3]Newcastle University, GB

Motion sensing camera traps are increasingly useful as tools for ecological monitoring over large spatial and temporal scales. Camera trap monitoring is typically composed of three steps: data collection, data processing (photo classification), and data analyses. There have been highly successful citizen science projects which crowdsourced the first two steps. Started in mid-2015, our pilot project – MammalWeb – has been integrating all three phases into a complete citizen science web platform. In a partnership between Durham University and the Durham Wildlife Trust, we recruited over 50 citizen scientists who manage camera traps at more than 130 sites across north east England. As of February 2016, they have uploaded over 40,000 images to MammalWeb, of which more than 28,000 have been classified by almost 100 registered users. In this session, I will demonstrate the current state of MammalWeb, including interfaces for contributing camera trap data and classifying photos. In addition, computer science students at Durham University are adapting an algorithm to compute consensus animal identifications for photos classified by multiple users, and designing public-facing dashboards for anyone to interrogate our database to answer their own ecological questions. We are partnering with local secondary schools where student groups develop interdisciplinary projects based on MammalWeb, and co-create educational modules with teachers that can be used in ecological curricula and community engagement. I will describe how these efforts guide the development of MammalWeb into a modular and generalisable citizen science web platform, where citizen scientists participate not just in the collection and processing of data, but are also active stakeholders in the camera trapping research lifecycle. Finally, I will identify challenges faced by our approach, and possibilities for integrating cutting edge technology such as data mining techniques or using crowdsourced classifications to train deep learning algorithms in automated image processing.

CITI-SENSE Observatory Toolbox – User Perspective

Hai-Ying Liu[1] & Arne Berre[2]
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With appearance of new low-cost sensor technologies, monitoring air pollution is in the hands of everyone. Novel sensor technologies open the opportunity to monitor air quality at spatial resolutions not possible to reach with traditional monitoring systems. Low-cost sensors are small, portable and easy to use. Citizens can now contribute to monitor the environment. The CITI-SENSE Citizens' Observatory Toolbox contains a number of elements that together provides the foundations of a complete Citizen Observatory.

These elements will be presented here from a user perspective, with an emphasis on the elements that have been realised for the nine city locations in the CITI-SENSE project. This includes support for collection of data and observations through sensors, mobile apps and surveys and also elements for analysis and visualisation of observations through widgets and web portals.

In the CITI-SENSE project the focus is on Air Quality with the following elements: Sensors – a set of sensor platforms has been developed for both static and mobile air quality sensors, including monitoring of CO/CO_2, NO, SO, PM, Radon, Temperature, Humidity etc. They are providing their observations into a common data server. Mobile Apps – a set of mobile apps has been developed to support user perceptions and user answers to surveys and questionnaires, with a focus on air quality questions. A tool for the creation of Surveys and Questionnaires is being used for the creation of both web-based and smartphone based surveys. Reusable Widgets has been developed to visualise the collected observations in different ways, typically based on time-based and location-based queries. A Web Portal is being provided including references for individual web portals for each of the nine city locations.

Methods includes guidelines for how to use sensors, mobile apps and portals in order to support citizens involvement and empowerment in environmental monitoring of air quality.

Citizens Observatories for Effective Earth Observations: the WeSenseIt approach

Suvodeep Mazumdar, Neil Ireson & Fabio Ciravegna
University of Sheffield, GB

In part the aim of Citizen Observatories (COs) is to facilitate the collection of environmental observations through the involvement of citizens. In this talk we will discuss the use of mobile and large scale Web technologies to provide support for COs. We will discuss our experience with an environment developed within the European project WeSenseIt that enables effective monitoring of areas through COs. In particular, we will focus on mobile-based participatory sensing that enables citizens to provide (and collect) information. At the core of our approach is a centralized repository of different types of 'regions-of-interest' (ROI). ROIs are defined as geographical regions marked by citizens and decision makers who deem an area to be of interest based on local, historical or observational factors. Citizens or authorities using our applications can be alerted whenever they enter these regions, and could be requested to perform applications such as providing data as observations, click images and videos, provide any assistance or evacuate areas of danger/risk. We developed this as a bi-directional framework to help citizens and authorities create their own ROIs. The use of smart mobile devices means that the device can provide contextual information, which can be considered during interactions. For example, the user can decide to allow our application to monitor their activity to determine their mode of transport and adjust the notification accordingly to minimize intrusion and thus increase the likelihood of the user providing information. In this talk, we will demonstrate how citizen scientists can engage with different communities to help collect large volumes of data in a variety of application scenarios. Though our application is based on emergency issues related to water management such as flooding, we foresee this as a medium to address other domains such as land cover and use, mapping biodiversity, noise-pollution, etc.

Fireballs in the Sky: A global fireball network in our pockets

Jay Ridgewell & Phil Bland
Curtin University, AU

Fireballs in the Sky is an award-winning smartphone app that uses the sensing technology of smartphones to enable all global citizens to contribute a scientifically useful report of a fireball sighting. Fireballs are long, bright meteors and have a much greater chance of resulting in a meteorite than smaller shooting stars.

Meteorites are the untouched fragments remaining from the formation of our solar system. Studying their pre-atmosphere orbits and composition will extend our scientific understanding of the solar system.

The Australian-based Fireballs in the Sky project uses augmented reality technology, magnetometers, accelerometers and gyroscopes inherent in today's smartphones to create the world's leading fireball reporting capabilities and enable researchers to unpack the pre-entry orbital location of the space rocks.

Day or night, citizens from around the world who see a bright fireball in their skies submit their sighting using the Fireballs in the Sky app. Over 21,000 downloads in more than 80 countries have resulted in over 1,700 reported sightings of fireballs in the app's three-year history. The sightings can be viewed on an interactive map by visitors to the Fireballs in the Sky website (http://fireballsinthesky.com.au/maps/app-sightings/). When multiple sightings for the same event occur, researchers engage submitters in further investigations and share updates and reports with the community.

Because of the unique and potentially once-in-a-lifetime nature of fireball sightings, the project calls upon a diverse array of outreach methods to maintain citizen interest in fireball science.

Fireballs in the Sky is the public engagement face of the Desert Fireball Network (DFN), based at Curtin University in Western Australia. The DFN comprises a network of 32 autonomous digital camera observatories across Australia, including 6 in schools, nightly capturing the paths of meteors through the atmosphere in order to track orbits and recover freshly fallen meteorites.

enviroCar – citizen science tools for sustainable mobility

Christoph Stasch, Albert Remke, Arne de Wall & Matthes Rieke
52°North GmbH, DE

EnviroCar is a citizen science platform with the aim of performing open research in the area of sustainable mobility. EnviroCar allows to collect, analyze and share car sensor data. An Android application enables citizens to collect car sensor data while driving using an On-Board-Diagnostics II (OBD-II) bluetooth adapter. Afterwards, citizens can upload their track data to the enviroCar ser-

ver that stores the data and provides an open API, where it is anonymized accessible as open data. The enviroCar portal gives users full control on their own tracks, e.g. deleting certain tracks, and provides basic analysis facilities, e.g. a map view of tracks and a time series chart for visualizing certain parameters of a track like speed or fuel consumption. Besides analyzing their own tracks, users can also compare summary statistics with other enviroCar community members, e.g. 'What's my average fuel consumption compared to others?'.

As the data is accessible as open data, it can also be used and analyzed by others. Traffic planners may utilize the data to check whether certain measures affect the traffic flow. A first study at University of Augsburg has shown promising results in utilizing the data for consumption based routing. In order to enable such analysis, several map applications and analysis are currently being developed. The enviroCaR package allows to import the data in the R software and to do further statistical analysis. To integrate customized analysis facilities, the Web Processing Service defined by the OGC is used. Several map applications, e.g. a density map of top Carbon-Dioxide emissions, have been implemented using ArcGIS Online and other technologies. In our talk, we will first illustrate the different tools and technologies used in the enviroCar infrastructure. Afterwards, we will describe lessons learned as well as challenges and opportunities for the future.

How reliable is data produced by citizen scientists?

Christopher Kyba

Deutsches GeoForschungsZentrum Potsdam, DE

Quantifying systematic uncertainties from a sensor is one of most the fundamental tasks involved in science. Regardless of whether that sensor is a particle detector at CERN or the eyes and brain of a citizen scientist, all data are subject to statistical and systematic errors.

The Loss of the Night app is a citizen science project that produces data about the brightness of the artificially lit sky at night (light pollution). Participants are asked to evaluate whether a series of individual stars can or cannot be seen. The quantitative nature of this data makes it possible to examine several of the sources of error in an observation. Examples of errors include: changing meteorological conditions, variations in eyesight, different levels of observational experience, different spectra of outdoor lighting, failure to understand how to use the app, and intentional false reports.

This talk will discuss how we are attempting to understand the uncertainty of app observations through partnership with the citizen scientists. Our „community experiments" ask the citizen scientists to perform the observation in an unusual way (e.g. making a pair of observations at the same location). Through „Flashmobs for Science", we gather a large number of participants to a single location to make simultaneous observations. Both of these methods provide increased motivation for experienced participants to continue to take part in the project. They could likely be adapted for many other citizen science experiments that involve data collection.

The talk will end with a brief presentation of www.myskyatnight.com, a portal that puts the data generated by the project back into the hands of citizens, and provides them with analysis tools to track local changes in skyglow.

Crime Scene German Inland Waters: On The Track Of CO2

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Inland waters are an active component in regional as well as global carbon cycling. German inland waters cover 2.4% of total land mass and ranges from coastal zones over lowland areas to alpine regions. Understanding the main factors controlling inland waters CO_2 emissions and relating these to the aquatic microbial community structure is essential for predicting carbon cycle responses to ongoing environmental change and anthropogenic stress. One factor that is growing in importance is the artificial lightning of ecosystems at night. Half of the human population lives within 3 km distance to a surface inland water. Because artificial lighting is tightly associated with human settlements, freshwater systems are particularly susceptible to changing light regimes. Within the citizen science project "Tatort Gewässer" we conducted a simultaneous sampling campaign across German inland waters. Therefore, we asked citizen scientists to take samples for measuring CO2-concentrations and microbial diversity and to evaluate the artificial light conditions at a water body close-by. We set up an online platform with an interactive inland water map where interested citizens could easily register their freshwater system of choice. In order to ensure standardized sampling procedure and a high quality of data, we developed the "Tatort Gewässer" sampling Kit including sampling equipment and a detailed manual as well as an online video tutorial. In total, we sent 742 sampling kits to registered citizens and received 86% of the packets back. Covering such a large spatial distribution of water bodies within a certain time frame was only possible with the help of citizens. Therefore, we assume citizen science to be a powerful tool to gain a better knowledge about the processes occurring in German inland waters.

Cities at Night: ISS pictures to trace the environmental impact the light pollution

Alejandro Sánchez de Miguel

Universidad Complutense de Madrid, ES

Cities at Night is a project to with the aim of preparing the ISS pictures for the scientific use. On it the volunteers tag, locate and georeference the pictures. During the last year it have been tagged more than 163000 pictures, 3000 locations and 700 georeferenced. The ISS pictures are the only source of information about the blue emission that is fundamental to trace the environmental impact of the light pollution. Some preliminar impact maps will be showed.

From an interdisciplinary science community to citizen science

Sibylle Schroer

IGB - Leibniz-Institut für Gewässerökologie und Binnenfischerei, DE

The European Loss of the Night Network (LoNNe) has established a highly interdisciplinary research community, which is bridging the regional and disciplinary gaps of light pollution research. The network could in a further step gain from citizen science. With this tool the network could increase the data collection outreach and improve the awareness of citizens about the environmental issue. But an important task for optimal outreach is to step out of the circle of existing communities of interest, e.g. astronomers or ecologist, and to involve the general public, lighting planners and authorities. Knowledge about citizen awareness of artificial light, its impact on nature and human well being is today biased. However, this knowledge is necessary basic data for citizen actions. Specific factors like culture, level of education, age and gender need consideration for arousing the interest. The EU-project STARS4ALL will establish a platform to involve citizens and collect data on the worldwide changing nightscape. Users will need rewarding in form of a functional community, which will offer news, events, data and the possibilities for own actions. With involving major players from different fields like arts, education and city development the community will be further supported by user's respective fields of interest. Within this talk the constraints of reaching the different groups of interest will be discussed.

SUCCESSFUL EXAMPLES OF CITIZEN SCIENCE IN SLOVAKIA : ENVIRÓZA, BEAGLE & NA TÚRU S NATUROU

Sylvia Baslarova (SK)

1. Enviróza (Envirosis) is a school program and outdoor game designed to gather and spread information on contamination sites in Slovakia.

Intended for primary and secondary schools, the programme is implemented through website www.enviroza.sk. Participants (teachers and pupils) seek out and identify localities of contaminated sites, publish data online and score points for doing so, and also inform the public about results. Envirosis is categorised as a citizen science programme; its practical role is to update information about selected contaminated sites registered in the Information system of Contaminated Sites (ISCS) and to identify new sites (known as "school-identified sites") that display signs of serious contamination. The informations are further processed by Slovak Environmental Agency (SEA) staff, integrated into the ISCS and thus made available to state authorities as well as the professional and lay public.

Envirosis's educational goal is to gain information about existing cases of contaminated sites and the state of their own environment based on first-hand observations in the field.

2. Beagle is a school program, where participants can choose one or more trees to follow throughout the year, they report dates of flowering, leaf burst and other phenological events along with photos to web site http://www.beagleproject.org. Later they can compare findings with other schools and see how the events took place across Europe throughout the year.

3. NA TÚRU S NATUROU is a school program focused on occurrence of plant and animal species. Activities in this program are divided into field surveys and web entries. Participants choose specific location and realize the field trip, where they seek out and identify and document the species (audio, video, and photo). The data are published online (website http://snaturou2000.sk – registration of the observation group, mapping the location, uploading the evidence of species appearance)

Driven to Discover: A model for using citizen science in the classroom

Robert Blair, Karen Oberhauser, Andrea Lorek Strauss, Nathan Meyer
University of Minnesota, US

"Driven to Discover – Citizen Science in the Classroom" is a program designed to show both formal and informal science educators how to use citizen science projects to engage middle- and high-school youth in independent science investigations. Our process consists of three major steps: 1) build the science skills of youth, 2) have them participate in a national or international citizen science project, and 3) have them conduct their own investigations based on their new knowledge. Throughout all of the materials, we emphasize that the process of science is an unending cycle of observing, questioning, testing, and concluding mixed in with ample opportunities to reflect and backtrack when necessary.

This project works. It was developed with funding from the National Science Foundation, which included a substantial amount of both formative and summative evaluation. The main conclusions of these evaluations were that students realize that they can contribute to national science efforts, that they can ask and answer their own questions, and that their research matters. You can find the full results at our website – extension.umn.edu/citizenscience.

Our curricula are paired with national and international citizen science projects that cover the topics of monarchs, birds, pollinators, dragonflies, and phenology, but our process will work with almost any citizen science project. We have completely developed curricula for the Monarch Larva Monitoring Project and eBird and these are available for free download at our web site. We are beta-testing curricula that pair with the Great Sunflower Project, the Migratory Dragonfly Partnership, and the National Phenology Network. These will be available in two years.

The Swedish Mass Experiments – a Win-Win for Schools and Scientists

Lotta Tomasson, Fredrik Brounéus
Public & Science (VA), SE

Since 2009, the Swedish non-profit organisation VA (Public & Science; in Swedish Vetenskap & Allmänhet) has been coordinating an annual national citizen science event for schools – a mass experiment. The mass experiment is part of ForskarFredag, the Swedish events on the European Researchers' Night. Through the mass experiments, thousands of Swedish students from preschool to upper secondary school have contributed to the development of scientific knowledge on a diverse range of topics, such as the

acoustic environment in classrooms, storage of refrigerated foods, children's and adolescents' perception of hazardous environments and the development of autumn leaves in deciduous trees. In 2015 the "Tea Bag Experiment" studied the decomposition of organic material in soil and its relation to climate change, by means of a newly developed, standardised method built upon the burying and weighing of tea bags. Through the mass experiments the students get to participate in real research, while the researcher is provided with massive amounts of data. From the teachers' point of view, the mass experiments provide them with material and methods based upon state-of-the-art research to integrate into the curriculum. The mass experiments efficiently link education to research, establishing valuable contacts with researchers and giving students insights into research methods and scientific thinking.

High school students as citizen's scientists in air quality research – lessons learned

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Bringing citizen science projects into the classroom can help students understand the relevance of curriculum objectives. As part of the ongoing CITI-SENSE project high-school students in Norway, Serbia, Slovenia and the UK were equipped with tools to study the air quality at their schools. The CITI-SENSE project (Development of sensor-based Citizens' Observatory Community for improving quality of life in cities) is a Collaborative Project under EU's Seventh Framework Programme, grant agreement no 308524) aims at developing citizen observatories related to environmental quality in cities. Results from the collaboration so far indicate that students and teachers are motivated to engage in these environmental studies, and able to perform studies of good quality. Students involved in such projects may be valuable collaborators with broader professional or citizen's science projects, as they can measure physical parameters, collect observations and perception or performance data while having a support network of experienced teachers. Furthermore, they can provide insight into the priorities and goals of the participants as well as the drivers and barriers for improving school environments. However, we have identified some challenges that need to be overcome to realize this potential. (1) Successful cooperation with schools requires adaptation to curricula and relatively strict schedules. A two-week delay may imply a full year lost. (2) Students are motivated when they are free to implement their own ideas and priorities into the projects. This may lead to datasets that are hard to reuse or compare with others. (3) Indoor environments vary widely between rooms and with usage and meaningful interpretation of measurements and other results often requires that a lot of context is recorded with the measurements. This is not always practicable/feasible. Despite the challenges, there is a tremendous potential of empowering the schools when providing them with tools to conduct research in their premises.

Phénoclim : 12 years of citizen science in three Alpine countries

Charlotte Mader

CREA Mont-Blanc, FR

Phénoclim is one of the oldest French citizen science programs created in 2004, associating rigorous science with environmental awareness. Phénoclim studies, through participatory science and innovative technologies, the impact of climate change on the seasonal cycles of flora and fauna. This protocol is suitable in all mountain environments for a general public, to develop scientific skills and ecological knowledge.

For 12 years, 5,000 volunteers (individuals, schools, protected areas, associations) have been participating in Phénoclim. Phénoclim focuses its efforts on involving schools. It now works with 138 classes in three Alpine countries: France, Switzerland, Italy. The average age of the student ranges from 10 to 12 years.

Phénoclim is a scientific tool for teachers. Based on their approach, teachers can build a multidisciplinary project around the program; for instance associating the program with biology, mathematics, poetry, drawing, foreign languages, music or sport. With high school students, supervisors can address more advanced topics relying on the CREA* studies of climate data: all data and analysis are available to all for free. Some exchanges have already been held between the classes of different participating countries. Phénoclim is also a way to raise students' awareness about other environmental initiatives.

The CREA speaker will present several key tools necessary to establish a sustainable participatory program, such as spurring interaction between researchers and participants, involving mediators at school, facilitating teachers' ownership over Phenoclim, and ensuring the quality and reproducibility of the protocols. Other questions for the future will be addressed such as fostering the

interactions between the various categories of Phenoclim observers (Protected areas, Schools, Environmental Education Centers, Mountain guide organisations) to create tools for young publics to be used in different settings.

*The Research Center for Alpine Ecosystems is a scientific and educational NGO working on the ecology of mountain ecosystems. www.phenoclim.org

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The use of the Open Air Laboratories (OPAL) surveys as a tool to promote science learning and engagement in schools

Gretta McCarron, Karen Kerr
Queens University of Belfast, GB

The Open Air Laboratories Network (OPAL) citizen science project began in England in 2007 and was extended to the rest of the UK in 2014. The project aims is to engage members of the public of all abilities in environmental research and learning about local environments. Six surveys: Air Quality, Biodiversity of hedgerows; Bug counts; Soil and Earthworm; Tree health and Water Quality include field notebooks and identification guides to support this objective. Community scientists are employed to deliver training and facilitate surveying across the UK. The School of Education at Queen's University Belfast is a delivery partner and we work with schools to complete the OPAL surveys within school grounds and further afield. In order to assess the value of OPAL activities for learning science in schools we developed an online questionnaire covering topics including science in schools; attitude to science; working with others and care for the environment. We invited schools doing OPAL activities to participate in our research project. A total 253 students (8-14 years) completed the pre- activity online questionnaires and 71 completed the post-activity question-naires between May and June 2015. Students reported if they learned science, developed new skills, improved their interest in science or care for the environment as result of participating in the OPAL survey activity. 73% of students reported learning science and enjoying the OPAL activity but although positive, there was no significant change in attitude towards science or the environment as result of completing OPAL activities. This result shows that Citizen Science activities have a positive impact on science learning in schools particularly as we only completed one survey with the students. We suggest an 'embedded' OPAL programme of activities within a science scheme of work involving repeated surveys over a sustained period could yield a more significant result.

Citizen Science in Biomedicine: Creating Experts with a Cloud Lab

Benjamin Keep

Stanford University, US

Citizen science participants can play many different roles in the scientific process. Eterna, a citizen science project in biomedicine, asks participants to make progress on specific open problems in RNA folding. Eterna's model flips the traditional model's roles of professional researcher and project participant: the research team creates the data by subjecting player solutions to tests in a remote lab; the project participant attempts to solve the problem, interprets evidence, and builds theory. I argue that this model, where the project developers run experimental tests and the project participants decide what to test, leads to new forms of scientific expertise. This development of expertise, in turn, accelerates the scientific discovery process and leads to high levels of collaboration between dedicated participants and project developers. Eterna's model offers many benefits, but also significant challenges. The problems have become much more complex, the amount of data available to participants can be overwhelming, and the development of expertise has become more challenging. The issue of how to curate and disseminate new knowledge— both to project participants and to the larger scientific community—remains. Will this model continue to work as Eterna asks participants to invent new RNA-based diagnostic medicines? I give an overview of Eterna's model, paying particular attention to future directions in biomedicine and give reasons to believe that this model could accelerate progress on other scientific problems.

Engaging citizens for social good: Drawing on behavioural models from social influence technologies to improve disease vector reporting by citizen scientists

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Following the spread of several infectious diseases, such as dengue, chikungunya and zika, concern is being expressed over the emergence of vector-borne viruses in new geographic locations. One of the vectors that has received particular attention in the last years is the mosquito. The Asian tiger mosquito (Aedes albopictus) and the yellow fever mosquito (Aedes aegypti) are of particular concern because they have adaptations to the environment that make them highly resilient and thus difficult to control or eliminate. For example, the fact that Aedes mosquitoes lay eggs, that can survive without water for several months, in so many different water containers (rain-filled cavities in trees, leaf-axils of plants, cans, pots, tires, cisterns, etc.) makes it very difficult, if not impossible, to monitor them effectively with conventional methods. The "Mosquito Alert" project (an extension of the former project "AtrapaelTigre"), is aimed at monitoring these two disease-vector mosquitoes using a citizen science based approach.

To date, despite the global acceptance of the need of effective citizen engagement as the most important requirement for the success of citizen science programs, most projects rely on tradition, intuition, or trial and error to develop engagement strategies. Mosquito Alert is developing a novel engagement framework inspired by theoretic behavioural models for social influence. In this contribution, the different behavioural models are reviewed, analysed, and discussed in the context of adaptation to maximize citizen participation. The authors compare participation trends before (year 2014) and after (year 2015) introducing this novel engagement framework into some of the project elements (e.g. mobile app, communication strategy, project network, etc.). Results indicate a clear improvement in many indexes related to citizen participation and in one of the main goals of the project: to maximize the quantity and the quality of mosquito related observations reported by the citizen scientists.

Crowdsourcing Research Questions in Science

Patrick Lehner

Ludwig Boltzmann Gesellschaft, AT

With the Open Innovation in Science project, the Ludwig Boltzmann Society is carrying out pioneer work in Europe: for the first time, open innovation methods are expanding the potential of research processes. One major part of this initiative is the Crowdsourcing Project: "Tell us! What questions about mental health does research need to answer?" This is the first European initiative to involve people from outside the science system in research on mental health by asking for their participation in the development of research questions.

From 16th April until 6th July an online platform was open for contributions. Within eleven weeks, 400 contributions of high quality were submitted by affected people, their families and experts. The platform "Tell Us!" has reached thousands of people from 83 countries. After an intense analysis phase, 8 major research clusters have been identified: mental resilience, more precise diagnoses, psychosomatics, psychotropic drugs, new options in therapy, health care structures, de-stigmatization of the mentally ill and mental health of children and adolescents.

In September 2015, registered participants were invited to vote on two topics that were most important to them. Afterwards, an international Jury Meeting took place, with representatives from the entire spectrum of expertise on mental illness and mental health of children and adolescents, the de-stigmatization of the mentally ill and the effort to achieve greater progress in the field of healthcare research were attested to be the suitable topics for further research investigations of the Ludwig Boltzmann Society.

The next step is a rapid transfer of its findings to concrete, cross-disciplinary research activities. It is the ambitious objective to clearly demonstrate that participative processes have the potential to support the creation and generation of novel scientific outcomes.

Evaluating Citizen Science: Too much „How", not enough „Why"

David Ziegler, Lisa Pettibone, Katrin Vohland
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Evaluating citizen science activities has become a center question both within the citizen science community and for funding institutions. Several publications in the Europe and U.S. have focused on developing quality criteria for citizen science and finding evidence of impact among citizen science participants (e.g. Brossard 2010, Philips et al 2014, Kieslinger et al 2015, Talmon-Gros & Teichler 2015, Ziegler et al 2015). So far however, these attempts at evaluation have done little work to acknowledge and incorporate the diverse approaches and different goals of citizen science projects, which range from development of massive datasets to education or scientific exchange among equals. By analyzing different citizen science projects in Germany, we have found that individual projects have very different, and in some cases even contradictory goals. It may thus be counterproductive to evaluate a project developed to address a local environmental problem on the number of peer-review publications it produces. In addition, different stakeholders in a citizen science project pursue different goals. We argue that a close look at an individual project's goals should be the basis of meaningful evaluation of citizen science. Also we discuss the aims of different stakeholders, especially comparing aims of funding agencies and project participants, and provide an overview of the types of goals citizen science projects can have. We close by offering a toolkit for self-evaluation of citizen science projects.

Session 06 Talks
Citizen engagement and collective intelligence for participatory Digital Social Innovation:
Opportunities and challenges for Citizen Science in solving everyday sustainability challenges

Youth Woodsmoke Photovoice: Participatory Action Research and Environmental Justice

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Background: Wood smoke pollution in winter is an everyday environmental justice threat for low-income adolescents living in Tacoma, Washington State, USA. As a federally designated "Wood stove Reduction Zone (WRZ)", this area experiences high levels (>35 μg/m3) of fine particulates due mostly to wood stoves. Little is known about how adolescents engage in environmental justice activities addressing wood smoke air pollution policies, including those directed at environmental sustainability and human health.

Purpose: This pilot study examined the feasibility of engaging, educating, and empowering policy actions in adolescents in a „citizen science" community sampling project for levoglucosan, a marker of woodsmoke particulate.

Methods: 10 adolescents (14-18 years old) living in the WRZ participated in the design and data collection of 24-hour indoor-air samples during the winter months of 2015-2016. Youth included Photovoice methods (digital-storytelling) in their data-collection design, and each produced two "works" that included there "air-sample-data + photo + caption" at a public event to which policy makers and the press were invited.

Results: Youth collected 24 samples during days of high and low pollution and 97 photos depicting their environments and concerns. Levoglucosan was detected in all samples (range 10-5200ng/m3). Themes resulting from the participatory Photovoice analysis included concerns for global warming, environmental degradation, economic justice, and protective actions for lung health.

Lessons Learned: This innovative participatory design allowed youth to determine and selection of novel locations for air-sampling and documentation of environmental threats. Sampling machine noise and the likelihood of the burn-ban events happening on national holidays are barriers for home sampling. Challenges remain in this methodology in the collective empowerment of youth citizen scientists to design creative and effective ways to represent the data and mobilize for policy change.

Policy recommendations for collective approaches to digital social innovation for mobility

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Social innovation is increasingly being seen as a way to address societal challenges, but is also a mechanism for achieving a systematic change. In this framework, the European Commission promotes the Collective Awareness Platforms for Sustainability and Social Innovation (CAPs) with the main aim to design and pilot online platforms to create awareness of sustainability problems and offering collaborative solutions based on networks, enabling at the same time new forms of social innovation.

The project CAP4Access is developing and pilot testing methods and tools for collective gathering and sharing spatial information relevant to wheelchair users with the objective to foster awareness of physical barriers, encourage urban planners for removing such barriers from bottom-up research, and enhancing the quality of life and movement of people with reduced mobility. Within the project, participative strategies for addressing accessibility have been developed and implemented involving different stakeholders in four pilot sites. After two years of the project, partners are gathering conclusions and recommendations that compile enabling and limiting factors with regard technological, stakeholder, governance, ethical, political participation, sustainability, and international aspects. These lessons learnt are being integrated in delivering policy recommendations which help to address shortcomings and limitations of current CAPs practice in Europe, in particular addressing accessibility.

The first lessons learnt report will be presented in the conference focusing in how to stimulate and sustain citizens' engagement over time, how to involve different target groups, how to avoid the digital literacy of certain citizens' groups, etc. The presentation will also address on the social impact of involving citizens in the tagging and awareness raising activities to increase the accessibility of European cities, to achieve changes in policy making and to improve the quality of life of people with reduced mobility.

Session 06 Talks
Citizen engagement and collective intelligence for participatory Digital Social Innovation:
Opportunities and challenges for Citizen Science in solving everyday sustainability challenges

The Grow Observatory: Collective intelligence and participatory citizen science
for growing for food and sustainable land use

Drew Hemment[1], Mel Woods[1], Rastislav Skalsky[2], Carlo Buontempo[3], Roy Neilson[4], Moeen Khawaja[5], Pavlos Georgiadis[6], Lucrezia Caon[7], Angelika Xaver[8], Naomi van der Velden[9], Andy Cobley[1], Nick Taylor[1], Selena Georgiou[10], Antonio Mollfulleda[11], Tim Knippers[12], Jerome Bouvard[13], John Rowan[1], Tomas Diez[14], Endre Dobos[15], Blair McKenzie[4], Matt Locke[16], Wolfgang Wagner[8], Ronald Vargas[7], Oliver Moore[17], Tom Rowlands[18], Scott Poynton[19]

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Citizen science has a long history, and Citizen Observatories have become an effective platform as increasing ownership of digital technology has opened up the possibilities for data collection and sense making. The European Community has identified the vital contribution Citizen Observatories can make to global environmental monitoring activities.

In this presentation we consider a critical challenge to address before the true vision of Citizen Observatories is realised, namely, balancing the problematic issue of scaling, and a requirement for actionable information, with a move from a ‚contributory' to a ‚collaborative' and ‚co-created' model of citizen science.

We present The GROW Observatory (GROW), a H2020 funded project employing a citizen platform and community to generate, share and utilise information on land, soil and water resource at a resolution hitherto not previously considered. The vision is to underpin smart and sustainable custodianship of land and soil, whilst meeting the demands of food production, and to answer a long-standing challenge for space science, namely the validation of soil moisture detection from satellites.

GROW will demonstrate and test a number of solutions to the aforementioned challenge. The burning issues of a specific community of interest are placed at the centre of the project from the very start. Low cost but high power consumer sensing technology, and an easy to use Soil Testing Kit, lower barriers to entry. A Massive Open Online Course (MOOC) facilitates scaling of rigorous citizen observation. Engagement is underpinned by storytelling and community champions. A campaign-based approach engages citizens, scientists and policy makers to co-design coordinated sampling operations around particular needs and issues.

We consider how GROW creates a simple, compelling proposition around newly available and powerful consumer sensing technology, a strong science and policy narrative, and the collective power of shared and open data and knowledge.

Session 06 Talks

Citizen engagement and collective intelligence for participatory Digital Social Innovation:
Opportunities and challenges for Citizen Science in solving everyday sustainability challenges

Engaging citizens in long-term data-collection activities: the role of Science Cafés

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Modern smart cities rely on massive amount data collected over long periods. Data can be related to weather, air pollution, noise, traffic, to mention but a few. Traffic data in particular are crucial for planning, operational and public information tasks. However, it is difficult to deploy infrastructure embedded with sensors that support collection of traffic data dense in time and space.

The recent growth of internet of things support a novel approach to long-term data acquisition, thanks to devices that combine small size, high computing power, and wireless capabilities.

In this context, project CHEST/TrafficFlow pioneered the participatory approach to road traffic monitoring: citizens were provided a device capable of collecting continuous statistics about vehicle count, speed, and type. A pilot action running in the Metropolitan Area of Florence, Italy, proven the approach to be very succesful: over 30 millions of passages were acquired since may 2015. These data already contributed to achieve high impact in viability planning, and public information to road users.

A major lesson learned was how to engage our users: after a technology assessment phase conducted with a small focus group, we addressed a larger community using various approaches, from meetings with representative of the public bodies, to social network campaigns. We discovered that an ideal setting to engage users were the meetings organised by the local chapter of the Science Cafè. These are sometimes defined as "anti-conferences", where the debate is driven by the public, rather than by experts. Through Science Cafè, we were able to find users for the project, discover the needs of the community, and assess the impact of the activities. This paper describes in detail our experience, with the aim to produce a blueprint for data-collection participatory projects in the era of the Internet of Things.

Session 07 Talks
Citizen Science Studies. Engaging with the participatory turn
in the co-production of science and society

Observing the observer: Citizen Social Science and the Participatory Turn

Alexandra Albert

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The rise of citizen science and participatory science, where citizens voluntarily participate in scientific activities, has drawn attention to the way in which scientific research is undertaken, to who the scientist is, who can collect data and what such data can be used for. Citizen Social Science (CSS) explores the way in which the description of society by those living it generates society anew. CSS unpacks traditional approaches to participation, and operates at the intersection of conventional methods for social science research and the process of practical knowledge production by and for everyday experts. It is a form of social science from 'within' and makes use of ethnomethodological approaches, of attempts to promote an understanding of society by the people being studied, for the people being studied. This research explores the Mass Observation Project (MOP) as an early example of CSS, and examines the experiences of the voluntary observers in recording and documenting their observations, and participating in the project. An analysis of a sample of responses to four directives in the second wave of the MOP sheds light on notions of reflexivity. It contrasts the assumed professional reflexivity of the trained social scientist with lay perspectives of the Mass Observers when asked about their role in the project. It explores the way in which the Mass Observers are enlisted as co-producers of social science and society. The Mass Observers view their role as one of contributing vital knowledge about current times for social and historical legacy. They are trusting in the framing of the MOP and the way it is set up. They value the opportunity for self-reflection in their approach to the different topics or questions posed in the project, as well as valuing the opportunity to reflect on previously unconsidered topics.

Who are the citizens in citizen science? Public participation in distributed computing

Jérome Baudry, Elise Tancoigne, Bruno Strasser

University of Geneva, CH

At the core of citizen science projects lies the belief that the making of science should not be seen as the sole purview of experts, but instead should extend to a broader public. Whether they are called "amateurs", "crowd", "people", or "citizens", they are increasingly enrolled by scientists not just to discuss and learn science, but also to actively engage in the production of scientific knowledge. However, surprisingly little is known about who the citizens scientists are, especially with regard to their education and professional backgrounds. The limited surveys which have been carried out tend to represent the most active participants only, leaving open the question about the identity of the participants as a whole.

Our presentation will provide a closer look at one kind of citizen science project: distributed computing (Seti@home, Rosetta@home, Einstein@home, etc.) focusing on the identity of the online participants. By mining online profiles and user data, our work provides a rich picture of the demographics of participation. We also examine how participation is shaped by the very infrastructure of the projects - public discussion spaces, teams organizations, and reward systems.

Openness in biohacking : expertise and citizen science

Rosen Bogdanov

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Biohackers and do-it-yourself biology present an interesting example of a citizen science in practice. Taking the current configurations of citizen science, it is not far-fetched to say that biohacking groups and networks have spurred a model closer to what many authors have dubbed a co-created or community-based participatory research. What does such a reproduction of hacker cultures in biology mean for the construction of expertise in citizen science?

In my presentation, I investigate numerous enactments of openness and the role they outline for the co-construction of expertise and citizen-scientist collaboration in the European biohacking practitioners. In their practices, biohackers value learning by doing and the adaptability of participants to novel knowledge or emerging problems through workshops and un-conferences. Additionally, they construct artefacts that can be modified, both technically and legally, and actively vouch for the construction of new versions that can bring unexpected originality out of mere reproduction. In other words, openness is enacted as, on the one hand, an endeavor for building citizen expertise, and on the other - as a form of participation, whereby each participant's goals and existing expertise are taken in consideration from the design of a project to its very implementation.

To that end, I argue that these practices of openness, more than representing a particular case of citizen science, can actually enlighten its current models by placing importance on the thin line between education and research when engaging with citizens.

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Citizen Science Observatory in Spain

Fermín Serrano Sanz, Jesús Clemente-Gallardo, Francisco Sanz, Eduardo Lostal, Mari Carmen Ibañez (DE)

Due to the boom of citizen science practices we are currently facing today, there is a need of having a clear picture of the situation in Europe. Addressing this at national scale, the Ibercivis Foundation is creating the Observatory of Citizen Science in Spain (www.ciencia-ciudadana.es), co-funded by the Spanish Foundation for Science and Technology FECYT. It aims to monitor the growth of such initiatives, to catalogue them and to analyze different impacts.

The first basic idea is to know who does what. By inviting actors to put themselves in the map, an interesting debate will emerge through the deliberate expansion of the concept evolving what is and what is not citizen science. An estimation of 200 cases in Spain will be cataloged by the end of 2016, including participatory projects, research groups, and also institutions who collaborate, finance or disseminate citizen science.

The second underlaying idea of this project is to understand how citizen science is changing the relationship between science and society. Therefore, a set of tools such as metrics will be identified and used to identify and analyze existing literature and statistics available. With an inclusive and holistic approach, the study will cover different models and formats of public engagement in science in order to analyze different perspectives and cross-cutting concerns. Among others, techniques from both humanities and social networks analysis will be used to analyze community behavior, scientific outcomes and knowledge sharing.

This project will combine offline and online activities such as twitter chat session using #CitSciChatES and participatory workshops. The portal will also provide services such as citizen science data visualizations and dissemination of scientific communication articles. Whenever possible, all the resources collected and produced within this project will adopt open data standards.

The (Citizen-)Scientification of Society and the Pleasures of Research. Citizen Science as Science Communication.

Sascha Dickel
TU München, DE

Citizen Science crosses the borders of established institutional spaces. Furthermore, participation in citizen science projects does not require certified academic expertise. Hence, citizen science might be interpreted as a practice which questions the modern authority of science and blurs the boundaries between science and society. This interpretation, however, is rather one sided because it is solely focused on the practice of knowledge production and views science primarily as an academic profession with experts on the inside and lay persons on the outside.

In my talk, I will analyze the discourse of citizen science (instead of its practice) and focus on science as a cultural form of life (opposed to science as a profession). I suggest that citizen science can be interpreted as science communication which legitimizes science as a form of life. While citizen science questions the jurisdictional claim of professional scientists as the exclusive producers of scientific knowledge, citizen science also reinforces the authority of science as an institution capable of solving the problems of our contemporary age. With citizen science, the practice of science-based problem solving expands to the private sphere. The discourse of citizen science presents research as a source of enjoyment – something that can be experienced and enjoyed in leisure.

The focus on the performativity of citizen science as science communication allows us to discuss it not just as a blurring of boundaries between science and society (on a structural level) but also (on a cultural level) as part of the ongoing scientification of modern societies and their everyday lifeworlds.

Engaging participants in citizen science studies: A qualitative approach to exploring the motivations and experiences of environmental citizen scientists

Ria Dunkley
Cardiff Universitry, GB

This paper explores how participation in citizen science effects volunteers interactions with nature, place and community, as well as how such experiences influence understandings of scientific processes and ecology. In collaboration with the Zoological Society of London, the University of Edinburgh and the Woodland Trust, this study involved an in-depth exploration of the experiences of 22 individuals participating in environmental citizen science projects. By contrasting the motivations and experiences of citizen scientists involved in a UK-based river-monitoring project with those involved in a phenology project, I explore the wide-variety of meanings that individuals ascribe to their citizen science experiences. I use narrative analysis techniques as a conceptual tool

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for thinking about the relationships between individuals and the environment. The study reveals that as well as being motivated by the desire to increase their knowledge and skills about ecological and environmental issues, both love of place and love of life appear to play their part in encourage citizen scientists to engage with projects and have an important role in sustaining their interest. I will also discuss the implications of being a citizen scientist for social identities connecting this to wider notions of citizenship.

Wisdom of the crowd as value-creation

Roel During, Rosalie van Dam, Irini Salverda
Wageningen UR, NL

In the current digital information and participatory society citizens need and create actionable knowledge. While governmental organizations produce the objective know how knowledge for legitimised policy implementation from the idea of fair and democratic actions, citizens however create new communication landscapes to enlarge their "citizens' science". This citizens' science isn't objective, peer-reviewed and accounted for in journals. Accumulation of knowledge is more about taking stock of every action and diffusing and reiterating it continuously via social networks. One way of looking at the accumulation of citizens' science is the perspective of shared values. We see knowledge creation as a specific case of value creation, and this opens up an array of research methods to understand how and why this happens.

In our research we reflect on this knowledge based 'collective digital value creation'. Some fields of citizens' science are public, others are collective or communal and others more private. Sometimes private and collective coincide and sometimes the public may not be so public. This perspective on public and private is combined with thematic fields: citizens' science in nature management, in agro-food systems and in environmental issues such as reducing energy levels in households. Our research focuses on governance and innovation. Governance because of the power relations in themes where a government is accountable for; innovation because of new online mechanisms of knowledge accumulation.

In our presentation we will highlight some thematic differences on citizens' science as well as the conceptual framework of citizens' science as value creation, as the first preliminary results of our research.

Citizen Humanities: Configuring Interpretation and Perception for Participation

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The history of volunteer participation in scientific work usually starts with ornithology in the late 19th century. Since then this practice has spread to many disciplines in the sciences. The success of such projects has to a large extent been a question of data quality and design of participatory protocols, which puts the contributor on par with the scientist as an observer of the natural world. The ability of the protocol to produce valid data, while also being inclusive enough to mobilize the volunteer contributors in large numbers, is still a challenge to citizen science (CS) projects. To enable the perceptual qualities of the contributor in mass observations, the cognitive thresholds have been kept low, thus making CS as inclusive as possible.

However, with few exceptions, the humanities have not managed to facilitate broad public participation the same way as the sciences have. Nevertheless several citizen humanities (CH) projects have been launched lately on platforms such as Zooniverse, Scholars' Lab and Micropast. As the humanities are generally associated with interpretation – a hard-earned ability acquired only through specialized studies (Bildung) – data is often perceived as inaccessible without training. Implied in hermeneutic ideals of knowledge, context is viewed as a prerequisite for informed interpretation. In this paper we are comparing how the design of participatory protocols in CS and CH are constructed, with special attention to where and how in the research process "citizen humanists" are put to work. Our empirical analysis consists of analyses of the online environments generated by a number of contemporary citizen humanities projects.

Understanding motivations of citizen scientists

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Citizen science is increasingly becoming a used, accepted and valued method for data collection within the natural sciences. As thousands of citizens engage with scientific research, questions arise about the socio-personal aspects of their involvement, particularly why people get involved. What personal psychological benefits do they seek? What motivates participants to keep contributing to

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citizen science projects? And finally, do project managers recognise and address the motivations of their volunteers, thereby helping to fulfil the volunteers' psychological needs and motivations? Building on established volunteer motivation theory, this research uses data collected from participants in citizen science projects as well as from citizen science project managers to explore the actual and perceived initial and sustained motivations of participants. Findings show that value and understanding aspects as well as a fun factor (rated 1, 3 and 2 respectively) are significantly more important motivators than career or social aspects for citizen scientists (rated 7 and 6 respectively). Project managers' perception of their volunteers' motivations mirrors this general pattern; however, the fun factor rather than the value factor is perceived as most important and the social factor rather than the career factor is perceived as least important. Understanding why participants get involved and continue in citizen science projects can provide project managers with valuable information to ensure the sustainability of their projects. Citizen science managers who understand participant motivation can tailor recruitment, engagement and participant involvement to ensure motivational expectations are met, thereby ensuring that volunteers are satisfied with their volunteer experience. The satisfaction of participants may subsequently influence their engagement and the time committed to the project, and ultimately impact on the amount and quality of data collected and the outcome of the citizen science project. Knowledge of participant motivation can therefore lead to better outcomes for both volunteers and citizen science projects.

What can Citizen Science learn from participatory research?

Tobias Krueger, Johannes Himmelreich, Anne Dombrowski, Bettina Koenig, Joerg Niewoehner
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Citizen Science is often defined in a narrow sense as a service subordinate to established academic science. However, the term Citizen Science suggests much more. It suggests modes of research that are participatory or transdisciplinary, if not altogether free from established scientific institutions. Although these modes of research have different historical traditions and philosophical motivations, and they aim for different outcomes, they all evidence that citizens have participated in science in different ways and in different contexts long before the popularity of the Citizen Science label. In this paper we discuss what can be learned from these participatory research experiences in order to enable and foster Citizen Science in a broad sense.

In particular, we will identify Citizen Science as a form of democratic control over established academic institutions. In so far as scientific results and recommendations are co-produced with societal context, the critical questions of citizens may counter path dependencies that are unacceptable, unfair or unsustainable. The confrontation of different knowledges in this process then bears potential to open up negotiation of the status quo, of values and aspirations in society. This kind of Citizen Science is much more than data collection; it guides a discursive reflection of what data actually mean.

Realising the transformative potential of Citizen Science, however, will require attention to issues of competence and fairness – another lesson from participatory research which will be discussed. Competence includes clearly and jointly defined responsibilities and procedures. Fairness problematizes who participates and why, and who is prevented from participating by political, economic, cultural or technical means. Neglecting these issues will run the risk of reproducing existing structures.

References: Krueger, T., Maynard, C.M., Carr, G., Bruns, A., Mueller, E.N. and Lane, S.N. (2016) A transdisciplinary account of water research. Wiley Interdisciplinary Reviews: Water, 10.1002/wat1002.1132.

Participatory turn's legacy and the European 'Responsible Research and Innovation' emerging framework

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Over the last two decades in Europe, science and technology's unforeseen impacts led many STS scholars to plead for a 'participatory turn' in order to make our democracies more able to handle sociotechnical controversies. This gave rise to the establishment of new deliberative forums, which share the ideal to accommodate different ways of reasoning and portray participation as free from strategic bargaining and manipulation. However, since the outset of this participatory turn, critiques have pointed to the risk of participation being either romanticized or instrumentalized. Against the backdrop of the emerging discourse of the European 'Responsible Research and Innovation' (RRI), these critiques recently found a new echo as science and technology are increasingly steered by a strong political and economic pressure to innovate in order to fix the so-called 'grand challenges' such as, for example, climate change, unemployment or ageing societies. We propose to scrutinize the impacts of the emerging framework of RRI on the legacy of the participatory turn, as we hypothesize a possible shift to a renewed version of participation, only valued for its capacity to include multiple stakeholders as early as possible in order to incorporate once for all the social dimensions into innovation. We

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propose to investigate this diagnosis and see in what extent it may contribute to the closing down of participation as-we-knew-it. We will do so by drawing on an intensive discourse analysis of official reports and documents, as well as interviews with RRI's proponents in academia and at the European Commission. As this research takes place at the very beginning of a broader PhD Thesis, intermediary results and reflections will be presented.

Are the rhetorics of citizen science prohibiting detailed accounts of its own practice?

Christian Nold
UCL, GB

This research is based on a three year ethnographic study of an EU funded citizen science research project as well as case studies of related projects. The focus of the paper is on the Air Quality Egg and Smart Citizen Kit, which are both environmental monitoring devices that have been deployed with the public to gather environmental data. These projects have been held up within the policy and academic literature as well as mainstream media as successful examples of citizen science. Yet based on my ethnographic accounts as a participant observer of workshops, interviews and analysis of the project's mailing lists, a more complex picture emerges. The paper asks why detailed ethnographic accounts of projects that identify the complexity of participatory practices are largely absent from the existing citizen science literature. The paper identifies that across the literature there are specific rhetorical devices such as 'the exemplar', 'empowerment language' and 'imagined future potential'. The paper makes the argument that these rhetorical devices are becoming the default way of framing citizen science and are displacing other ways of creating accounts of its practice. As an alternative, this paper argues that we should be encouraging reflexive participant observer accounts by citizen science project initiators. These have the potential to open up more nuanced descriptions of projects and enable a rethink of the methods and potential of evaluation within citizen science.

Co-producing conflict: The making of wolf numbers in France and Finland

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Citizen science is often justified because it is believed to provide legitimate and socially more robust knowledge. Drawing on a highly contested case of wolf population monitoring, we address the unexpected outcomes and tensions related to collaborative knowledge production. As 'academic reflectors', we compare monitoring practices in Finland and France — two countries where collaborative monitoring of wolves is well established. Although taking different forms, wolf monitoring has triggered tensions in both countries. We discuss these tensions in terms of the role of participatory techniques in creating or limiting possibilities and agency of the participants. In particular, we highlight the affective nature and eventfulness of participatory techniques and settings: their capacity to invite or alienate different types of volunteers (professional and non-professional volunteers), and to spark new concerns, roles and identities for them. We identify tensions between expected and actual forms of volunteering, highlight the shifting roles of volunteers as activists or cognitariat, and discuss the patterns and power relations of as well as the potential for distributed expertise in volunteer participation in knowledge production.

A brief story of the Barcelona Citizen Office: community of practice, the rules of governance, and the connection with citizens and public administration

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In 2012, we decided to create a group with the very few (five) citizen science projects from Barcelona that were active at that time. We created a community of practice where we were learning from each other in a mutualistic form envisaging the city as an open lab and citizens as highly motivated volunteers to support and create new research projects. Along these 4 years, we have built what we call the Barcelona Citizen Science Office. Community has grown up and the Office has become a meeting place for up to 15 projects from a wide diversity of disciplines. Within this framework, we have helped each other to face common challenges and share main worries. We have also built some rules to govern the community, we have found the ways to improve concrete projects, we have organized events to meet and discuss, we have created a prize, and we have even developed new projects with many different actors. And finally, we have succeeded in this way to make citizen science more popular in Barcelona and stronger in many senses. All these actions were only possible with the Barcelona Institute of Culture (Barcelona City Council). Public administration has played a fundamental to role

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to make the Office something meaningful, useful for everybody and able to put different universities, different disciplines and different projects in the same arena. Future challenges and main difficulties of these sort of initiatives with such a large number of projects and with close connection with a city council or any other kind of public administration or public agency will also be discussed.

What is citizen science today? A case study of current practice in Germany

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Citizen science is quickly becoming all things to all people: a way to collect massive data sets at relatively low cost, a way to break science out of the ivory tower and better engage the public, an approach to educate the untrained in scientific methods. These goals are underpinned by different normative assumptions and understandings of science–society interactions. In order to deliver background to the stirring theoretic discussion in this session, this paper seeks to present an empirical overview of how citizen science is practiced in Germany, based on research conducted through the capacity-building project "BürGEr Schaffen WISSen" (Citizens create knowledge or GEWISS). What sorts of projects call themselves citizen science, who is involved, and what sorts of interactions are taking place – or desired? In addition, what issues are being debated: and what truths are taken for granted? This paper aims to set the stage for discussion by showing what the German community sees as citizen science today.

Creating Communicative Spaces that nurture inquiry, reflection, and dialogue in citizen science

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Public engagement in science, citizen science, and related practice generally aspires to broadening participation and democratising science – but what is this participation for and what is the nature of this democratisation? While some conversations to answer these are being had at the same time that technological advancements in the digital information age are transforming access, reach, and the impact of science, the methods, principles, or spaces to explore and achieve democratisation within citizen science remain scant. While acknowledging that the spectrum of engagement and goals of citizen science are broad, I argue that valuable lessons can be drawn from both communities of practice and communities that research and support community-led inquiry. In this paper I present some of lessons learnt from reflective practice in the technoscientific work of the grassroots organisation 'Public Laboratory for Open Technology and Science' and the explorations of the community group 'Citizen without Borders'. Based on these and drawing on Action Research theory I put forth principles for the creation of communicative spaces, that is, spaces that build community, confidence, trust, and capacity, by promoting mutual understanding and consensus about what to do, and where silenced voices can speak, expertise mixes with experience, and experimentation is encouraged. Grounded on epistemological and practical foundations, these spaces have the potential to nurture inquiry, reflection, and dialogue in citizen science. That is, spaces, physical and virtual, to bolster quality of communication and dialogue to create more effective communities of inquiry, to foster the transfer of artifacts/tools/innovations as well as the integration of knowledge and information across disciplinary/practice boundaries, and where longer term capacity for democratic knowledge production and sharing is built.

Who Cares? Reflections on participatory research inviting written care stories

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Finding answers to the question „Who cares for whom in the future?" is by no means easy. Care tasks concern us all and every day. This project investigates and analyses how and under which conditions care can succeed in daily life. Leading questions are: Who is involved? What kinds of support networks are helpful? What might a fair future care culture look like? The project is conducted in cooperation between schools (students and teachers), universities (researchers) and the broad public as citizen scientists.

Citizen scientists are invited in different ways to participate in the knowledge production: 1) The "call for contributions" has been circulated within a research-practitioners network, 2) The author network of "people writing stories" has been contacted per e-mail and traditional letter, 3) Cultural and gender diverse personal networks have been addressed, 4) An open participation zone has been established via internet

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addressing citizen scientists in broad public to share their written care story in order to find out what a fair future care culture might look like.

Up to present 93 written care stories have been submitted. Themes encompass everyday life situations, helping people in the neighborhood as well as giving care to people until their end of life. Reflections on motivations to contribute show that 1) already existing trustful relationships to authors support participation, 2) questions of dealing with data are essential concerning ethical aspects and 3) enlarging the diversity of authors has to take cultural aspects, language, gender and critical attitudes towards research into account.

Participatory research approaches within citizen science dealing with "care stories" need high sensitivity in collaboration processes. A broad variety of issues are raised and every author has her or his concern motivating writing. 'Practitioner-reflectors' and 'academic-reflectors' work together on grounding the insights more deeply.

Scrutinising citizenship in citizen science

Eugenia Rodrigues
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Over the last three years, I have been an interested observer of citizen science (CS) phenomena in their current forms. Lately, I have been involved in the creation and running of a network on citizen science and crowdsourcing. This has provided me with close-up observations on the actors, practices and meanings that populate the vast universe usually encapsulated by the term CS.

For an external observer as I think of myself interested in issues of public engagement and participation with and in science, the perspectives under which CS can be analysed are manifold. In this paper, I am particularly keen to bring citizenship into the 'citizen science' equation. I have, also, in the recent past, had the opportunity to discuss and frame issues of citizenship in relation to CS: 'What kind of citizen is the citizen in citizen science?' (CSA conference, S. José, 2015); 'Conceptualising and enacting the citizen in citizen science' (IPA Conference, Lille, 2015). This time I am asking what does CS do for citizenship? I am not interested in limiting this discussion to the debates that have taken place in STS on scientific citizenship (nor am I discarding them). These would inevitably lead the reflection to consider (for instance) whether CS deepens scientific citizenship and in what way, through which process and so on. Rather, what I'd like to propose to the session is a reflection on citizenship – as analysed and critically debated in socio-political theory – and its relation with science through the lenses of CS. My proposition would be that in order to address the question I formulate above, one needs to look into the manifestations of 'citizen-ness' in citizen science (for example and very simply, what civic rights/duties are deployed in CS? What do they do for the relationship between members of society and science?), and examine the implications for science-society relations.

Citizen science: can a community of practice advance scientific reflexivity?

Jennifer Shirk
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At this critical time in the field of citizen science, one challenge is in defining the practice. Some refer to citizen science as a technical method, emphasizing rigor and the quality of research (e.g., Dickinson et al. 2010). Others use the term as a call for public engagement, equity, and justice in setting the research agenda (e.g., Irwin 1994). These perspectives can seem difficult to reconcile, as they prioritize different approaches to collaboration and different outcomes of the research partnership (Silka 2013).

Although scientists are increasingly expected to attend to both social and technical aspects of complex problems, decades of institutional and cultural expectations can limit the ways they consider engaging with the public. In every field, the narratives and discourse of professional communities significantly frame what is considered legitimate work (Kuhn 1962, Harding 2000). Citizen science has provided an opportunity to reconsider some expectations of scientific practice, but can it encompass aspects of both equitable engagement and rigorous research?

I'll share narrative research that helps reframe perceptions of scientists as detached, and of citizen science as purely technical. Narratives can help us appreciate the cultural challenges scientists face to being socially responsive, and can reveal ways scientists navigate nuanced interests to engage in both rigorous and relational work. This research opens an inquiry into ways that scientists, through citizen science, approach what Schön (1983) calls "problem setting," the collaborative process of identifying what issues to address and how to address them.

As associations emerge to foster a community of practice for citizen science, it is timely to ask how such groups might help establish and productively reinforce new norms. Can we begin to develop a richer and more inclusive narrative about the work of scientists, one that can appreciate or even enable reflexive work?

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Dingdingdong. Interferences with the Natural History of a Disease

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The paper retraces a number of research activities undertaken by the collective Dingdingdong – Institute for the Co-production of Knowledge about Huntington's Disease (HD). Dingdingdong came into being as a reaction to the dramatic effects of current medical definitions and cultural images in circulation about Huntington's disease as the most horrible, most terrifying of all diseases. These definitions that are not only perpetuated within medical discourse but gain a frightening impact through recent representations of HD in TV-series and a growing number of novels risk not only to define this 'neurodegenerative' disease as solely tragic from an outside perspective but also to prescribe - thus functioning like self-fulfilling prophecies - how the illness is or will be lived and experienced. With my presentation I intend to introduce Dingdingdong's pluridisciplinary enterprise in which research and political activism are closely intertwined. At the beginning, in 2012, Dingdingdong was what we might want to call a bluff, its only site of existence being an internet-page. By stressing our crucial alliance with pragmatist philosophy on a number of levels, I would like to show, how the wager we committed to collectively then, has been producing quite a number of very real effects over the last four years. I also attempt to clarify Dingdingdong's pragmatist heritage that is of utmost importance to all our activities by exemplifying its effects or operativeness by zooming in on some sites of our ongoing investigations that all share the aim of co-producing new « natural histories » of Huntington's Disease with and for its users.

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Citizens Science for environmental monitoring:
Engagement and Empowerment in Citizens' Observatories

CITI-SENSE: Observing environmental quality at public places, a step towards empowering citizens in local management

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One use case developed within the CITI-SENSE project (EU FPVII 308524) is the toolkit for monitoring environmental quality and giving direct feedback in public spaces. It measures thermal and acoustic conditions and collects citizens' perceptions about public spaces in terms of the environmental conditions and about their general satisfaction with the place. The aim of the toolkit is to empower citizens and facilitate the dialogue between citizens and local authorities contributing to, and participating in, environmental governance and decision making associated to public places in a city. The issues of public spaces clearly fall within the framework of citizen observatories. Citizens should play a key role in the understanding and the success of a public place as a factor in increasing the quality of life and health. As it is recognized in the placemaking approach within the Project for Public Spaces UN Habitat: "when it comes to public spaces, the community is the expert". We engaged citizens to observe 4 public places in the city of Vitoria-Gasteiz (Spain) using this toolkit. This presentation focuses on the storyteller of the experience shared between citizens, city authorities and scientists designing the toolkit. We will show the observations made, how they were experienced and used by the participants, by city authorities and by other stakeholders, and the evaluation of the toolkit from users perspective.

Citizen engagement

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A new conceptual model is presented for engagement in citizen science and for integrating earth observation and citizen science worldwide. The related novel strategies for citizen engagement consist of three components: (1) consolidation and expansion of existing citizen observatories and citizen-science projects; (2) recruitment of new citizen observers from society at large; and (3) improvement of knowledge transfer and capacity building through the formation of local leaders to strengthen local-community networks. This model (1) fulfils the need to demonstrate engagement in each citizens' observatory, (2) provides the necessary engagement and training tools, and (3) results in a consistent, scalable approach to citizen science worldwide. It includes novel training materials and 'Train the trainer' workshops, which provide skill development for citizen-science leaders, viz., in: engaging and retaining volunteers; field management (risk assessment and emergency response plan); engaging stakeholders; selecting, designing and developing specific activities (e.g., bioblitzes, DIY workshops, species surveys, volunteered-geographic-information workshops); and monitoring these activities. Online training materials are developed as supporting documentation to the face-to-face training workshops. Additionally, guidelines on how to start a new citizen-science observatory are produced and best practices provided for technical tools, enabling rapid idea-to-realization related to geographic information and standardized environmental observations. The adaptability of workshop materials to specific citizen-science projects using a co-created approach demonstrates the applicability across a range of stakeholders and audiences. Monitoring technologies are used to develop citizen engagement activities, with data to be collected, interpreted and managed using advanced analytical techniques. Business plans to involve entrepreneurs into citizen science as a way to enhance economic sustainability are also developed. The proposed strategies are used to demonstrate how to engender massive, long-term and global participation.

Session 08 Talks
Citizens Science for environmental monitoring:
Engagement and Empowerment in Citizens' Observatories

Public air quality information and perception in eight cities: the CITI-SENSE empowerment initiative

Tom Cole-Hunter[1], Arne Berre[2], Núria Castell[3], Mirjam Fredriksen[3], Johanna Robinson[4], Leonardo Santiago[5], William Lahoz[3], Hai-Ying Liu[3], Tania Martínez[1], Philipp Schneider[3], CITI-SENSE Consortium, Sofia Aivalioti[6], Sonja Grossberndt[3], Hans Keune[7], Fintan Hurley[8], Mark Nieuwenhuijsen[1], Alena Bartonova[3]

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CITI-SENSE (EU RTD FP7 co-funded collaborative project) aims at development of citizen observatories related to environmental quality in cities. We developed several interactive tools for engaging and empowering citizens, which rest on collecting user-contributed observations of air pollution level and sources of emissions.

Using our tools, the public can both contribute observations and receive visual information on air quality. Being used are the CityAir smartphone application, the Little Environmental Observatory (LEO), an online perception questionnaire and network-modelled map (supported by the Spatial and Environmental Data Services, SEDS, and Web Feature Service, WFS, platforms) in Barcelona, Belgrade, Edinburgh, Haifa, Ljubljana, Oslo, Ostrava and Vienna. They are being evaluated by the user for usefulness and empowerment potential.

Objective air quality data is visualised with a novel Air Pollution Indication (APIN). This is informing users on levels of pollution in different places, and helps them for example to choose alternative routes in the city. The CityAir app is identifying perceived hotspots of good and bad air quality and qualitative sources of air contamination, in locations as far as the United States, India and Iran. The online questionnaire is surveying citizen opinion on air pollution issues in their cities. These results can be used to inform authorities on the needs of citizens towards optimising public air quality information services.

By the end of 2016, these tools will be fully-documented in an online, open-access Citizens' Observatory Toolbox. This toolbox will be available for user groups including citizen scientists and city authorities wishing to conduct similar empowerment initiatives, and can be adapted towards the needs of each initiative. The tools are now operational, and their wider use through the establishment of sustainable Citizens' Observatories continues to be evaluated.

The Use of Citizen Science and Participatory Mapping
in Gathering Local Environmental Knowledge of Air Quality

Louise Francis

Mapping for Change/ University College London, GB

Participation in environmental decision making was pushed to the fore as a result of the Rio Declaration on Environment and Development. However, the provision and production of environmental information, particularly on issues such as air quality, relies heavily on a 'top-down' approach. There is the need for better mechanisms that support citizens to consume, generate and utilise environmental information if they are to actively participate in environmental decision making.

This talk will describe the processes and methods used to generate and share local knowledge on air quality, by over thirty communities across London. We will highlight some of the criticisms levied at citizen science projects, such as data validity, whilst exploring the successes and failures of publicly initiated scientific research compared with local authority initiated programmes.

Our aim was to provide affordable and accessible monitoring equipment, which included the use of diffusion tubes to measure nitrogen dioxide levels, paper maps to record tube locations and survey sheets to provide additional local knowledge about the monitoring sites. To streamline the process and extend the number of potential participants a mobile application was developed that enabled georeferenced data collection and publishing of results via an online Community Air Quality map. Different recruitment methods were used and the level of active participation in the data collection varied, as did the level of dissemination and introduction of measures to reduce pollution levels. To date, the environmental knowledge produced has been used to gain media coverage; lobby Mayoral candidates; hold talks with Transport for London, initiate low emission zone feasibility studies and widen awareness of the associated issue.

Citizen science and participatory mapping provide practical opportunities with which to bridge the environmental knowledge gap and encourage more citizens to participate in environmental decision making.

Session 08 Talks
Citizens Science for environmental monitoring:
Engagement and Empowerment in Citizens' Observatories

Empowering citizens by applying a user-centered design for constructing a citizen science presentation platform

Yaela Golumbic, Ayelet Baram-Tsabari, Barak Fishbain
Technion, IL

Many leading citizen science projects have invested greatly in creating a user friendly experience and designing platforms for data submission, social interactions and learning materials. These platforms have often been shown to enhance motivation and enjoyment, serve as community building tools, enable participant to share their findings, collaborate, and engage in discussion. However, while many of the citizen science projects have publics' needs in mind, their main goal remains advancing scientific research and hence project platforms do not necessarily comply with the desires of the public involved.

As part of the European „CITISENSE" project for developing sensor-based citizen observatories, we have developed a platform for air quality data presentation. The platform was built using a user-centered design approach that included several interviews and focus groups to determine the public needs and desires in such a platform. Using the platform, participants have open access to all data collected by the air quality monitoring units, they can use the presented data for their personal benefit, analyze the data, discuss the results, make suggestions for further research and use their new scientific knowledge to further advance social involvement and activism. Applying the user-centered approach, contributed to a better design and development of these tools, and ultimately supports publics' needs in a clear and practical fashion. These tools further contribute to public empowerment and support long-term engagement and activism in local environmental issues.

The Impact of Citizen Science projects
on Participants' Perceptions and Behaviour towards Air Pollution

Diana Silva
King's College London, GB

Background: It is widely recognised that air pollution is a public health concern accountable for numerous health problems and tens of thousands of premature deaths per year in the UK. Despite this evidence, awareness of the issue is low in comparison to other public health risks. Improved methods for engaging with the public and communicating this risk are required.

Aim: To investigate the impact of an air pollution Citizen Science project on participants' perceptions and attitudes towards air quality issues.

Methods: The methodology used is rooted in Community-Based Participatory Research (CBPR) and uses observation, surveys and interviews. Parents from a "Parent and Baby Group" participated in an information session on air pollution causes and effects; then using portable exposure monitors and GPS watches, a subset of parents measured the air pollution they and their children are exposed to as they go about their normal day.

Results: Most of the participants expressed the view that being able to collect air pollution data themselves was a key motivator for deciding to take part in the project.

The majority of the participants stated that having access to personalised environmental information they themselves gathered increased their air pollution awareness and their desire to identify ways in which they could reduce their and their children's air pollution exposure. Additionally, some participants expressed their desire to use the air pollution data collected to raise awareness and persuade local government to address the issue.

Conclusion: This citizen science project appears to have raised awareness of the risks of poor air quality by supplementing information provision with active collection of personalised exposure data. Citizens' responses included personal behaviour change in order to reduce air pollution exposure as well as a desire to use data to lobby local government for change.

CITI-SENSE Observatory Toolbox – Developer Perspective

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The CITI-SENSE Citizens' Observatory Toolbox contains a number of elements that together provides the foundations of a complete Citizen Observatory. These elements will here be presented from a developer perspective, with an emphasis on the technical elements and frameworks that can be reused for the creation of new Citizen Observatories.

The elements provided through the developer's perspective of the CITI-SENSE Observatory Toobox include guidelines for how to set up and test sensors packages and sensor platforms, open source software for the creation of mobile apps possibly with attached mobile sensors, software for the creation of surveys/questionnaires and a data model and data storage service for the storage of sensor and human observations.

The architecture follows a scalable architecture with an option for multiple front end sensor systems as well as multiple mobile apps for data. A generic framework for multiplatform mobile observation apps is provided. The CITI-SENSE Data Model version 2.2 is implemented in a WFS server, and supports the storage of air quality observations as well as questionnaires.

The Big Data aspects of sensor data streaming and handling of velocity of sensor data is handled by an option of delegating the first storage step to sensor platform dedicated storage services, with a subsequent storage into the common WFS server supporting the CITI-SENSE Data Model. This server supports access to the data through multiple representation formats such as XML, CSV and JSON. In addition there is an experimental export to linked data through a SPARQL endpoint.

Reusable Widgets has been developed to visualise the collected observations in different ways, typically based on time-based and location-based queries and these can be used both through development in smartphone apps as well as in portal development.

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Title iSpot data quality, metadata and visualisation

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The Open University, GB

The iSpot platform (www.iSpotnature.org) helps people learn how to identify species but also collects biological records, so far over half a million observations recorded. To use iSpot the observer takes a photo of the organism and uploads it, the community of users then help to identify the species. A likely identity of the observation is determined based on the reputation of the users who suggest and agree with identifications. When a large number of the likely IDs produced by the iSpot system were checked by the national expert verifers the vast majority of records were accepted as correct. The reputation system on iSpot allows a kind of 'triage' since the majority of observations are of common easily identified species which those with moderate level of knowledge can quickly identify and thus the experts are not overloaded by having to deal with very large numbers of observation. Instead experts can concentrate on the more difficult observations without a likely identification.

Each record in the iSpot system has full metadata including who made the observation, when, where, what species names were suggested and by whom, the full reputation of each person is also recorded as are the voucher images. Some of the most common errors on the system were associated with entering location information e.g. missing out minus sign on latitude or longitude coordinates, many of these errors disappeared when we switched to reading the location directly from the image metadata or by allowing users to put a dot on a zoomed in live map.

It is particularly important to make data visualisations relevant to the target audience, some highly complex visualisations have been used in scientific papers about iSpot whereas maps or video of the data and data input are used on the public face of the website.

The COBWEB Quality Assurance System in Practice: Example for an Invasive Species Study

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COBWEB is one of five EU FP7 funded citizen observatories projects. Besides the goal of empowering citizens in biosphere reserves towards contributing to environmental policy, COBWEB focuses on the generic software infrastructure needed to support a range of environmental issues: biological monitoring and earth observation validation. Towards this flexibility, the quality assurance system is proposing to the stakeholder designing the survey, to also design the quality assurance process. The approach is based on workflow composition combining different quality controls belonging to 7 categories or "pillars" (Meek et al. 2014). Each pillar is focusing on a specific dimension of qualifying the captured data and therefore on the type of reasoning algorithms to set the values of a range of quality elements. Three complementary quality models are used (i) the producer model using ISO19157, (ii) the consumer model using GeoViQUA and (iii) a stakeholder model to qualify the volunteer with quality metrics such as vagueness, reliability and trust (Leibovici et al. 2015). Computed and evolving through the workflow the quality element values constitute the metadata on spatial data quality. The paper describes the practical use of this quality assurance system for an invasive species citizen science study concerning the Japanese knotweed carried-out in the Snowdonian National Park in Wales. Focusing on the species occurrence from the citizen's observations, the paper describes the design steps of the QA workflow process and presents quantitative and qualitative results of data quality as compared to additional ground truth. The paper concludes on the usability and usefulness of the COBWEB quality assurance approach.

Meek et al. (2014) A flexible framework for assessing the quality of crowdsourced data. AGILE conference, Castellon, Spain

Leibovici et al. (2015) DQ in the citizen science project COBWEB: extending the standards. Data Quality DWG, OGC/TC, Nottingham, U.K.

Ready, steady, go! Bringing CS observations to interoperability standards.
The adapter approach (and iNaturalist)

Alessandro Oggioni, Paolo Tagliolato, Fabio Pavesi

CNR - National Research Council of Italy, IT

Citizen Science project data repositories (e.g. iNaturalist [1], Ornitho [2], etc.), are growing up to millions of observations, fed by smart applications and enthusiast users. They are often characterized by very well structured systems and community practices, but until now they lack in interoperability among each other and other systems. The need for an interoperable standardization of Citizen Science (CS) data and metadata is an emergent topic. The main Citizen Science Associations (U.S. Citizen Science Association CSA, European Citizen Science Association ECSA, and the Australian Citizen Science Association ACSA) are collaborating on this process [3]. Some proposals are considering OGC and ISO observations and measurements (O&M) [4], a conceptual model that could be ideal to standardize data representation without loosing specificities of distinct projects and letting them being shared with a wider audience.

Our proposal aims to preserve community practices, maximise interoperability between existing systems, and immediately increase their usefulness.

The idea is to follow the adapter pattern [5] between an original CS system and an international interoperability standard. In this way the legacy API and data structures could be exploited by using a lingua franca. We agree that O&M could be a good candidate for interoperable representation of Citizen Science data. We will present as a proof of concept our development of an O&M adapter to iNaturalist and we will show by examples how it permits the immediate integration within interoperable SDI.

[1] http://www.inaturalist.org

[2] http://www.ornitho.it

[3]http://staging.citizenscience.org/2016/02/09/data-and-metadata-reporting-from-the-citizen-science-data-and-service-infrastructure-meeting-in-italy/

[4] Cox, S. (2013). Geographic information - Observations and measurements - OGC and ISO 19156. Open Geospatial Consortium.

[5] Freeman, Eric; Freeman, Elisabeth; Kathy, Sierra; Bates, Bert (2004). „Head First Design Patterns". O'Reilly Media: 244. ISBN 978-0-596-00712-6.

Data quality, metadata and validation in EyeOnWater

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The EyeOnWater (EOW) website (www.eyeonwater.org) and app (IOS and Android) have been launched end 2015. These instruments help to assess the colour of natural waters. The app was developed within the EU-Citclops project to estimate the colour of water bodies by citizens via the Forel-Ule (FU) scale. The colour of the waterbody is compared with 21 on-screen colour bars.

This type of data is fitted seamlessly in the stream of data collected by operational coastal monitoring stations. (a.o making use of OGC services and INSPIRE compliant marine standards from SeaDataNet/EMODNet) . Expensive satellite observations and professional in-situ measurements can now be complemented by low-cost EOW colour observations, collected by citizens.

Citizen data is of inhomogeneous quality and should not be used and distributed to a wider community without validation. We will present two innovative methods to validate and standardize the EOW data. The observations from the app are sent to the server and stored. The data include the image taken, the FU-index as marked by the user plus metadata important for quality assessment: Location, date/time, device, angle, azimuth angle, installation ID etc.

EOW validates incoming data in two ways:

- Innovative algorithms were developed and published in the scientific literature to retrieve the colour index from the images taken with the App. Results of these algorithms and their use for quality control of the colour information provided by the App user are presented.

- All App observations are visible on the Eyeonwater website. Other users can flag a certain observation as "possibly not ok", and a message is sent to an expert who has the final verdict.

The EyeOnWater concept with standards for data, metadata, quality and visualisation treatment of citizen science data is easily transferable to additional parameters, such as water transparency, phenomena alerts, and algal fluorescence.

Wide access to Spatial Citizen Science Data

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Recent studies have proposed conventions to make Spatial Citizen Science data available via GEOSS using OGC standards. The GEOSS community however has limited outreach into the 'web of data', due to incompatible conventions between the OGC and the W3C community. A substantial part of the Citizen Science participants and researchers is not aware of OGC standards, they may be users that assume: "if my search engine can't find it, it is probably not online".

OGC and W3C recently started an initiative 'Spatial Data on the Web', to discuss the interoperability challenges and prepare a best practices document. The presenters have recently cooperated in a testbed 'Spatial data on the Web' organised by Geonovum, which studied the effects of the proposed best practices, such as use of Linked Data principles and SEO (Search Engine Optimization) for spatial data.

In the testbed the presenters developed software that is able to expose existing Web Feature Services (WFS) and Catalogue Services for the Web (CSW) as both crawlable content for search engines and JSON-LD Linked Data using the schema.org ontology. The software was tested on open data provided by Dutch governmental organisations. A set of recommendations are formulated as input for the OGC/W3C Spatial data on the web workgroup. In this presentation we present the findings of the testbed research in the context of Citizen Science Data. Which benefits and what challenges can be identified if such an approach is adopted by GEOSS for Citizen Science Data.

Session 10 Talks
Exploring the opportunities and challenges:
Citizen Science and Responsible Research and Innovation

Responsible Research and Innovation (RRI) is an important new concept in science and society and one of the cross-cutting themes of the European Commission's Horizon 2020 programme. Drawing together long-standing perspectives including public participation, ethics and gender in science, RRI has the potential to offer new opportunities but also challenges for Citizen Science.

In this session, we discuss the concept of RRI further and, through group work, consider the opportunities and challenges it presents to Citizen Science. We will also help participants to work through the RRI-Tools toolkit, to identify resources that could be useful for citizen science, to add any resources that appear to be missing and to suggest new developments that can support activities in the future.

Cat tales: the social side of an international citizen science project exploring the movement and management of cats

Heidy Kikillus (NZ), Hayley Tindle, Sandra Taylor, Philip Roetman

University of South Australia, AU

"Without cats, there would be no reason for facebook" – this is just one of the answers that we received when we asked New Zealanders and Australians to tell us their cat stories. Cat Tracker is an international citizen science project investigating the movement and management of pet cats. It was established in the USA and has expanded through collaborators to other countries. In Australia and New Zealand we have run a social survey alongside the GPS tracking of pet cats. The social survey has explored attitudes towards and management of domestic cats, including an open-ended section where participants are encouraged to "tell us your cat story". Previous social surveys on urban wildlife have shown that the stories people tell about animals can reveal a great deal about the nature of their affectional bond with animals they know as individuals. Conversely, stories can also reveal negative attitudes and concerns about management practices. This talk will highlight some of the themes that emerged from the cat stories, from adventures of individual cats, public attitudes towards cats and their management, and the story of how the information collected has influenced policy on cat management.

City foxes: An unusual cooperation between a research institute and a public broadcasting corporation

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Successful Citizen Science depends to a large extent on the successful recruitment of participants. How can such recruitment be quickly and efficiently accomplished? Here we describe the results of a novel collaboration between an academic institution and the key player in the regional media landscape relevant for the planned project. In May 2015, the public broadcasting corporation rbb (Rundfunk Berlin-Brandenburg) started a media campaign on red foxes in the city of Berlin, designed to operate as the starting point for a Citizen Science project on the ecology of Berlin foxes run by the IZW. The topic "Foxes in Berlin" was covered from many angles in numerous TV and radio shows, and the audience was asked to send in photographs, videos and narratives of fox encounters which were then published on a dedicated website. The response exceeded the expectations of both partners: more than 900 "fox watchers" submitted contributions. The resulting publicity will be used to kick-start a Citizen Science project asking members of the public to take over different tasks in the IZW's research project on foxes.

In this talk, we will analyse this collaboration between a scientific institute and a public media corporation from both perspectives. We will illustrate each partner's assumptions, expectations and objectives, the challenges that arose in the course of the campaign due to misunderstandings or differing goals, and the benefits that accrued to both partners. Our goal is to highlight the importance of collaborations between research institutions and the media in the context of Citizen Science, and to alert both sides to the potential stumbling blocks resulting from a "clash of two worlds".

The Magic Mountain: Citizen Science and Intrigue at 1400 meters

Chris Leonhard, John Harlin

Leysin American School, CH

Leysin is a sunny mountain village located on the eastern edge of Lake Geneva, Switzerland. In addition to the chalets, hiking trails, and ski lifts, Leysin is home to many former tuberculosis clinics. It is in the repurposed shells of these clinics, and the forests and meadows surrounding Leysin, that our story unfolds. It is the story of citizen science's arrival to Leysin. The cast of characters responsible for bringing citizen science to Leysin includes a mountain climber, a collection of teachers at Leysin American School (LAS), a willing administration, and an army of high school students. The group's aspirations consist of building a scientifically valid program of citizen science run through LAS with the support of local universities and conservation groups. Specifically, the signature project is a longitudinal study of Leysin's local environment using an elevation transect focused on forest and meadow plots at elevations from 600-2300 meters. In addition to scientific rigor, the project must provide an educationally relevant experience, helping students to learn about their local environment and its connection to the rest of the world while exciting them about science. This journey is uneven and full of surprises and mistakes, but also successes and unexpected benefits. Join us as we reveal how we stumbled around, over, and through obstacles as we tried to turn an idea into reality.

Catching stories

Andrea Sieber

Alpen-Adria-Universität Klagenfurt, AT

The Citizen Science project (2012-2015, sponsored as a Sparkling Science project by BMWFW, Austria) in co-operation of the Alps-Adria University of Klagenfurt with local schools at the Lesachtal in Carinthia, a valley at the border of Austria and Italy, targets vanishing communication and cultural tradition around flax in the region using oral history and history re-enactment:

Little information about flax can be found in written documents such as diaries, chronicles and farm records, but practices and knowledge can be reconstructed along oral history interviews. Students were trained in interview techniques and in interviewing elderly locals the project provided intergenerational communication to revive interest in old agricultural practices and knowledge among the young population. Results of the interviews were used by the students to create u.a. an animated film, a documentary film and an application for a self-guided audio tour.

Traces of flax are still visible in the landscape of the Lesachtal, in built structures of the valley (e.g. "Brechlstuben", "Brechl-Löcher") and in many kept tools and products, such as bales of linen. In several workshops the students of local schools used architectural objects and tools together with experienced locals to "re-enact" old work practices, to cultivate flax on a small scale, to re-use old buildings and tools to re-create the old knowledge base for flax production.

Oral history and history re-enactment of flax cultivation and production generated interactions between locals of different generations and between locals and tourists as well.

See the research diary: https://lesachtalerflachs.wordpress.com

NatureToday.com; how biologists can dominate the news world-wide with their stories

Arnold van Vliet, Wichertje Bron

Wageningen University, NL

Naturetoday.com aims to inform society at large on topical developments in nature by stimulating biologists from all over the globe to publish their stories on the plants, animals and ecosystems that they observe, love and study every day.

The vision of Nature Today is: By continuously and actively informing the public and specific target groups on topical developments in nature people will become more connected with nature, they will get more knowledge on nature, they will better appreciate nature and they will be more motivated to contribute to monitoring, management and preservation of nature.

In our contribution we will explain how NatureToday.com will help biologists, press officers of the organisations where biologists work and journalists to significantly improve their impact. We will zoom in to the content generation, marketing and communication tools of Nature Today. Furthermore, we will demonstrate how easy it is to present your ecological stories in a newsworthy way so that they will be communicated to millions of people via mass media.

Landscape Change

Wolfgang Wende

Leibniz Institute of Ecologicial Urban and Regional Development, DE

"Landscape" is part of the land, as perceived by local people or visitors, which evolves through time as a result of being acted upon by natural forces and human beings (Council of Europe 2000). Thus, landscape represents the results of interactions and dynamics between the social and the ecological system, and therefore addresses the issue of citizen sciences very well. The transition of landscapes caused by land use change is one of the biggest drivers of biodiversity loss worldwide. Landscape change is analysed in particular against the background of its perception in society. The project integrates the competences of environmental and social scientists and benefits from mutual partnerships with the general public as citizen scientists. Thus, the scientists enable citizens ("citizen scientists") to actively participate in the research, in order to gain a better understanding of the multifaceted causes and consequences of landscape change, and to develop future landscape scenarios. This is facilitated by an issue that concerns everyone – namely the landscape as living space of society, and by a means which everyone knows and uses – photography. Pairs of photos depicting a landscape detail recorded at different points in time are particularly suitable for perceiving and documenting changes (Jürging & Schmida, 2005). Being clearly recognizable and initially value-free, the changes can be grasped immediately by the viewer, independent of any specialised prior knowledge. The citizens participating in the project are encouraged to document the changes in landscape and biodiversity using such photo pairs. Landscape in our experience and story is a very valuable subject for activating locals, and, thus citizen sciences.

Digital game design for citizen science about sustainability: exploring a 'learning by modding' approach

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In this study groups of teachers collaboratively re-designed a given digital game to make it appropriate for their students to learn about the idea of sustainable city. We discuss how a specific genre of digital games can be used as a means to engage citizens in systems-thinking with current socio-scientific issues, such as sustainability in the city. For the player, the game involves visiting as many places as possible without losing out on the values of several 'fields' related to living in a city, such as 'health', 'wealth', 'well-being', 'work', 'leisure', 'environmental protection', etc. Each visit has conflicting consequences, so no one possible choice can be positive in all fields. For the designer, creating a game involves choosing a map of a place, the names and sorts of places to be visited, the 'fields', the value consequences, the rules for remaining or ending the game. We study the process of the designers' engagement in re-designing the game while critically addressing the inherent complexity and indeterminacy of the 'sustainability' concept. We discuss the potential for this kind of game in setting-up new citizen science communication contexts amongst various groups of people and for introducing new forms of citizen science practice involving exploration, exchange and integration of scientific knowledge with individual and collective experience and public understanding of current societal challenges. The analysis focuses on how the designers' ideas around urban sustainability changed as they discussed what to change in the game and as these changes were inserted in the game itself. (The research leading to these results was funded from the European Union, FP7, GA 610467: project "M C Squared", http://mc2-project.eu <http://mc2-project.eu/>. This publication reflects only the author's views and Union is not liable for any use that may be made of the information contained therein.)

Citizen science motivated by collaborative gamified services

Gunnar Øyvin Fredrikson, Arne Berre
SINTEF, NO

User collaboration is a goal for many business applications today, and they are often faced with challenges motivating users to voluntarily engage in providing information and/or take part in collaborative activities.

Multiple approaches have been initiated to face these challenges and gamification is a possible method to address these problems. Gamification uses elements from computer games as part of its process, but actual games are rarely used as a source of inspiration for designing such services. At the same time many computer games today can boast with extensive and elaborate collaborative activities and should be a natural source of inspiration for such an endeavor.

This talk presents key design components and insights based on common concepts from massive multiplayer online games and combining them with divergent arguments relating to gamification concepts and definitions, the purpose of which is to create positive collaborative gamified user experiences.

The main contribution is taken from the presenter's work on 'CURE – a companion for the design of collaborative gamification services'. The second contribution in this talk challenges some of the existing definitions and common perceptions of gamification to explore alternative interpretations. Both contributions help to form a new understanding of how to work with gamification and many of its related areas such as serious games, e-learning and simulations.

Two actual cases, where gamification is considered as a method to enhance their service, were chosen to explore the potential of collaborative gamified services. The first proposal is an enhanced gamified solution for the mobile application Biocaching that seeks to motivate its users to gather bio diversity data. The second proposal adds game complexity and a fictional game world to the prototype from the citizen science project CITI-SENSE that looks to gather environmental air quality data.

Biocaching

Bjørn Hjelle
Biocaching, NO

Biocaching is a concept under development and aims to be an educative gaming app, based on observing and taking pictures of species. A design goal is that the app will be easy to use, with tools to help the user identify the species, and fun, with a gaming concept that engages users over time.

Besides crowdsourcing open data for science, nature management and policy processes, Biocaching aims to engage people of all ages to learn about nature and to raise awareness of the changes in nature caused by human activities.

Biocaching will use open data from diverse sources, such as the Norwegian Biodiversity Information Centre (NBIC), the Encyclopedia of Life, the Catalogue of Life and Wikipedia. All observations collected by the Biocaching game will be made freely available for use by both science and the society.

To support the applications, back-end services will be developed. Examples of services are a service to identify species and a service to manage the gamification aspects.

Several biodiversity observation apps let the user select species name from a list. Biocaching will go beyond that and will seek to give users more help at the identifying species. Some approaches that we will consider are:

• use machine learning and image recognition

• localization

• semantic search

Biocaching will employ gamification to make the task of observing and reporting on observations enjoyable and fun. Users will be able to form communities and take part in challenges organized by others. Observations will earn users awards and they can observe as individuals or in groups, such as families and friends.

Challenges and missions can be initiated by users or by scientists who may want to crowdsource observations of interesting species such as those on the Red List or invasive species.

Games and Gamification in Citizen Science: Lessons from Citizen Cyberlab

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There is a growing interest in "gamifying" citizen science to make contributing more fun for volunteers. Drawing upon three case studies, we share lessons from our research in Citizen Cyberlab:

1) In the educational game Hero.Coli (developed by UPD), the player controls a character and overcomes various obstacles with the help of synthetic biology principles. In our experiment we found that participants who rated the game higher for immersion scored higher on a synthetic biology quiz. In line with previous work, we suggest engagement and learning are related: the more a person is engaged, the more they learn, and the more they learn, the more engaged they become (Jennett et al., in press).

2) In the Virtual Atom Smasher (developed by CERN), volunteers tune the parameters of physics simulations to get the best fit, and interact with additional content to win "science points". We interviewed users and found that many were physics students, they liked the game-like design and desired even more game features. This supports previous findings, suggesting gamified citizen science is most suitable for attracting Millennials (Bowser et al., 2013).

3) In GeoTag-X (developed by UNITAR/UNOSAT), volunteers tag photos with information that is useful for humanitarian disaster response. On the community page there is a leaderboard showing who has contributed most. When we interviewed volunteers, we found that although some did find the leaderboard motivating, the biggest motivator was helping research. In line with previous work (Iacovides et al., 2013; Eveleigh et al., 2013), we suggest that game elements can help to sustain engagement; however the feedback that volunteers value most is project progress, e.g. did the science team find their contributions useful? Figuring out how to make project progress feedback more frequent, exploring game-like ways of presenting this information, are directions for future research.

Fun, Science, Reputation or Gift of self ? The motivations behind a top Foldit player

Bruno Kestemont

Citizen scientist - Foldit player, BE

What motivates a serious person to play Foldit 8 hours a week during several years? I'll tell my 2 years story, starting as "beginner" to "top 2" with Foldit "live" illustrations. I'll mention the changing rewards and motivations that kept me playing every day. I'll put it in context, quoting players who are still there after 7 years and players who stopped playing.

It appears that motivations to play "serious" games can be similar to motivations for studying, for volunteering or even for being "work addict". Enjoyment, strain, "hope to be useful", gains and deceptions are ingredients of many addicting activities. The only mystery of playing serious games resides, from my point of view, in reputation. If reputation plays a role for a researcher, a worker or a volunteer, it's hard to seek any reputation in playing a game. Hopefully, this story will help researchers to design successful science games, and employers to design attracting jobs…

Gamification for public engagement with invasive tree pests and diseases

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Invasive pests and diseases, for example, Dutch Elm disease in the 1970s, Dendroctonus micans in the 1980s, and Phytophthora ramorum and Ash dieback in the 2010s, are an ever-present and growing threat to the health of forests. Many invasive pests and diseases can cause significant damage when outside of their natural range as there may not be any natural control to their spread. Drivers such as climate change and increasing global trade in plant material induce the movement of pests and diseases outside of their typical native range. Conventional methods of pest detection using trained professional plant health inspectors are unable to keep up with the growing scale of this problem. There is therefore great benefit to be derived from involving members of the public in detecting incursions of pests and diseases. This has led to a number of citizen science projects in the UK, including Tree-Alert, Observatree, ProTree and others, organised and funded by EU and national bodies and charities like the Woodland Trust.

We conducted workshops at the Food and Environment Research Agency and at Forestry Commission Scotland in 2014 and 2015 to scope the potential uses of gamification for plant health protection. Gamification was identified a potential tool for raising awareness of threats to plant health, engaging and training volunteers for citizen science projects, and retaining their interest and participation. We report on some of the conclusions and feedback from these workshops, and the various ways that were identified for gamification to play a role in public engagement with plant health. We also briefly describe a prototype immersive computer game designed to educate the player about a specific threat, Oak Processionary Moth, through role-playing the part of an estate manager dealing with an incursion of this pest.

Examining the effects of gamification and communication in Citizen Science

Ramine Tinati, Markus Luczak-Roesch, Elena Simperl
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The use of gamification within the design of citizen science platforms is a controversial and highly debated topic; supported by a balance of studies reporting a mix of benefits and drawbacks from its use. Studies have shown that given the right domain and task, gamification can help recruit participants, yet overtime, participants become disengaged, possibility as it does not sufficiently support the intrinsic motivations of participants. Somewhat in contrast to this, communication mechanisms such as discussion forums, chat mechanisms, and mailing lists have been shown to have an overall positive effect on citizen science project success; from encouraging sustained levels of participation, to the emergence and documentation of citizen-led scientific discoveries, which are often outside the original scope of the citizen science workflow. However, whilst communication is vital for community building, as with other online environments, initial engagement is often difficult due to the perceived level of skill required to engage in discussion.

In this paper, we describe our study of Eyewire, a citizen science platform which combines gamification and real-time messaging. We examine how these two highly contested elements of design affect participation, and their effect on EyeWire's success. Our study draws upon a quantitative platform data analysis and a qualitative review of an online player motivation survey. Our findings reveal interesting findings with respects to several components of the EyeWire platform, specifically with regards to the use of competitive gamification elements such as leaderboards and player statistics, and how motivations of participation is related to the ability to engage with a vibrant community, and also, with the potential to learn about the scientific domain of the project. In summary, our findings have implications for research in the design and analysis of online citizen science games, with findings relating to the benefits of combining gamification and discussion.

The participant's experience in human behaviour public experiments

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Experiments to study specific aspects of human behaviour generally are carried out in controlled scenarios such as research labs, however they are usually limited to a few dozens of participants. To increase participation to hundreds of people we perform participatory collective experiments, moving the lab to open and dynamic scenarios. These scenarios present a new challenge: how to adapt research infraestructure and how to encourage and engage general public to take an active role in the scientific research process while controlling the environment to maintain the scientific rigour. In our case we offer a solution to this problem by defining a very controlled environmental setting combined with a web-app game framework that can be adapted to different scenarios. We have repeated this setting in three experiments focused on answering specific questions about human behaviour: (i) Mr.Banks "Market Game" to study how people take decisions in uncertain environments; (ii) Dr.Brain to explore cooperation profiles, and (iii) Dr.Brain 2 "The Climate Game" to shed some light on the negotiation against climate change. For each one of these experiments we transform a research question into a captivating game in order to attract participants and provide an enjoyable experience through the use of storytelling to present the problem and the use of gamification techniques to engage and retain participants. All these experiments generated relevant scientific outcomes, statistically consistent under different circumstances, and the feedback provided by the volunteers after the experiments reveal high interest in the scientific purpose, as well as a positive and enjoyable experience for the participants involved.

Play DECIDE: Gaming Social Sciences

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DECIDE is a card-based discussion format that enables small groups of people to deal with and debate complex issues without previous knowledge about them, to discuss their scientific, political, and social aspects and to develop a position towards the respective topic. The project YouTest – Young people performing technological impact assessments employed this game for the exemplary topic direct-to-consumer (dtc) genetic testing. In this project, a collaboration of natural, social, and political scientists accompanied and supervised pupils from two different types of schools in critically reflecting a new technology and forming a well-informed opinion about it.

The project team prepared the game material for the participating students to play and test. Suggested changes and input were then incorporated in a reviewed version of the game, as well as results from the project itself with its social science approach. In this case, data collection did not happen via the game, but the game was fed and alternated by the data collected by citizen scientists (in this case, school students).

DECIDE is a viable instrument to disseminate the results of the project to a broad public and it can be learned from the research done by citizen scientists; the final version of the game is publicly available on www.playdecide.eu and can be downloaded and played by everyone interested. Other students already benefitted from the game: at the final event of the project, guest school classes played the game, instructed by the students that were involved in its content development.

In our presentation, we first want to introduce DECIDE as a format that incorporates content produced by citizen scientists and then discuss its implementation and potential as a social science game.

Session 13 Talks
Citizen science with small sensor networks complementing traditional insitu observations -
gaps, advances and limitations. From activism to collaboration in environmental measurements

Can low-cost sensors contribute to air quality assessment and citizen science?

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Clean air is a basic requirement for human health and well-being. In Europe, the majority of the population lives in areas where air quality levels frequently exceed WHO's ambient air quality guidelines.

The emergence of low-cost, user-friendly and very compact air pollution platforms allowing observations at high spatial resolution in near-real-time, provides us with new opportunities to simultaneously enhance existing monitoring systems as well as enable citizens to engage more actively in environmental monitoring. However, the data sets generated by these type of platforms often show questionable data quality.

In the frame of the EU project CITI-SENSE, we have conducted an exhaustive evaluation of commercial low-cost platforms against CEN reference analyzers, evaluating their measurement capability over time and through a range of environmental conditions. Results show that sensor performance varies spatially and temporally, as it depends on the atmospheric composition, the meteorological conditions and the sensor degradation over time. Thus, it is necessary to calibrate the sensors in-field, and to apply the derived corrections.

There is a lack of guidance on how to test sensor platforms to ensure adequate performance prior to marketing. We have implemented and tested diverse metrics in order to assess if the sensor can be employed for applications that require high accuracy (i.e. capability to meet the data quality objectives defined in the air quality legislation) or lower accuracy (i.e. ability of the sensor to represent the pollution level on a coarse scale).

Data quality is a pertinent concern, especially in citizen science applications, where citizens are collecting and interpreting the data by themselves. Our results show that since performance varies from platform to platform it is necessary to characterize data quality upon their use. In general, while low-cost platforms present low accuracy some platforms can provide coarse information about the observed pollution.

Humans as sensors - complementing traditional land use measurements with citizen science

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IIASA has developed the FotoQuest Austria (http://fotoquest.at/) app, which aims to engage citizens in exploring Austrian landscapes, geo-tagging land use and land cover across the country using a simplified version of the Land Use / Cover Area frame statistical Survey(LUCAS) protocol. The app shows the location of nearby points, and once at the location, volunteers take pictures in four cardinal directions and at the point location, recording the type of land use and land cover from a list of options in the app. Implementation of the simplified protocol uses the mobile technology to record the location, the angles of inclination of the phone when taking the pictures, the compass directions and the precision of the GPS to restrict when users can take photographs. These measures were employed to ensure high quality data collection. FotoQuest Austria has been running since the summer of 2015 with more than 2500 points on the ground and more than 12500 pictures collected by volunteers. Advantages of such an approach include the collection of a denser sample and a more frequent revisit time than the 3 year update cycle of LUCAS, which may then be used to detect ongoing change. Additionally, the involvement of citizens in getting to know their surrounding landscapes is a very valuable process and can be a positive vehicle for raising awareness of possible environmental conflicts and issues. This paper compares the results from this ongoing campaign with data from LUCAS. The presentation also outlines the lessons learned and highlights the minimum requirements needed to collect high quality data from volunteers. Recommendations for use of the app to complement LUCAS surveying and its application to other domains will also be discussed.

Augmenting Observations from Satellites with Crowdsourcing

Suvodeep Mazumdar, Stuart Wrigley, Fabio Ciravegna
University of Sheffield, GB

The impact of Crowdsourcing and citizen science activities on academia, businesses, governance and society has been enormous. This is more prevalent today with citizens and communities collaborating with organisations, businesses and authorities to contribute in a variety of manner, starting from mere data providers to being key stakeholders in various decision making processes. The recently concluded European Space Agency (ESA) funded Crowd4Sat project aimed at understanding the potential of crowdsour-

cing initiatives, particularly focused on observations from satellites. This talk will present the final results of the project from two perspectives: the first being an analysis of the current citizen science and crowdsourcing initiatives, stakeholders, trends and the challenges and opportunities for sustained citizen engagement. The second area is aimed at understanding how crowdsourcing can address key societal and scientific problems via four demonstration projects. The first project exploited participatory sensing from hiker groups via mobile applications and integrated the resulting data with satellite observations to improve the precision of snow coverage in the Pyrenees. The second project collected large volumes of opportunistic sensing data from vehicle movement via mobile applications, integrating with remote sensing data for developing improved vehicular pollution models. The third project integrated opportunistic crowdsourced data from social media with satellite observations to improve quality and timeliness of flood emergency mapping. The final project integrated participatory and opportunitistic sensing with land cover data and satellite observations to improve the accuracy and timeliness of land cover for water management. In this talk, we will share our results and insight from the project.

Citizen observatories to complement space-borne remote sensing: case study Red River Vietnam

Martine Rutten

Delft University of Technology, NL

Remote sensing and citizen observatories can be attractive for low cost data collection and awareness raising. In developing countries with sparse monitoring network, they provide an attractive solution to intensify a monitoring network at reasonable costs. Yet doubts about the accuracy of citizen observations and remote sensing are common. Citizen observatories can be a means to raise environmental awareness and stimulate more environmental friendly behavior.

 In the Red River in Vietnam we investigate how citizen observatories be used to gather data complementary to information of remote sensing. For land use and water quality we develop approaches to make use of complementary characteristics of various sensors. These complementary characteristic include for example Landsat's time series length, Sentinel's cloud penetration and citizen ability to observe land use instead of land cover. We quantified uncertainties of citizen observations in field experiments with Vietnamese students in the Day River basin close to Hanoi. Pixel heterogeneity makes classification of land use difficult for citizens and contributed largely to uncertainty in citizen observation. We conducted interviews with participants to understand their motivation for participation in citizen science and to evaluate the effect of these activities on awareness. The most important reasons to participate in citizen science were to improve water quality to give direct feedback and to contribute to conservation. Awareness about water quality problems was especially raised by playing a newly developed serious game at the start of the observation activities. This game entitled "Walk around the Lake" gave the participants insight on the impact they have on water resources, on pollution, specifically plastic waste, floods and droughts.

The next step of this research is to develop Bayesian frameworks for combination of multi-sensor data and scale the approaches with non-student citizens in the Red River basin.

The Dutch Environmental Protection Agency finding its way into Citizen Science

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RIVM National Institute for Public Health and the Environment, NL

Environmental sensors are becoming smaller and less expensive, enabling new concepts in monitoring. Lack of accuracy may eventually be compensated by higher numbers of sensors and more spatial detail. Inexpensive sensors are also attractive to municipalities and citizen communities, building alternative monitoring networks complementing official monitoring networks. The Dutch EPA, RIVM has the ambition to support these activities. We would typically have a role in assuring data quality, providing calibration facilities, knowledge and a (political) context for interpreting the results. At least in theory. But what do citizens need from us in practice? To find out we joined projects such as the Amsterdam Smart Citizen Lab (https://waag.org/en/news/amsterdam-smart-citizens-lab-publication) and the project Smart Emission in Nijmegen (http://www.ru.nl/gpm/onderzoek/research-projects/smart-emission), focusing primarily on air quality. We learned that taking citizen science seriously is a self-fulfilling prophecy. The participation of institutes such as RIVM in citizen projects increases the chance of success by raising trust and enthusiasm in the participants. Citizens seem quite prepared to take responsibility, but some expertise and help from the government is often much appreciated. Providing information is an important task, for example about which pollutants are important and what typical concentrations to expect. Timing is crucial. Citizens need enough information at an early stage, to set off their plans in the right direction for them. However, too much information limits their freedom; citizens may have different goals, and are not bound by

all regulations that official institutes have to comply to. For EPAs the main challenge lies in being flexible and in learning how to deal with high quantities of low quality data. The ambition of the RIVM is to develop the right tools and strategies to be able to incorporate citizen science data into regular monitoring regimes.

Sensors and citizens: how far can we get?

Ernie Weijers

Energy research Centre of the Netherlands, NL

It is generally agreed that traditional monitoring is costly, prone to government and research spending cuts and sometimes poor in spatial and temporal resolution. Sensor networks have the potential to generate new information or to complement existing measurements. In the Netherlands a network of 35 sensor stations has been configured measuring air quality (PM, NO2, temperature) in the city of Eindhoven. In its preparative phase it turned out that some "cheap" sensors were of poor quality and needed technical improvements to yield a satisfactorily 'near-reference'level of quality and implementation in national monitoring Based on this "improved" sensor design a (mobile) sensor platform has been built which is or will be part of several citizen science projects currently running/starting in the Netherlands.

In this overview our (early) experiences with small sensor CS networks will be presented. Several aspects will be discussed: the construction of the network with the help of citizens, the calibration of sensors, data collection and quality as well as technical and practical limitations. The presentations ends with some recommendations.

Improving participation in citizen science using the Science Capital concept – a workshop exploration

Neil Bailey
Earthwatch, GB

Earthwatch is an environmental NGO with over 40 years' experience of delivering citizen science projects. Over this time Earthwatch has sought to generate scientific data that addresses key environmental issues whilst also providing participants with a learning experience that will engender an ongoing interest in the environment and sciences. To this end, careful consideration has been given to project design to maximise impact on participants. However, is Earthwatch 'preaching to the converted' and should they also be examining ways to reach out to the disenfranchised in order to build an interest in environmental / scientific issues in the wider community?

The relatively new concept of Science Capital (Archer et al., 2015) potentially offers a framework to engage wider audiences in citizen science thereby increasing their environmental and scientific knowledge via informal means. Specifically it provides citizen science practitioners with an appreciation of some of the key barriers to participation of those with low Science Capital and hence provides the ability to alter project design and devise interventions that overcome such issues.

This workshop will examine how Earthwatch might widen participation in citizen science through a better understanding of Science Capital and societal factors. Building on an understanding of Science Capital developed in previous sessions, attendees will be invited to highlight potential barriers to participation in citizen science projects and devise solutions to address these. Important Science Capital and societal factors that are likely to be considered and overcome are scientific literacy, family background, gender, ethnicity and social networks. The strengths and limitations of using Science Capital as a framework will be explored. Where possible, practical interventions and design changes will be sought, these may encompass project design and delivery, communications, gamification and engagement approaches.

Exploring the relationship between educational background and learning outcomes in citizen science

Richard Edwards, Diarmuid McDonnell, Ian Simpson
University of Stirling, GB

Drawing upon an online survey of over 900 overwhelmingly adult contributors to two citizen science projects organised by the British Trust for Ornithology, the paper explores the relationship between the educational backgrounds of volunteers, the types of contributions they make and their learning outcomes. It will focus not only on the educational levels of contributors, but also the subjects they have previously studied to explore the extent to which prior study of sciences may affect participation in citizen science. In addition, the paper will explore how elements of science capital contribute to participation and learning within these citizen science projects, but also what effects participation has on elements of science capital. Analysis of the date from the surveys indicate that:

a. Relatively the learning outcomes of citizen science are more significant for those with lower prior educational qualifications;

b. While significant numbers of contributors have school-level qualifications in sciences, proportionally less have formally studied sciences beyond school;

c. Elements of science capital may not be as significant for participation as theory currently suggests;

d. Overall the impact of participation in citizen science on elements of science capital is negligible.

The oral presentation, supported by a paper, will outline the findings from this project. A research briefing will also be made available to attendees at the session. These will be used to stimulate debate on varying ways to enhance learning for different demographic sectors of the population.

Considering external resource use in forum discussions as an indicator of citizen scientist learning

Thomas Hillman, Åsa Mäkitalo
University of Gothenburg, SE

In this presentation, we address the challenge of identifying learning in citizen science projects by examining the activity of volunteer participants in Galaxy Zoo. This project represents a style of citizen science where participants classify images using a simple protocol. Since this activity has limited interactional possibilities, it is difficult to identify learning by examining it. Instead, we examine interactions on an online forum formed in relation to the classification activity. Working from the Vygotskian (1978) notion

that learning is a process of appropriating cultural tools, we examined the use of online resources external to Galaxy Zoo in forum posts over time. Using over 30,000 posts, we plotted external resource use trajectories for participants with more than 50 posts. Based on date of first post, we examined the trajectories of new participants in relation to those of already established members. For new participants, already active amateur astronomers could be discerned from those with little experience. This distinction was confirmed through the posts that new participants make where they often provide self-evaluations. The trajectories of active astronomer new participants tend to exhibit heavy use of external resources in early posts followed by a reduction. Those of non-astronomer new participants who later become established members tend to exhibit a gradual increase. When examining the external resource use of non-astronomer new participants in the context of the forum threads in which they are posted, shifts in type and usage along the trajectories are also discernable. Shifts in the type of resources from popular media to scientific are visible along with shifts in usage from asking for guidance and curating online content to formulating arguments and guiding other members. Such shifts in type and usage combined with rising trajectories of use indicate the appropriation of cultural tools and the development of astronomy literacy.

Designed for Learning: impacts and future direction of the Vital Signs program

Sarah Kirn

Gulf of Maine Research Institute, US

Vital Signs is a 7-year-old citizen science program designed to especially serve learners age 10-16 years and their educators, as well as 60+ collaborating scientists, resource managers, and expert citizens. Our research focuses on mapping and monitoring the presence, absence, and impact of invasive species in Maine, the northeastern-most state in the US. We designed the Vital Signs program to specifically support science novices, motivate their engagement, and develop their identities as scientists. Features include: species identification protocols structured as a "spot the difference" rather than dichotomous key exercises; choice among field missions and target species; inclusion of diverse data types (measurements, descriptions, digital images, and sketches) to allow differently talented students to experience success in science.

Stories and quantitative data indicate that these design choices have collectively supported science engagement, learning, and identity. Researchers have found that 50% of students who reported low interest in science find Vital Signs interesting. Both students with low and high interest in science reported that Vital Signs lead them to look at plants differently (50% and 75% respectively); many continued to notice the species they studied and even talked about invasive species with their parents. Teachers report stories of students who were previously uninterested in science becoming engaged because of the attention their contributed artwork received from the online community. Many teachers report on the transformative impact scientists' comments on student work have on students' sense of themselves as scientists.

We recognize that citizen science has great potential to help youth build their own science capital independent of their families'. Looking forward, we are redesigning our program to enhance science capital-building opportunities for youth. Our design goals are to expand science learning around data, strengthen students' interactions with experts and peers, and recognize accumulated contributions and growing competency of each participant.

Evaluating learning in online Citizen Science: reflections on a mixed methods approach

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Although most citizen science projects are usually firstly designed with science in mind, educational goals become more and more important as (a) learning is shown to be an efficient way to encourage sustained participation of engaged volunteers (Jennett et al., forthcoming), (b) science education and promotion are considered a challenge and asset for future democracy in both the US and Europe, and (c) project teams may face requests from funding agencies to analyze the educational potential and outcomes of their citizen science projects. However, evaluation of informal learning is a challenging task (Lemke, 2015; Kloetzer, 2016), all the more as citizen science proves to be a highly heterogenous field. In this contribution, we will reflect on evaluation approaches that can be appropriate for diverse citizen science projects, and give arguments for a flexible mixed methods approach. We will compare what we learned through qualitative methods, quantitative methods, and learning analytics. We will discuss the use of learning objectives in clarifying the educational goals of the project. Finally, we will argue that learning evaluation should be planned from

the early steps of the project. This contribution willl open a discussion with project teams on the best way to design an evaluation plan and implement evaluation tools in their projects.

References

Lemke, J., Lecusay, R., Cole, M., & Michalchik, V. (2015). Documenting and assessing learning in informal and media-rich environments. MIT Press.

Jennett, C., Kloetzer, L., Schneider, D., Iacovides, I, Cox, A, Gold, M., Fuchs, B., Eveleigh, A., Mathieu, K., Ajani, Z., Talsi, Y. (forthcoming). Motivations, Learning and Creativity in Online Citizen Science, Journal of Science Communication.

Examining how participation and engagement in citizen science influence learning: a mixed methods, collaborative research project

Tina Phillips
Cornell Lab of Ornithology, US

Within citizen science, the terms engagement and participation are often used interchangeably. We argue here however, that they are different constructs and understanding their distinctions is important for assessing participant experiences and outcomes. In this session we first look at some of the theoretical underpinnings of these two constructs to compare and contrast them. We offer alternate ways to measure participation and engagement beyond output measures such as the number of participants, rate of retention, the number of web page hits and downloads, and other baseline measures of recruitment, retention, and outreach. We then describe the first phase of a NSF-funded collaborative research project that seeks to understand the relationship between engagement, learning, and identity in adults participating in citizen science. Six projects were purposively selected to span the continuum of contributory, collaborative, and co-created projects. We conducted and analyzed in-depth interviews with 72 participants that differed in the types of activities they did on behalf of their respective project. In addition to comparing how these activities differ across projects, we will also describe pertinent aspects of how learning takes place and how it is influenced by group dynamics, individual experiences, and communities of practice. Finally, we offer some thoughts on the extent to which science capital may play a role in enhancing learning experiences. Results from this work will shed light on the complex dimensions of participation and engagement in citizen science, as well as a better understanding of the relationship between participant experiences and intended learning outcomes.

Solar Radiation in Schools

Marta Aido, Rodrigo Silva, Miguel Brito

Instituto Dom Luiz, Faculdade de Ciências, Lisbon University, PT

1800 hours of exceptional sunshine conditions per year reinforces the importance of bringing the topic of renewable energies, in particular solar energy, into the class room in Portuguese schools. Instituto Dom Luiz of Lisbon University, a reference Geosciences research Institute in Portugal has kept throughout the years a tight collaboration with schools, through different initiatives, such as thematic visits to its Labs and training of teachers in geoscientific topics. With a meaningful new technology project of citizen science in education -Solar Radiation in Schools- we aim to enrich school's scientific curriculum and bring awareness about solar radiation as a clean energy source.

The project will consist in the development of a low cost solar radiation sensor, which will be placed in the schools. In a first stage, the students will participate in practical sessions on the construction of data acquisition and control systems, using arduino. In the second stage, the students will monitor the available solar radiation and use the obtained experimental data to estimate the solar potential of the roofs of their own schools. Finally, their results will be presented to their colleagues and also to an audience of investigators and University students in our Institute.

Solar Radiation in Schools will be the starting point of a more ambitious project, which will reach not only schools, but also the general urban population. The acquired data (distributed solar radiation) will be useful for state of the art solar radiation forecasting methods using online distributed data.

We believe this project will be an extremely helpful tool for teachers to motivate their students. In the ECSA Conference, we hope to share experiences on science communication to schools and learn from other institutions with similar projects of embedding citizen science into schools, in order to better implement our future project.

Citizen science and learning through iSpotnature.org

Janice Ansine

The Open University, GB

More and more people are finding and sharing interests through social networking sites and activities, while learning about a range of topics. When combined with citizen science based opportunities, the scope for and benefits of inquiry-based learning are further enhanced. iSpot (www.iSpotnature.org), The Open University's (OU) citizen science platform, demonstrates this providing a multifaceted learning experience incorporating participatory science research and the use of innovative educational technology which provides a unique informal to formal learning journey.

iSpot was launched in 2009 and engages the public through their interest in wildlife by crowdsourcing names to species and recent research demonstrates the success of its model in accurate species identification. Combining learning technology and social networking with crowdsourcing, it enables beginners to connect with experts, leading to plant and wildlife species being identified accurately. iSpot's unique user 'reputation' motivates iSpotters to verify species and rewards them for doing so. By effectively connecting users in this way they are able overcome social and geographic barriers that prevent sharing of knowledge.

 The framework of the site, and how it is used, contributes to learning building natural history skills; a specialism noted as missing from current biological education at all levels. iSpot is integrated into courses and other learning resources utilising and embracing many of the new forms of teaching, learning and assessment identified as the way forward for science education. iSpot contribute to a social form of teaching and learning using a combination of social networking, public engagement, informal access to expertise, and learning opportunities.

This presentation will share examples of iSpot's impact sitting on the cutting edge in the use of technological innovation in pedagogy. It will demonstrate how to gain maximum advantage from a citizen science platform which uses technology to enhance learning in a variety of ways, highlighting its scope for further research and practice not yet fully exploited.

GBIF - enabling unparalleled data access for research

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The Global Biodiversity Information Facility (GBIF, www.gbif.org) is an international open data infrastructure. It allows anyone, anywhere to access data about all types of life on Earth, shared across national boundaries via the Internet.

By encouraging and helping institutions to publish data according to common standards, GBIF enables research not possible before, and informs better decisions to conserve and sustainably use the biological resources of the planet.

In February 2016, GBIF offers a single online access point (through the GBIF portal and its web services) to over 643 million biodiversity records from some 15,580 datasets published by more than 790 institutions. Focusing on primary data on natural history collections and observations, GBIF enlarges to sample data (abundance). Lots of observation data sets are coming from citizen science and these data mobilized through GBIF help countries and the global community to meet the commitments made in recent years to slow the loss of biodiversity and to use biological resources more sustainably.

GBIF operates through a network of nodes, coordinating the biodiversity information facilities of Participant countries and organizations, collaborating with each other and the Secretariat to share skills, experiences and technical capacity. GBIF France is the French node of GBIF and one of its missions is to help national institutions to connect their data to the GBIF portal, including citizen science data sets such as Diveboard - Scuba diving citizen science observations, Tela Botanica or some of the SPN- Service du Patrimoine Naturel, and e-ReColNat, MNHN.

Engaging citizens in online communities of scientific investigations

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Citizen Inquiry communities support citizens to plan and implement their own science investigations, supported and guided by online systems and tools within an inquiry environment, while collaborating with science experts and amateur enthusiasts. Two intervention studies, 'Inquiring Rock Hunters' and 'Weather-it', investigated designs for citizen inquiry communities, recruitment, and retention of members, and factors that engage or disengage community members.

The interventions utilised mixed methods, and an analysis of outcomes from 'Inquiring Rock Hunters' informed a re-design for Weather-it. The investigation was facilitated through a variety of data collection (interviews, log files, questionnaires, usability scales, focus group and researcher notes) and data analysis methods (thematic analysis, content analysis, social network analysis, clustering and graphs). The outcomes highlighted the importance of: recruiting new members via word-of-mouth advertisement, frequent project communication through emails and other social media, notifying members for updates about any responses to their posts, multiple ways of participation, software usability, and ways of interaction and collaboration between the members. They also indicated disengagement factors including lack of time, interest and confidence.

This work, enhanced by feedback from community members, concludes with some design considerations for sustaining engagement in future citizen participation communities: enable content sharing technologies to attract new members, design built-in functions for moderators to support frequent communication, optimise interaction tools and social technologies to promote a sense of community identity and retention to the community, update members with lists of small tasks, support variety in topics and ways of participation, promote support groups to facilitate members' confidence, and allow ongoing feedback on the software by members. Finally, providing members with more opportunities to learn about the scientific topic may strengthen their intrinsic motivation to participate and encourage them to stay longer in the community.

Challenges of Online Engagement, Social Innovation and Societal Impact

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The evolution of our internet based lifestyles, widespread broadband access and use of mobile devices, large-scale virtual connected communities, augmented intelligence and experience as well as societal resilience is pervasive. The bottom-up nature of such developments and the ability to exploit the resulting network effects is a fundamental aim of Collective Awareness Platforms for Sustainability and Social Innovation (CAPS). Such platforms allow a greater and more diverse number of people to parti-

cipate in science as citizens, bringing science closer to the people and their most valued needs, and supporting citizens and civil society organizations with finding innovative solutions to their concerns. As an example SciCafe2.0 project has been focused on adapting methods used for engagement with science to enable more participative ways of engaging citizens; in particular science cafes applied to online and offline contexts. Drawing from the results of the SciCafe2.0 project this presentation will review 3 specific but converging mechanisms of science-society interactions and engagement: Science Café, Science Shop, Citizen Science to gain insights on their models of co-creation, social learning processes, and their transformative impact on the science-society relations. The paper argues that there is an emergent convergence of science-society interactions, learning from each other's approaches which creates possibilities for better ways of knowing, doing, framing, and organizing science and society interactions.

A Smartphone Application for a citizen science project on seafood sustainable consumption

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New Information and Communication Technologies (ICT) are playing a key role in Citizen Science outbreak, allowing a wider public participation. In fact, the increasing availability of smartphone can be exploited as a tool for easy and quick data collection.

A mobile application has been conceived for a Citizen Science project on sustainable consumption of seafood "Il pesce giusto". In fact, the overexploitation, the employment of destructive fishing practices, as well as the widespread illegal fishing, have led to a loss of marine biodiversity and to a food resources decline. Innovative approaches recommend the public involvement for the sustainable management of the natural capital. Improving citizens' ecological knowledge concerning the conservation strategies of natural ecosystems and the importance of sustainable consumption seems to be particularly important.

The aim of the present work is to describe the planning of the mobile application (App).

The App allows to monitor the sustainability of consumers' purchases through different criteria: size, origin, production and seasonality of some fish species. This tool can be practically utilised by citizen and it can provide information about marine resources sold in the Italian markets with the easy submission of pictures of the marine species purchased. Moreover, the instrument can be considered also as an educational tool: an immediate feedback to the user about the sustainability of the food choice is provided, and other sections of the App are dedicated to the spread of information about ecology, conservation and sustainability, contributing to the educational goals of the Citizen Science research.

Steps, strengths and weaknesses of the development of the Citizen Science project will be showed, with particular attention to the interdisciplinary framework.

A focus on localpiblic participation in science research:
Citizen science in the Italian landscape

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Over the recent years Italian citizens have had the opportunity to play a valuable role in contributing to projects in collaboration with universities, government agencies and NGOs. Such initiatives have become increasingly popular and have been given various terms, including citizen science, volunteer monitoring, public participatory research.

In this framework we want to show the result of a descriptive survey on differentiated approach of citizen science projects in Italy, and generally on the entire landscape of Public Participation in Scientific Research (PPSR).

A questionnaire has been subjected to the coordinators of the various Italian participatory projects through the use of social media, blog, email and interviews. 50 projects have been identified with a response rate to the questionnaire of approximately 82%.

The required information concerned the essence of the project, the discipline area, the organisation and the nature of the involvement of volunteers. The results show a growing development of participative activities, starting from the first project in 1991. A strong prevalence of projects in the areas of environmental science emerges, while are lacking the contributions concerning other disciplines. Besides, most of the projects (55%), are yet characterized by a top-down approach for citizens' participation, meaning that people still play a marginal role in the different phases of the project.

senseBox:edu – DIY citizen science for the engagement in environmental activities

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senseBox is a DIY citizen science toolkit for building web-enabled sensor stations for environmental phenomena. The senseBox:edu is a specialized version for education, consisting of a microcontroller (Arduino Uno), an ethernet-shield and a variety of sensors and actors. Two to three children can work with the senseBox:edu. They build and code their own sensor stations, make them a part of the web of things and measure a plethora of environmental phenomena to create open environmental data. Sensors for temperature, humidity, pressure, illuminance, UV-intensity, loudness, distances can be used to build weather stations, traffic counters or sound- or light pollution stations. The toolkit is accompanied by open educational resources in a wiki. Children learn to work scientifically, learn to code and make sense of the raw data. The measurements are being made available on the openSenseMap, a web portal for open sensor data, with an easily accessible API.

We deployed 120 senseBox:edu kits it in German schools and school laboratories situated in Universities and conducted one to two-day workshops with 110 secondary school students and their educators. We designed a questionnaire about their experience with the senseBox:edu and asked for the influence of its use on their interests for STEM-subjects, measuring environmental phenomena, citizen science and their interest in coding. We also asked the students to estimate the quality of the project-oriented workshops in terms of structure, learning, and motivation. The results are very positive in terms of motivation and engagement for environmental activities, coding and the referring to real world problems and show a very high quality of project-oriented learning.

How can online crowdsourcing campaigns engage millions of volunteers and generate high quality data?

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Online crowdsourcing has emerged as a rapidly growing field in research and online content creation. With the emergence of Web 2.0 novel ideas such as citizen science problem solving games, apps and large-scale online activities have become remarkably popular. A major new player in this field is Tomnod –a project owned by Colorado-based satellite company DigitalGlobe that uses crowdsourcing to identify objects and places in satellite images. Tomnod volunteers tag objects of interest for a range of targeted campaigns. These include assisting in disaster response, environmental mapping and even searching for the missing Malaysian Airlines flight MH370. Most campaigns typically attract thousands of volunteers, yet during peak participation periods this has risen as high as eight million.

Research into online crowdsourcing platforms has found that participant motivations and their contribution of data vary depending on the website's nature and its features. This study explores the enablers and barriers for volunteer contributions of high quality data in Tomnod campaigns. Surveys, interviews and forum observations portray a high diversity in volunteers, in their demographics, the factors affecting their participation and the quality of the data. Measures to improve data quality by Tomnod are also examined within the context of campaigns to map flooding events around the world. The results indicate that crowdsourcing campaigns will benefit from increased interaction between coordinators and volunteers, both in the design of the platform and in providing feedback. This, in turn can enable online crowdsourcing campaigns to play a significant role in a range of scientific projects including mapping

The CONCIB-e initiative: using a citizen science platform for in situ and ex situ traditional ecological knowledge conservation

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Traditional ecological knowledge (TEK), understood as the adaptive knowledge system referring to the relationships between humans and the environment existing in socioecological systems and cumulated after generations, is essential not only for biodiversity conservation and environmental management, but also for providing resilient livelihoods, especially in a context of constant change.

Despite its importance, this body of knowledge is rapidly eroding due to factors such as integration in market economies, auto-

nomy loss due to stricter regulations, and the expansion of de-contextualized schooling. To redress such an erosion process, both in situ (based on TEK sharing and transmission) and ex situ (based on TEK gathering and inventorying) TEK conservation initiatives have been proposed, with mixed success.

We are developing a citizen science platform (CONCIB-e, standing for "Citizen Biodiversity related Knowledge" in Spanish), that has the potential to simultaneously contribute to the in situ and ex situ conservation of TEK. The aims of the platform are twofold. On the one side, CONCIB-e will gather biodiversity related TEK in Spain, a knowledge that will be potentially integrated in the Spanish Inventory of Traditional Biodiversity related Knowledge, thus contributing to ex situ TEK conservation. On the other side, the platform will allow commenting and sharing TEK that was introduced by average citizens, but also by interest groups and targeted rural students (subject to a complementary educational program), who hold linkages to the knowledge holders (mainly elders). The participation of all these types of users will potentially contribute to TEK transmission, thus contributing to TEK in situ conservation.

This initiative adds to the debate about expanding the limits of citizen science, from being a mere observations' crowd-sourcing tool to becoming an instrument to gather and transmit knowledge that is essential to the conservation of biocultural diversity.

Interoperability in GLOBIS-B

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Developing a common data model to support the standardized collection, sharing, and re-use of citizen science data requires attention to a range of application domains with existing standards and practices. One application domain is biodiversity, where data on key indicator species are collected through a range of methodologies including remote sensing and in-situ observations. Integrating these sources requires attention to technical interoperability, but also semantic, legal, and policy considerations. Furthermore, coordination requires attention to the political and ethical context of the initial data collection activities.

The GLOBIS-B project, a component of the Group on Earth Observations Biodiversity Observation Network (GEO BON), seeks to support frontier research on biodiversity by developing a set of Essential Biodiversity Variables (EBVs) underpinning key indicators, and a technical infrastructure to coordinate the collection and sharing of EBVs. This ambitious project recognizes that legal and policy interoperability issues (both normative and legally binding) must be diagnosed and identified. In February 2016, GLOBIS-B will host a workshop with biodiversity, technical, and legal/policy experts to evaluate the degree that potential EBV calculations are compatible with one another, as well as with other open access, data sharing, and data management principles.

This workshop will identify key interoperability considerations directly relevant to biodiversity citizen science. Discussing the results of this workshop during the session on data, metadata, quality and visualization can provide one point of departure for identifying semantic, legal, policy, and political dimensions of interoperability for the common data model. As the second GLOBIS-B workshop is scheduled for June, knowledge sharing will be reciprocal if discussions from the ECSA session are shared with the GLOBIS-B team.

Scientific Diving - What is happening under the water surface?

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Aquatic habitats – both freshwater and marine - provide numerous species of plants and animals as well as microorganisms and fungi. "Science under water" intends to develop a better public understanding of fragile water systems. This could help to solve current and upcoming questions and hereby contributing to the preservation of these regions, which are important for human life. Citizen Science projects under water are a constructive possibility to receive wide information for further evaluation of the biodiversity and ecology. The projects are interdisciplinary ranging from biology, geology, hydrogeology to archeology. Dedicated and well-instructed sport divers, which have the ability to collect substantial data, are the basis for citizen science projects. Collecting large date sets on habitat properties as well as on biodiversity could never be managed by a small number of scientific divers. Thereby educated scientific divers adopt the supervising function and the evaluation of the produced data.

Successful projects are for instance the mapping and expansion of neobiota in local lakes (1) as well as the jellyfish monitoring in Germany (2, 3). Furthermore, sport divers provide powerful input for the investigation of the biodiversity of sponges and other

invertebrates in Brijuni, Croatia organized by the University of Stuttgart (4). Further successful applications of citizen science projects are workshops in scientific diving methods including taxonomic training e.g. of macrophytes (5). Diving clubs are often interested in the ecological status of their local lakes. Thus, basic practices in sampling, mapping and documentation are an expedient introduction to understand and monitor waterbodies.

(1) Fritz GB, Schill RO, Brümmer F (2008): Public awareness and scientific interest - obtaining data on non-indigenous species. In: Rabitsch, W., F. Essl & F. Klingenstein (Eds.): Biological Invasions – from Ecology to Conservation. NEOBIOTA, 7, p. 41-45.

(2) Fritz GB, Pfannkuchen M, Reuner A, Schill RO, Brümmer F (2009): Craspedacusta sowerbii, Lankester 1880 – population dispersal analysis using COI and ITS sequences, Journal of Limnology, 68(1), p. 46-52.

(3) Fritz GB, Schill RO, Pfannkuchen M, Brümmer F (2007): The freshwater jellyfish Craspedacusta sowerbii Lankester, 1880 (Limnomedusa: Olindiidae) in Germany, with a brief note on its nomenclature, Journal of Limnology, 66(1), p. 54-59.

(4) Brümmer F, Maichl D, Dehmer H, Gutekunst V, Mueller C, Pinter S, Rapp L, Russig S, Vetter W, Vetter E, Andres-Brümmer D, Buršić M (2016): Rapid assessment of the biodiversity of spongs (porifera) and other invertebrates in the coastal waters of Brijuni Islands, northern Adriatic Sea, Croatia, 2nd European Conference on Scientific Diving, Göteborg, Schweden

(5) Mueller C, Winkler K (2013): Makrophyten-Seminar am Degler See, Sporttaucher Magazine, (3), p. 12.

Environmental monitoring system for urban areas

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The contribution describes an experimental environmental monitoring system, which is focused on air quality measurements, but is ready for expansion by other sensors that can measure quantities affecting quality of life in the cities (noise level, traffic intensity etc.). The system has a star architecture with master and slave units, complemented by independent mobile units for pedestrians. The master unit is used as a gateway for slave units and it is also used as main measuring unit. It measures VOC, CO, SO2 NO2 concentrations, dust particles concentration, temperature, humidity and noise level. The slave units represent low-cost platform for additional measurements. They allow to extend the developed sensor network and can be placed hundreds meters away from the master unit. The mobile units represent wearable electronic devices composed of sensor and wireless communication interface for connection with a smartphone. The aim of the experimental project, which is currently being tested in Prague, was to bring a sensor network for informative online measurement. The system also includes server and web application for presentation of measured data displayed on a map background. It provides easily readable form with current data for citizens. Analytical filters and charts showing the trends are available for professional users and public authority.

Amateurism in the Digital Age

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Contemporary narratives tend to represent public participation in research as an emerging phenomenon. The storyline is that research was once the realm of academic and qualified elite secluded in the ivory towers of universities, museums, and other professional institutions.

This perspective seems to ignore two main aspects: 1. The numerous examples of amateurs who significantly contributed to science; 2. The 'primitive' forms of crowdsourcing information experimented in the past centuries.

Many contemporary professions were established by amateurs. Astronomers, archaeologists, musicians, and painters first earned their living doing something else, even though they were experts in their respective areas of (then) leisure. As professionals begin to dominate a field pioneered by amateurs, the meaning of the term amateur is transformed.

With the advent of social media, amateur activity has grown and become more visible, raising contrasting considerations. Various scholars have recognised the value of amateur endeavours and of knowledge creation beyond institutional walls. Nonetheless, other authors despise amateur-generated content. It is evident that the word 'amateur' has connotations. Once a term of approbation, it is now often used—especially in circles where amateur research is unfamiliar—to banish certain people or activities as untrained, low level, marginal and unvalidated.

In this work, we will reflect on the role of the amateur in the digital age, and its contribution to the research in the humanities from the crowdsourced creation of the Oxford English Dictionary to contemporary practices.

The School of Ants Project:
a bridge between scientists and the science education in the Italian schools

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The aware citizen needs a basic scientific knowledge in order to understand science, its technological applications and its purposes. This will lead to the acquisition of a "Scientific Citizenship" for the correct evaluation of the social use of science and the comprehension of the political decisions that affect our lives and of our community. The Italian society is facing a clear lack of Scientific Citizenship and two main causes can be identified. The Italian school is still following a model of science education too conceptual and insufficiently laboratory. On the other hand, scientific institutes are too slowly recognizing the big communicative gap between researchers and the rest of the society. The Italian version of the "School of Ants" is a Citizen Science project that was initially born to answer a scientific question, but very quickly developed in an interesting example of inquiry-based science education and direct link among researchers, teachers and students. Can ants be a useful model to study how human impact is shaping Italian urban biodiversity? Studying Italian ants using citizen scientists was thus a promising approach to address this scientific question. Initially, we developed a pilot project that saw the collaboration of the Myrmecology Lab. of Parma University, the Cariparma Fundation and the Parmigianino Educational Institute. During one year, students collected the ants of their schoolyard using a specific ant collecting kit and a standardized protocol. At the same time, teachers and researchers developed a multidisciplinary learning path that used the "hands on" experience to understand many different concepts. The promising results and feedbacks led to the current second phase with two main aims: the passage from local to national level and the participation of students in more complex scientific studies such as the researches on animal behavior.

Citizen Science and the challenge of the neglected insects:
a focus on the aquatic Heteroptera

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Citizen Science is a burgeoning source of occurrence data used for easily detectable animal taxa such as mammals, birds and butterflies. Its performance on lesser known taxa, however, has until now been poorly analyzed. We selected Gerromorpha, Nepomorpha, and water dependent Leptopodomorpha (Hemiptera: Heteroptera), three groups of aquatic bugs which, due to their unattractive features, tend to appeal little to the wider public.

We have selected the CS platform "iNaturalist" (www.inaturalist.org) as our source for this case study. Worldwide records dated up to 31th January 2016 were taken into consideration and we only considered "Research Grade" observations (georeferenced, with photo and date).

Families were divided in three categories according to their preferred habitat (water surface, underwater, and shore). Three categories were also established according to the body size of each family: small (< 4.9 mm), medium (5.0-14.9 mm), large (> 15 mm).

Most of the observations (n = 1167) came from North America and some from Europe; data pertaining to other regions was scarce.

We found that the highest number of observations refer to easily detectable bugs. Inhabitants of the water surface represent more than half of the occurrence records, while about 40% refer to those that live underwater, and only 6% those that live on shores. The latter result is probably related to the cryptism of some groups. As expected, no records for benthic and marine taxa, and for true shore bugs (which are very hard to detect) were available.

Most of the records concerned common species, but there were a few interesting observations made in unusual geographical areas, which are of particular scientific value. This data provides researchers with a useful contribution for neglected groups, even if it has many limitations, mainly due to the low detectability of many taxa when compared to more 'appealing' fauna.

Etopia-Unizar, Citizen Science Laboratories

Francisco Sanz, Fermin Serrano, Jesús Clemente-Gallardo, Eduardo Lostal, Mari Carmen Ibañez (Zaragoza, ES)

One has to have in mind that only three things are needed to do scientific research, knowledge, time and resources. It seems clear that nowadays this knowledge is getting out of the traditional track and citizens are having more and more free time. So we must ensure that these needed resources are available for citizens.

With this idea in mind, the University oz Zaragoza has set up up to eight laboratories devoted to Citizen Science: FabLab, Electronic Lab, WetLab, Visualization Lab, Audio Lab, Video Lab, Programming Lab, Astronomy Lab and Robotics Lab, with a total budget of half a million euros. In these laboratories the Citizen Science community along with the Scientific Community is able to develop their own scientific projects. All these laboratories are set up in the Etopia building: Center of Arts and Technology, occupying and area of 1000 m^2.

Bringing knowledge and technology between the scientific community and citizens is essential to take advantage of the maximum potential that these citizens can offer to Science. Having them as mere observers or circumstantial actors without initiative do not allow us to obtain all the possible outcome. There are several aspects why physical mix between citizens and professional researchers is well worth. Firstly, for citizens, work together with professional scientists allow them to understand and practice the scientific method, secondly, the citizen science community has access to some resources traditionally reserved to professional researchers, thirdly it allows the scientist to use the resources citizen science offers for their own research and last but not least, understand and improve the Citizen Science process.

In this presentation we will describe the acquired resources and their selection process as well as the upcoming governance challenges.

Citizen science as a strategy: Sustaining the co-creation of value for science and society

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Citizen science is a particular form of crowdsourcing aiming to enable citizens to participate in scientific projects. The increasing requirement for organisations to open their boundaries has created new challenges, and citizen science actively participates in defining such an opening. University research is forced to find innovative ways to sustain in the face of declining public support, and opening the scientific processes is one such way. The result of such openness is a change in the nature of control away from the center of organisations, be they research institutes or commercial companies, to an often undefined periphery of crowds.

This change of control alters how value is created and how it should be evaluated. When such projects truly come to give an ample space of engagement to citizens, tensions arise over the value and the direction the project should take. For example, tensions have arisen in studied citizen science projects, reflecting an accelerating trend from the notion of 'science by citizens' to 'science with the people'. How can we understand this trend? What are the consequences on the sustainability of a scientific project when doing science with the citizens?

Our paper proposes to study these questions in the context of citizen science. Contrary to other types of crowdsourcing activities such as open source development, citizen science often involves a crowd of amateurs who may not have much previous experience in science. Thus, doing science with the people involves an initial strategic tension which needs to be resolved: to ensure the accomplishment of scientific objectives while attracting and maintaining a sustainable participation of citizens.

Embedding citizen science about urban sustainability in a tertiary education curriculum

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The case study presented here offers one example of how citizen science can be successfully embedded in tertiary education. Within the context of an introductory foundation course in Environmental Education offered by the Department of Pedagogy of the University of Athens (Greece), undergraduate students participated in a workshop on co-constructing digital stories about sustainability in the city. The didactical design of the workshop was to engage students in collaboratively investigating their everyday reality in the city, gathering data and multi-modal evidence about actual challenges in living in their city, and then bringing all material and their experience back in classroom where they could share and discuss it with their co-learners and negotiate and combine their individual representations of what sustainability in the city means in a collective view. In the workshop the students had also the opportunity to develop some basic digital literacy which enabled them to make their own digital stories (i.e., mutli-media authoring, including sound, video and image processing). In these digital artefacts they integrated their representations of urban sustainability (or absence of it) into short (up to 3 minutes) video- or animation-like digital stories, made with inexpensive, readily available technology (i.e., Windows Movie Maker).

The whole learning activity lasted for something less than 3 months (early April till mid-June 2013). It enabled the participating

students to get involved in an empowering DIY citizen science experience which allowed them to collaboratively develop a more meaningful insight into the inherently complex, elusive and context-specific concept of sustainability. The whole idea of engaging the students into an intriguing citizen science project, quite different from what they were used to up till then in their academic studies, not only had a considerable learning impact, but also added value and meaning to the existing curriculum.

Co-designing digital educational resources addressing sustainability issues for citizen science

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This case-study addresses creativity in the co-design of digital educational resources aiming to involve students in learning about current sustainability issues in the context of citizen science projects. The rationale and a methodology of how to bring together representatives from various groups of stakeholders (researchers, educational designers, scientists and students) to co-define and address the 'challenge' set to them (to co-design an e-book engaging prospective learners in creatively thinking about math and sustainability concepts) is analysed. Critical episodes of their co-design activity, which led to the production of a set of sustainability-themed e-books (called "c-books", "c" for "creative") will be provided to depict the design processes and products. Special emphasis is assigned into framing the knowledge-brokering exchanges that took place within heterogenous groups of designers jointly striving to ascribe meaning into how to foster the students' engagement in citizen science issues of their everyday reality (i.e., biking in the city) or of a more global perspective (i.e., climate change), as well as how to motivate them to get involved with finding the 'mathematics' behind these issues. 'Boundary Crossing' theory (Akkerman & Bakker, 2011) is applied as a theoretical frame to study the processes and strategies employed by co-designers stemming from different disciplinary backgrounds, epistemological perspectives and professional expertise, to 'bridge their differences' and combine their 'intersecting worlds'. The outcomes are a new knowledge co-creation practice and a set of innovative products aiming to support citizen science learning activities to address current societal challenges, such as climate change, sustainable cities, sustainable transportation, etc. (The research leading to these results was funded from the European Union, FP7, GA 610467: project "MC Squared", http://mc2-project.eu. This publication reflects only the author's views and Union is not liable for any use that may be made of the information contained therein).

Co-authoring interactive citizen science stories with digital media: a walk in a 'bioclimatic luna-park'

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The empirical study presented here discusses the potential of digital media to develop into new means of citizen science communication through the telling of new kinds of stories, interactive stories. The study involved a group of professionals within the field of education, but with diverse disciplinary backgrounds and expertise. They got together to collaboratively craft a story by means of an e-book with new kinds of affordances, such as being able to include interactive dynamic models and representations amongst the text for readers to be able to carry out their own investigations and experiments related to the story. These kinds of media allow citizens to experiment and come up with unpredictable or alternative outcomes, while also having freedom in intervening and taking ownership of the story itself. Our focus is on how citizen science can invest on new, creative and immersive communication and learning tools such as collaborative storytelling with new digital means. The story presented here was produced out of the researchers' task to challenge story-tellers to think of what may initially look like a paradox, a 'bioclimatic luna-park', and the exhibits, games and activities which could be designed to achieve 'sustainability' as a priority. For analyzing the process of the story's progressive co-creation 'Boundary Crossing' theory (Akkerman & Bakker, 2011) was employed as an appropriate theoretical frame. We focus on the processes and strategies employed by the story-tellers while exchanging, negotiating and integrating their perspectives as processes of a new co-creation practice leading to new citizen science learning tools. (The research leading to these results was funded from the European Union, FP7, GA 610467: project "M C Squared", http://mc2-project.eu <http://mc2-project.eu/>. This publication reflects only the author's views and Union is not liable for any use that may be made of the information contained therein.)

Scientists by chance: what tell us data from unaware citizen scientists?

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In Italy, several citizen science projects dealing with biodiversity have recently been developed involving citizens in surveys and monitoring programs. Most projects deal with animals and plants, explicitly encouraging people to collaborate with scientific research teams. On the other hand, the World Wide Web provides a wide array of opportunities for citizens to share and publish data of their own observations. Are these data potentially useful to be part of the rapid grow of biodiversity big data system?

The aim of our work has been the development of a "pilot" database of georeferenced data on Lepidoptera based on photographs and information published on diverse websites involving unaware citizen scientists. A careful examination of some websites where amateur naturalists posted their observations allowed us shortly to assemble an introductory database consisting of more than 2500 records. Starting from textual sites description we georeferenced the collecting localities and systematized spatial and temporal data from all the photos taxonomically validated by expert entomologists. The dataset was limited to a few Italian regions and, interestingly, included species listed in the Habitats Directive (92/43/EEC). The georeferenced data have then been used to analyze the geographical position of the observation points with respect to environmental features of the localities frequented by the citizen scientist (e.g. elevation, protected areas, and land use).

Results of this exploratory study confirmed the possibility to assemble useful biodiversity data from the web, at least for those taxa like butterflies and moths where validation by expert taxonomists is affordable. However, this attempt also revealed some limits and bias typically associated to the lack of sampling design.

OpenAIRE 2020: How eInfrastructures open science to the world

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OpenAIRE2020 is an Open Access (OA) infrastructure for research which supports open scholarly communication and access to the research output of European funded projects. With over five years of supporting the European Commission's OA policies, OpenAIRE now has a key role in supporting the EC's Horizon 2020 Open Data Pilot. This presentation will outline how an infrastructure like OpenAIRE can open science to the world.

OpenAIRE's community network works to gather research outputs, highlight the OA mandate, and advance open access initiatives at national levels. It has National Open Access Desks in over 30 countries, and operates a European Helpdesk system for all matters concerning open access, copyright and repository interoperability. At the same time, OpenAIRE harvests metadata information from a network of Open Access repositories, data repositories, aggregators and OA journals. It then enriches this metadata by linking people, publications, datasets, projects and funding streams. This interlinked information – which currently encompasses more than 13 million publications and 12 thousand datasets from more than 6 thousand data sources – helps optimise the research process, increasing research visibility, facilitating data sharing and reuse and enabling the monitoring of research impact.

Keywords: open data, open access, open science, research infrastructure

Distribution of the invasive slug Arion vulgaris in Austrian gardens: first results of a citizen science project (BOKUArion)

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The Spanish slug (Arion vulgaris or A. lusitanicus) is one of the 100 most invasive species in Europe and a major horticultural and agricultural pest. The burning questions are (i) to what extent this invasive species suppresses or replaces the native Red slug (A. rufus) or Black slug (A. ater) and (ii) whether structural and biological prerequisites of the habitats affect the occurrence of A. vulgaris. Using a citizen science approach more than 150 participants collected slugs in private gardens across Austria following a standardized protocol. Generally, the taxonomy of A. vulgaris is a matter of ongoing debate due to hybridization between A. vulgaris and the closely related native species and because of difficulties in distinguishing species by morphological features making species identification by citizen scientists very hard. Therefore, we used molecular-genetical methods, i.e. DNA barcoding of the mitochondrial COI region, for identifying slug samples collected from citizen scientists to demonstrate how widespread the Spanish slug actually is in Austrian gardens.

Our first results indicate that the native slug species have either been replaced by A. vulgaris or are not detectable anymore due to hybridizations in the investigated gardens. We hope that further analysis of the collected data on plant diversity and earthworm activity can help us better understand the means of success of the Spanish slug in Austrian Gardens.

Who are the citizen scientists involved in French biodiversity monitoring programs?

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For ten years, the French National Museum of Natural History has been involving non-naturalist volunteers in several biodiversity monitoring schemes under the Vigie-Nature program umbrella. Every year ca. 15 000 volunteer citizens collect data among various taxa such as butterflies, flower-visiting insects, birds, snails and urban plants.

A challenge of these citizen science programs is to attract people without scientific background or previous interest in biodiversity, and to adapt the schemes to their skills and expectations. But since participation in these programs is performed through internet platforms, scientists generally do not have direct contact with participants, and do not know much about them. For a better consideration of citizen expectations and a shift toward a less top-down approach in the conception of citizen science programs, a mutual understanding of scientist and non scientist is necessary.

Participants of six monitoring programs were asked to complete a survey about their participation, motivations and knowledge acquisition. Nearly 2000 participants replied positively during the winter 2015. The results allowed to characterize the typical Vigie-nature participant and to understand the reasons they became involved in the project. We also explored how repeated observation of nature influence environment perception, increase knowledge on biodiversity and can foster pro-conservation behavior. Finally, this survey raised issues about the factors leading some citizen scientists to end their participation. A better understanding of these factors is of great importance as long-term, continuous involvement of participants is a major issue of most citizen sciences programs.

This study delivers a better understanding of citizen science participation and allows providing recommendations that should be taken into account at different stage of the programs evolution. It will help establishing a dialogue and mutual understanding between scientists and volunteers in citizen science programs.

Engaging participants in citizen science studies: A qualitative approach to exploring the motivations and experiences of environmental citizen scientists

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This paper explores how participation in citizen science effects volunteers interactions with nature, place and community, as well as how such experiences influence understandings of scientific processes and ecology. In collaboration with the Zoological Society of London, the University of Edinburgh and the Woodland Trust, this study involved an in-depth exploration of the experiences of 22 individuals participating in environmental citizen science projects. By contrasting the motivations and experiences of citizen scientists involved in a UK-based river-monitoring project with those involved in a phenology project, I explore the wide-variety of meanings that individuals ascribe to their citizen science experiences. I use narrative analysis techniques as a conceptual tool for thinking about the relationships between individuals and the environment. The study reveals that as well as being motivated by the desire to increase their knowledge and skills about ecological and environmental issues, both love of place and love of life appear to play their part in encourage citizen scientists to engage with projects and have an important role in sustaining their interest. I will also discuss the implications of being a citizen scientist for social identities connecting this to wider notions of citizenship.

Kids in Participation

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The Ocean Sampling Day (OSD) project [1] aims to increase the knowledge of marine microbes by bringing people together to study the microbes in ocean ecosystems. Due to microscopic size, their diversity and their big home – the oceans of the world – it is very hard to study them. Therefore, "citizen scientists" are engaged in this project to help scientists to sample marine microbes so that they can identify them and conduct further research on the benefits of microbes.

In this presentation we report about the science education project "Kids in participation". Pupils of the upper secondary level of four schools in Bremen get partner within the initiative MyOSD of the MPI (Max Planck Institute for Marine Microbiology Microbial Genomics and Bioinformatics). Supported by science educators of the University Bremen the Kids investigate the importance of microbes for human health, environment and the global carbon and nitrogen cycle. The activities are based on the principles of the Inquiry Based Science Education (IBSE) which provides increased opportunities for cooperation between actors in the formal and informal arenas [2]. Within the project the participating Kids get to know scientific methods for the sampling of microbes and conduct a sampling on June 21st 2016, the worldwide Ocean Sampling Day. They provide their sampling to scientists of the MPI and present and discuss their results at the local community as well as by snowballing via social media.

[1] Kopf, A., Bicak, M., Kottmann, R., Schnetzer, J., Kostadinov, I., Lehmann, K., et al. (2015). The ocean sampling day consortium. Gigascience 4, 27.

[2] Rocard, M., Csermely, R., Jorde, D.,Lenzen, D., Walberg-Henriksson, H., Hemmo, V. (2007). Science Education Now. A renewed pedagogy for the future of Europe. European Commission. http://ec.europa.eu/research/science-society/document_library/pdf_06/report-rocard-on-science-education_en.pdf

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Citizens and their involvement on environmental issues: The experience of the Val D'Agri environmental observatory. A starting point towards new challenges

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The Val d'Agri (Basilicata region – southern Italy) is an area characterized by a great environmental complexity where naturalistic aspects coexist with high impact anthropogenic activities. In fact, on one side Val d'Agri is a farming and breeding site included in a protected area, on the other side, it houses the largest on-shore European oil reservoir, with 27 active productive wells and a crude oil and gas pre-treatment plant (i.e. Centro Olio Val d'Agri - COVA), operating since 2001. These anthropogenic activities are located close to several small towns (from 1700 to 5400 inhabitants), thus causing great concern in local citizens and inhabitants, seriously worried about the potential damages to health and environment.

To face these aspects and as an environmental compensation, the Environmental Observatory of Val d'Agri, at present Regional Environmental Observatory Foundation of Basilicata Region, has been established, with the aim to manage the data provided by the local environmental monitoring system and to inform citizens about environmental issues and hazards possibly related to the above mentioned industrial activities. In this framework, the CNR-IMAA supported the Basilicata Region by cooperating in the design of technological information systems and organizing workshops, seminars and open discussions.

As a possible future activity, a citizens' observatory for environmental monitoring might be implemented, aimed at making the local citizens key players, actively contributing in providing environmental data to support a more effective environmental governance in this peculiar area.

Citizen Science for CIGESMED, or how to engage divers in marine ecological monitoring: first steps of a new project

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Citizen Science for CIGESMED is a new European project which focuses specifically on the Mediterranean biogenic algal reefs known as "coralligenous". These habitats are considered hotspots of biodiversity, harbouring rich benthic assemblages and valuable biological resources. They are extremely popular among divers due to their complex structure, conspicuous biological wealth and high aesthetic value. Nevertheless, data on their distribution, structure and conservation status is lacking for several Mediterranean areas while they are vulnerable to multiple threats.

A specific protocol for underwater observation and a multilingual website were developed, comprising an educational platform, providing information about coralligenous habitats, and a data submission platform. Data focuses on: i) topographic and abiotic features, allowing a preliminary characterization of the site; ii) presence and relative abundance of conspicuous typical species of coralligenous assemblages, and (iii) recording of pressures and imminent threats. Data-recording dive slates were designed according to the principles of the "rapid visual assessment", in order to optimise the time of the observation and enhance diving security. A group of volunteer divers have been engaged in preliminary field trials in different areas of the Mediterranean, in order to test the protocol and guidance material, offering suggestions to improve its usability and effectiveness. Furthermore, the validity of the answers provided by the divers was assessed in comparison to those provided by scientists, in order to test the reliability of the protocol and identify possible correction factors for the obtained datasets. Results showed that for few species (e.g. small-sized ones with a patchy/scarce distribution in the study site) the abundance was underestimated. Some pressures also appeared difficult to identify and quantify. Future efforts will aim to maximize the engagement of the enthusiast participants, train less competent ones, and enhance the communication between citizen scientists and professional researchers.

Stakeholder Analysis on CS data & metadata standardization

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In the past year, several initiatives with the aim of fostering interoperability and developing joint standards as well as infrastructures for citizen science data and metadata emerged. For instance, an ontology for citizen science data and metadata, the development of new as well as linkages between existing project and data repositories, and a reference model for sharing citizen science IT tools are currently being discussed. Actors from around the globe are involved and include working groups of CSA and ECSA, platforms like CitSci.org, SciStarter and the Atlas of Living Australia, the Joint Research Center of the European Commission, and the Open Geospatial Consortium.

In this context, the Commons Lab at the Woodrow Wilson International Center for Scholars, US, is leading an analysis of important international stakeholders in citizen science. The main goal of this stakeholder analysis is to identify the individuals, groups, and organizations that will be impacted by a data and metadata standardization project. Standardization efforts will affect and benefit the broad range of citizen science communities in different ways. Therefore the stakeholder analysis seeks to gain insights into the data-related concerns of communities and devise ways for broad participation in the standardization efforts. The ultimate aim is to contribute to the inclusiveness of standardization initiatives which is needed to ensure the development and uptake of widely applicable data standards for citizen science.

The talk will introduce the methodology of the stakeholder analysis along with what has been done so far. The aim of the talk is to make the study widely known to potential stakeholders and get feedback and inputs from the session participants. If it is possible, the talk can be combined with a brief interactive part, such as a stakeholder mapping exercise and/or identification of salient data and metadata issues from participants' projects.

Stakeholders Reflection on Citizen Science:
A UK case study on Tree Health Science, Management and Policy

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Citizen science (CS) has been advocated as a powerful research tool for undertaking environmental monitoring and scientific research and for engaging and collaborating with the general public. Diversity of stakeholders involved in the process warrants analysis of their expectations, motivations and experiences in engaging with CS projects. Early insights on stakeholder views and opinion on CS approach would help in effective design and implementation of citizen science projects and to eventually reap true benefits of this approach. Taking tree health sector in the UK as a case study, the present paper assess the contribution and relevance of CS approach in terms of policy, management and science. The paper reports on the series of qualitative interviews (N = 40) conducted across the three stakeholder groups (policy, management and science) and explores their views on the current evidence needs and scope for citizen science to address their needs. It also reflects on the stakeholder's expectations from citizen science, and where they see the real challenges and opportunities for using a citizen science approach. It identifies the similarities and divergence of thoughts on citizen science across policy makers, CS practitioners, scientists and academic reflectors involved in

addressing tree health in the UK. Learnings and implications for future engagement with CS practice are discussed in general and also in context to tree health domain in the UK.

Community Curiosity Labs in Nottingham

Rick Hall
Ignite!, GB

Ignite! is a small not-for-profit creative learning agency based in Nottingham, one of six designated 'Science Cities' in England.

Over the past 10 years Ignite! has developed a range of interventions in schools and in community settings to promote the appreciation of STEM subjects as innately creative. Of these programmes Lab_13, a school-based laboratory that is managed by pupils for their own investigations and research, working with a Scientist in Residence, has become the best known and widely evaluated for impact.

In 2015, Ignite! took the concept of Lab_13, where science investigations are prompted by the curiosity and questions of the participants, into a community context, in one of the poorest neighbourhoods in Nottingham. Children explored questions with a Scientist in Residence from the local university, and enjoyed practical hands-on experiments.

Many people think that science is difficult and not for them. But everyone is curious about something, and the kinds of questions that children ask can help families learn together. Community Curiosity Labs, which take place in local libraries, social and community centres, show that science can be fun, exciting and is part of our everyday lives. Activities are designed to build up 'Science Capital' in families with very little contact or prior interest in science.

Although we have subsequently raised further funding to extend the programme from the Royal Society of Chemistry, it is interesting that funding for the pilot Community Curiosity Lab came from a fund for community development from the National Lottery. They recognize that science capital can impact on social confidence in some of the most deprived communities in the city; which our evaluation has borne out.

In this presentation, I will describe the process of engagement, partnerships, questions asked and activities, and the key findings from our evaluation.

Expedition Münsterland – A bridge from science to society

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The idea of Expedition Münsterland, as an outreach strategy was born when reflecting upon the importance of the WWUs' regional competence. How to apply approved means of the internationalization process for an outreaching regionalization of science activities. Since 2010, an unconventional research community repeatedly sets off on expeditions supported and moderated by the WWUs' Innovation Office (AFO) to discover and explore unknown or forgotten places and themes in the rural living environment of citizens of the region (Münsterland). Formats used are exhibitions, excursions, talks, publications etc, all with contributions by citizens as well as professional scientists. The agenda for the numerous and diverse expeditions is mainly based on the input from citizens and leads to further community-based research by the various university departments. A heterogeneous research community composed of professional scientists, a general public interested in science, university of third age, local heritage and cultural societies, citizens' initiatives and municipalities starts tailor-made planning of the activities one year ahead with the aim to meet broad expectations of all later public spectators. Key factors of the Expedition Münsterland are to increase regional prosperity, to stimulate mutual exchange between the region and its university and to take on social and ecological responsibility for the Münsterland. To meet these ambitions the Expedition Münsterland is embedded in a target agreement with the Federal State Government of North Rhine-Westphalia. Though the motivation behind is the great common need of all actors of the unconventional research community to build something meaningful, with joy and passion.

To ensure sustainability and to use multiplying effects most of the activities are processed on the Expeditions' website and the AFO is currently working on further digital, mobile and multi-functional devices to improve the self-determined information approach.

Citizen Social Science in schools? Involving students in finding solutions for energy efficient ICT practices

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Discussions on embedding citizen science into schools focus mainly on the natural sciences and activities related to data collection in the form of measuring, counting, etc. This paper aims to move the focus to the discussion of 'citizen social science' (i.e. citizen science activities in the social sciences) and the potential of introducing it to schools. How can students be involved in the social sciences? What potential learning outcomes could this give both to students and social scientists?

The paper discusses these questions based on reflections about the IEE-funded project 'useITsmartly' that focused on engaging high school students in finding solutions for behavioral change towards more energy efficient ICT use and for communication strategies that lead to action and practice change. This involved observing their own and their peers' ICT practices, reflecting on the potential to change these practices, and formulating and implementing communication strategies based on how they observed the communication practices among themselves.

Citizen social science has been said to have the potential to empower citizens, as they involve in observing the world around themselves, and to inform policymaking on issues of concern. Based on the findings of the useITsmartly-project, the paper also addresses in what ways citizen social science can contribute to the empowerment of students, particularly related to the tension between involving motivated highly capable student volunteers, which probably would render more useful results for the scientists, and a focus on empowerment and diversity.

Data Quality in Citizen Science Projects considering Roadkills

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Roads are an essential part of Central European landscapes and therefore have a major impact on flora and fauna. The most direct negative effect of roads on animals is roadkill, i.e. the collision of animals with vehicles, leading to the decrease of populations of several animal groups. For most countries, roadkill data are only available for huntable animals, however, very little is known to what extent non-huntable wildlife or red list species are affected by roadkills. In Austria amongst others, 37 412 Roe deers, 22 602 European hares or 1 193 European badgers were killed on roads in the year 2015.

In several European countries reporting systems for observations of road killed animals have been established. The Austrian Roadkill project (www.roadkill.at) uses a citizen science approach to get an overview of the type, number and distribution of road killed animals. Participants report roadkills using a customized smartphone app or an online form. However, collecting reliable data of road killed animals over a wide area and over a long time span can be very challenging since many biases exist, which influence mortality estimates on roads. On the one hand citizen science is critically viewed because of possible biases in 'presence only' data collection. On the other hand citizen science seems very promising in collecting robust roadkill data with good knowledge of the limitations of the data. Additionally citizen-reported data is useful to raise public awareness on accident risks and conservation concerns. This contribution will address caveats when using a citizen science approach in road ecology and will highlight solutions to overcome these challenges in order to achieve a robust data set.

The Next Generation of Citizen Observatories

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The European Commission through Horizon 2020 is supporting the development of an ecosystem of Citizen Observatories. The underpinning vision is to create a movement around environmental observations to inform and empower citizens to participate in environmental decision making, leading towards more inclusive, sustainable and smart economic development. The potential to scale Citizen Science to such a level of involvement, due to the introduction of powerful sensors in mobile devices, has been identified as a robust methodology to involve the public in data collection and evidence-based policy making by the European Commission.

Four new Citizen Observatories projects – Ground Truth 2.0, LANDSENSE, SCENT and The GROW Observatory – have been funded under the Horizon 2020 programme as a response to the topic SC5-17-2015 „Demonstrating the concept of ‚Citizen Observatories'". These new projects build on five FP7 Citizen Observatories that developed methodologies and technologies for crowdsourced data collection around water (WeSenseIt), atmospheric pollution (CITI-SENSE), Biosphere environment (COBWEB), coastal water (Citiclops) and odour (OMNISCIENTIS).

Each of the new projects aims to scale up and demonstrate in real-life conditions Citizen Observatories systems, thereby enabling effective transfer of environmental knowledge, with a focus on land cover and land use. All of them aim to be driven by, and to answer real needs of, citizens. There is a focus on co-creating actionable knowledge, empowering citizens and enabling them to take on new roles in participatory governance and policy making. This can be achieved by strengthening the full feedback-loop in the information chain from citizen data collection to knowledge sharing and use. Citizen contributions are identified as valuable inputs into the EU's Earth Observation (EO) monitoring framework. This can support more comprehensive environmental monitoring systems, extending GEOSS and Copernicus, and, in turn, open up a world of scientific information for discovery by citizens.

How to make use of citizen environmental sensing data?

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Citizen science is widely used for scientific research. The rapid developing sensor technology promotes this even further. The low cost and miniaturized sensors give citizens new tools to collect environmental data. However, this doesn't necessarily mean large impact has been realised. The combination of citizen sensed data with data from formal environmental monitoring networks is still challenging.

Similarly to other citizen science projects, the data quality is a critical issue to make sense of citizen environmental sensing. In this study, we investigate the challenges of citizen environmental sensing and propose a conceptual model which integrates informal citizen environmental sensing with formal data sources from official organizations. The data issues are not just the quality but also trust in the data. According to the experience from Amsterdam Smart Citizens Lab (ASCL) project, help from experts for citizen sensing is appreciated. On the other hand, official organizations are also interested on potential of citizen environmental sensing, even though some of them may feel threatened too. Often, citizens are more aware of their local environmental problems or questions. They are also enthusiastic to participate citizen sensing campaigns. However, they usually do not have the abilities to process and analysis the data to make sense of it. The ASCL and Urban AirQ projects, which are ongoing in the city of Amsterdam, will be used to analyse the importance of perception from both citizens and official organizations' perspectives. The perception will lead to an integration model which use official data source for citizen sensing data quality assurance and control, this in turn makes it possible to combine citizen sensed data with official data to produce high spatial temporal environmental information. .

Real-time air pollution monitoring in elementary school perform by and present to children

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Air pollution is the single largest environmental health risk in Europe and children need to be made aware early. Children, like adults, spend their majority of life in indoor environment. The indoor school environment is of particular interest since the children spend about 6 hours per day there.

There are a number of projects and numerous scientific articles about indoor air pollution in schools, but the challenge is how to bring such studies closer to the children. There are many reasons for poor indoor air quality in school, including infiltration from outdoors, cleaning practice, pupils' occupant ratio. CITI-SENSE project developed tools and performed a study to actively engage pupils in elementary and secondary schools in Norway, Serbia, Slovenia and the UK in air pollution monitoring in their schools. In this paper we discuss usability of low-cost air pollution platforms (EB700) developed in the framework of CITI-SENSE project for monitoring selected air pollutants in school (e.g. CO_2, CO, PM2.5, PM10, T, RH, P). As an example of children engagement we present a campaign to collect and evaluate air quality using commercially available low-cost devices (IC-meters) in two classrooms

of pupils 11-12 years old. The campaign was planned in detail and led by the school teacher of the elementary school in Belgrade. We will also show results of an exercise about particulate matter pollution (a major air pollution hazard). This exercise used a mobile TSI particle counters (OPS 3330) to assess different scenarios engaging the same pupils in the classroom.

The present study suggests that an early age pupils show engagement and interest in pollution issues as presented by our three exercises. Such teaching and training builds a step by step systematic understanding of indoor air pollution issues relevant for schools, but also for other indoor environments.

Citizen Science: who is in the driver seat and which fuel do they need?

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Public participation in Citizen Science projects is increasing. Citizens engage in scientific data gathering and data manipulation, they count bees and birds, analyse images of cancer cells and rainforest deforestation, and collect water samples and air pollution sensor data. But do we run the danger of reducing Citizen Science to large data handling to achieve scientific goals defined by scientists? Next to science-led activities we are witnessing the emergence of new forms of collaboration and grassroots initiatives that hold great potential of contributing to the wider goal of an inclusive society, opening science to the endorsement of interventions in socio-ecological systems. If we want to foster diversity and creativity in citizen science, we need to allow for these emerging forms of civic participation.

Science driven by civic society requires different support structures, depending on how distinct the collaborative projects are from established forms of research. Strategic policy-making needs to consider inclusive programme designs and funding mechanisms. As Citizen Science facilitators we have to think about new ways of integrating emerging knowledge produced by laypersons into the scientific knowledge landscape. We have to find ways of dealing with intellectual property and ascertaining scientific rigour in doing things. We might consider new ways of optimising citizens' integration by offering a stepwise approach towards a more active and more responsible form of participation.

To stimulate discussion during the workshop, we bring a classification matrix for Citizen Science projects along two axes: 1) the locus of knowledge creation and 2) the focus of project activities. Providing a snapshot of prevailing patterns of collaboration and expected project outcomes we investigate different support needs that cover prevailing and emerging forms of Citizen Science.

Monitoring the Water Quality using Citizen Science Approach

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A long-term study has been initiated by a group of environmental and geomatics scientists with support of Water Management Authorities for environmental monitoring purposes in Turkey. The objectives of the study are manifold and include rapid collection of large amounts of environmental data, facilitating instant data collection and involvement of volunteers over many years.

Comprehensive analysis on the water pollution is traditionally performed by well-equipped laboratories and encompasses hundreds of parameters regarding organic and inorganic matters. However, such analysis are slow and costly, require expertise, and provide data only from few collection nodes. The cost of monitoring water quality, for around 6200 data collection nodes, in Turkey is approximately 23M Euros per year, which is expected to increase due to stricter regulations.

Citizen science concepts open up exciting new opportunities especially in environmental monitoring, where volunteer works can reduce the monitoring costs significantly, accelerate data collection, and provide instant data especially right after an eutrophication incident. On the other hand, the development of new easy use sensors and software tools is required and only fewer parameters could be collected.

Strong interdisciplinary collaboration is crucial for successful monitoring activities. Within this project, the following activities are being performed and planned for the future:

- To enable citizen participation in acquiring physical water characteristics data in streams;
- The establishment of a common platform for data collection and presentation using Web- and Mobile-GIS technologies integrated with the satellite remote sensing as well as positioning technologies (e.g. GPS);
- Monitoring of water quality by measuring dissolved oxygen, temperature, turbidity, pH, bacteria, etc. parameters and improvement of new low cost sensors for monitoring water colour, transperancy and fluoresence, etc.;

- Development of image processing algorithms for end user cameras for water quality analysis;
- Development of algorithms and tools for data analysis and quality assessment.

The „Living Atlas of Germany" project – synthesizing volunteer conservation and biodiversity observation initiatives in Germany

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Biodiversity observation and conservation initiatives in Germany are borne by volunteer work. However, data collection and storage on the variety of taxa and spatial coverage is organized by different expert associations, NGOs, national and local authorities, museums of natural history, universities and other scientific institutions. Many of these institutions collect and maintain their data by the aid of Citizen Science projects, which often operate only on a local scale. Moreover, each project follows its own survey design, taxonomic concept, data standards and host its own database, not necessarily digital or accessible through a web portal. Following the urgent need for a more comprehensive approach we are currently carrying out a feasibility study for a Living Atlas of Germany that aims to bring together the multiple projects and data sources in one online portal to synthesize biodiversity monitoring and conservation efforts in Germany. We develop a framework for such a portal in dialogue with representatives of all relevant institutions, through workshops, questionnaires, meta analyses and personal conversations. At this, the first and foremost objective of the atlas platform is to build up a network of cross-taxonomic experts, conservation organizations, scientists, authorities and citizens to enhance communication, coordination and knowledge exchange. Additionally, consensus is that the atlas initiative should harmonize existing heterogeneous survey and data standards and provide services, such as hosting databases, providing web space or developing analysis tools or applications, especially for smaller and/or ill-equipped projects. An upcoming Living Atlas of Germany is also considered to serve as a tool for environmental education and to preserve taxonomic knowledge. In a progressed phase the portal is supposed to include supportive abiotic data, such as climate and environmental data, land cover/use, and also socio-economic parameters to facilitate an added value through professional and meaningful cross-component analyses.

A Citizen Science-project on marine litter –
The impact of engaging K-12 students in scientific research

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"Pathways of plastic litter" is an international Citizen Science project that aims to involve K-12 students in the public discussion of marine litter. Students apply various research methods, evaluate their data, communicate their results, and propose solutions to solve this problem. The project is conducted in Chile and Germany at the same time, allowing the participating students to share and compare their results and discuss their ideas with an international partner. The communication between partner schools takes place on the website www.save-ocean.org. The project promotes intercultural and scientific skills of the students. They gain insights in scientific research, learn about another culture, and experience plastic pollution as an important global problem. Since May 2015, 450 students aged 10 to 15 years and 20 teachers in Germany and Chile have explored the plastic waste on beaches. Where are the largest plastic garbage deposits? Which items of plastic are mostly found in Germany and Chile? Where does this garbage come from? These and other research questions are being answered by an international network between students, teachers and scientists. After completing the first Citizen Science pilot study successfully in summer 2015, the entire German and Chilean coast will be explored in May/June 2016 by approximately 1500 participating students. To reach these goals scientists, teachers and pupils work together in a network. To ensure reliability of the results, each participant receives a booklet that guides

through the scientific work and method. An admission to the project is given through a teacher training. The project is a cooperation of the Kiel Science Factory (University of Kiel, Germany) and the Cientificos de la Basura (Universidad Catolica del Norte in Coquimbo, Chile).

Citizen Science: A balancing act between delivering research & outreach

Poppy Lakeman Fraser
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With the proliferation of a diverse array of citizen science (CS) activities over recent decades it becomes increasingly helpful to reflect on how practitioners can effectively work together to consider best practice and maximise impact. Based on new research which proposes one such model, we present the findings from a study which investigates challenges and solutions associated with balancing research and outreach objectives in CS activities.

While some CS projects focus primarily on the collection of rigorous scientific data and others are positioned towards the public engagement end of the gradient, the majority of initiatives attempt to balance the two. Although meeting multiple aims can be seen as a 'win–win' situation, it can also yield significant challenges as allocating resources to one element means that they may be diverted away from the other. We explore the inherent trade-offs encountered and assimilate experience from the Open Air Laboratories (OPAL) network to investigate practical approaches taken to tackle arising tensions.

We found the following elements to be important: ensuring outputs are fit for purpose, developing strong internal and external collaborations, building a sufficiently diverse partnership and considering target audiences. We combine these 'operational indicators' with four pre-existing 'outcome indicators' to create a model which can be used to shape the planning and delivery of a citizen science project and maximise impact.

This research assimilates feedback from, and was conducted by, a host of citizen science practitioners and so called 'reflectors' and we would like to share these findings and obtain feedback from delegates at the first European Citizen Science Association conference.

Ordinary people and ordinary biodiversity monitoring: subjectivities at stake (a case study in France)

Marine Legrand
National museum of Natural history - Paris, France, FR

This presentation aims as sharing the results of a study conducted during my PhD in environmental anthropology, focused on a French local citizen science program called "Observ'acteurs" (a play on words that could be translated by "Watching is acting"). Directed toward the engagement of ordinary city-dwellers in ordinary biodiversity monitoring, this program implemented in 2010 by local public authorities in Seine-Saint-Denis, a post-industrial suburban territory next to Paris, that has been engaged for more than ten years in various urban biodiversity conservation and environmental education programs, and is considered as a pioneer in France for ecological management of urban parks.

The "Watching is acting" program can be understood as a frontier objet that is situated at the edge between two knowledge co-production regimes. On the one hand the "watching is acting" program appears as part of a larger device that brings together institutions, places, rules, techniques and information, directed toward an enrolment of city-dwellers in biodiversity monitoring: an dynamic that is directed toward the idea of making everyday nature experience efficient as part of the urban infrastructure management system. On the other hand, the participatory nature of the "watching as acting" program, including turnkey pedagogic tools and open training sessions, and the fact that the program points at ordinary forms of life (such as snails and slugs, or plants growing in the streets) seems to lead to the emergence of creative encounters between actors that were previously marginal in urban biodiversity conservation networks.

A Case Study of Citizen Science in the International Baccalaureate (IB) Diploma Program

Chris Leonhard, Dan Patton, John Harlin
Leysin American School, CH

The International Baccalaureate (IB) is a non-profit education foundation offering four international education programs, including the Diploma Program (DP) for students aged 16 to 19. Over 2,800 schools around the world offer the IBDP. According to the IB mission statement, the foundation, "aims to develop inquiring, knowledgeable, and caring young people who help to create a better and more peaceful world through intercultural understanding and respect." The IB science curriculum values personal

engagement, international mindedness, scientific literacy and public understanding, objectivity, and an awareness of the human face behind the scientific endeavor. The use of citizen science to encourage these scientific values flows naturally from the nature of citizen science. According to the ECSA best practices for citizen science, participants should be engaged in projects with genuine science outcomes. They should also have the opportunity to work on multiple stages of the project directly with scientists, including evaluating the success and limitations of the project. Many citizen science projects also cross local or national boundaries, thus allowing participants the chance to think globally about the scientific questions that affect all of us. This presentation will review the parallel goals of citizen science and the IBDP using the case study of Leysin American School (LAS) in Switzerland and its effort to develop a citizen science program to support the school's IB program. The approach taken by LAS is a climate ecology study using an environmental transect, in this case focusing on monitoring forest and meadow plots at elevations from 600m to 2300m. By institutionalizing this project, LAS intends to motivate students to care more about science while carrying out scientifically valid longitudinal climate research.

Monitoring, hunting, tracking & collecting: five leading citizen science projects from the UK

Kate Lewthwaite
Woodland Trust, GB

The UK has a proud history of amateurs collecting biological data. Conservation charity the Woodland Trust leads or collaborates on five nationally important citizen science projects which impact conservation outcomes in a range of ways.

Nature's Calendar: Our data forms the longest written biological record of its kind in the UK, beginning in 1736. Citizen scientists record phenology (seasonal timings) of a wide variety of species e.g. date of oak leaf fall. Records are used by UK government and researchers to track effects of climate change and included in Intergovernmental Panel on Climate Change reports.

Track a Tree: Established by our Nature's Calendar PhD researcher at Edinburgh University. Volunteers monitor the spring phenology of individual woodland trees and the relationship with flowering plants that grow beneath them. Insights will help understanding of how woodland communities may respond to climate change.

Ancient Tree Inventory: The UK has a rich collection of ancient and veteran trees which volunteers search for and map. We currently have 150k records which are used to designate Sites of Special Scientific Interest, identify priority wood pasture and parkland, lobby for legislation and policy changes and challenge planning applications.

Observatree: A UK-wide network of volunteers acts as a tree health early warning system. They recently found a new tree pest of concern which resulted in direct action by government officials. Volunteers also monitor spread of new arrivals such as Chalara dieback of ash. A multipartner LIFE+ funded initiative led by Forest Research UK.

UK National Tree Seed Project: Partnership project led by Royal Botanic Gardens, Kew. Teams of trained volunteers are gathering a genetically comprehensive collection of important UK tree seeds e.g. black poplar, to aid research and conservation efforts. Seeds are stored at Kew's Millennium Seed Bank as a future resource.

Automatic bat monitoring: when humans become more and more necessary

Grégoire Lois
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In the recent years, bat monitoring benefited from huge technological improvement allowing i) direct recording, without signal degradation or compression ii) long term recording with weather proof devices and iii) automatic identification. Such improvement could seem to negatively affect citizen science by implicitly making the human input almost dispensable. Nevertheless, experience shows that the power of such system relies on human expertise both to qualify libraries, used as reference for identification, and to estimate and correct the residual errors of the automatic identification.

In France, national monitoring program now allows such kind of involvement. Citizens can join such initiative and deploy automatic ultrasound recorders following predefined sampling strategies. This project ensures massive data collection which have proved to be of great scientific value in many fields: bat species trends, human activities impacts such as artificial lighting, extension to non-targeted species (bush-crickets), etc.

On one hand, robustness of identification depends on the size and accuracy of the reference dataset, on the other hand, citizens can reach a very high expertise in visual identification of sonograms thanks to their participation. Thus, a parallel citizen science initiative relying on collective intelligence could improve automatic identification through the collaborative collection of reference

sound data, using expertise of participants. It then appears obvious that, in such case, scientific program based on sensors and automatization do benefit from citizen expertise.

Tagging the Natural World: A pilot citizen-science project at MUHNAC, University of Lisbon

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* The first two authors contributed equally to this work

The National Museum of Natural History and Science, MUHNAC (University of Lisbon, Portugal) has collections covering c. 1 million objects, including c. 3000 zoology, botany and anthropology illustrations, resulting from natural expeditions to the former Portuguese empire (18th-19th centuries). Some illustrations are worldwide known and widely documented, e.g. the series of A. Rodrigues Ferreira (Brazil) and F. Welwitsch (Angola). However, a significant number of illustrations remain un-catalogued, including many animal and plant species unidentified. The Museum has developed an innovative citizen science project aiming at unravelling these illustrations. Citizens from all over the world will be involved in thoroughly describing them using tags identifying the presence of objects, people, animals, plants, colours, actions, quantities, species names, and captions. This pilot approach, later to be applied to other iconographic collections (e.g. photography, engravings), will enrich the illustrations with detailed, comprehensive and unique information. Assembled data will then enable the development of faster and more accurate search tools in scientific collections databases updating them with efficient and user-friendly search filters. Ultimately, the goal is to provide online free access to these illustrations and associated data. We will present the project and methods and discuss preliminary results.

Humanities at the intersection between science and society

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In Portugal, citizen science projects are still scarce and seem to follow a dominant global trend, i.e., mainly involving research data related to biodiversity, environment, astronomy and public health. Worldwide the number of citizen science projects using data arising from the humanities is still reduced, and Portugal is no exception. At the same time, although studies on citizen motivations abound, the motivation of researchers to promote citizen science projects has not received the attention it deserves. What motivates researchers to promote citizen science projects? What are the requirement and conditions? Are some disciplines more 'suitable' to knowledge co-production? If so, which disciplines and why? In particular, are the humanities and social sciences intrinsically difficult to involve citizens in research? Why?

We will discuss these questions and propose a research framework to study them in the Portuguese context.

Environmental quality for outdoor sports - eQUOS app

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eQUOS (Environment Quality for Outdoor Sports) is an app for mobile devices that suggests to the final user whether to perform a specific outdoor physical activity in a specific geographical area on the base of environment quality, using open database on changing environment. In particular, Tropospheric Emission Monitoring Internet Service (TEMIS) will provide near real-time data on: air pollution (nitrogen dioxide), UV radiation (Clear sky UV index), climate change (aerosol index and cloud information) and monitoring volcanic plumes (Sulphur dioxide and ash).

The data in TEMIS are available in Hierarchical Data Format (HDF), a set of file formats designed to store and organize large amounts of data. The HDF libraries and associated tools are available under a liberal, BSD-like license for general use, and HDF is supported by many commercial and non-commercial software platforms,

In the first phase of the eQUOS development, we plan to develop a web service that retrieve data from TEMIS web site and organize them in a proper way in order to be directly available for the mobile app. Such data will be organized in a database, that will be make possible to query the environment quality data by GPS coordinates.

eQUOS will retrieve environment quality data related to the GPS coordinate of the mobile device, and will correlate them with metabolic equivalent of task (MET) of different outdoor physical activities to show an easily understanding icon, which will suggest whether to perform an outdoor activity.

We plan to develop the mobile app eQUOS for Andoird, since it is the most worldwide used platform, using Java and HTML5. The Web service for the data will be developed using Java Enterprise Edition platform.

Researching Polli:Nation (UK):
understanding citizen science's contribution within a landscape change project in schools

Greg Mannion, Andy Ruck
Univ of Stirling, GB

In this presentation we outline a plan to research and evaluate a large-scale UK-wide citizen science and habitat restoration project, Polli:Nation. The programme commenced in spring 2016 with 260 participating primary and secondary schools. It aims to engage pupils in the transformation of school grounds into bee-friendly habitats, and in monitoring of the effects via citizen science. The programme seeks to simultaneously address the decline of bee populations, and to "create a network of knowledge-able and enthused young conservationists" (Learning through Landscapes 2014). There will be a comprehensive training input for staff and materials to resource schools. The project (with £1.4M from Heritage Lottery Fund) is led by the charity Learning through Landscapes and supported by Buglife, Field Studies Council, Butterfly Conservation, the OPAL network (Imperial College), University of Stirling, and volunteering organisations (BCT TCV).

The Polli:Nation project provides a distinctive opportunity for researching the process of embedding citizen science into schooling. The presentation focuses on how the qualitative and quantitative research design will support our understanding of the impacts and outcomes for pupils in environmental education's terms. We theorise the programme as a form of co-creative curriculum-making that harnesses the agencies of pupils, staff, scientists and others, and the more-than-human agencies found in outdoor places. Inputs include citizen science activities, but also participation in conservation / civic ecology (Zint et al 2002, Krasny and Tidball 2012), and community- and place-based education (Higgins and Nicol 2006, Mannion et al 2013). We anticipate effects to arise from the process of 'doing citizen science', but also from contact with volunteers and "real scientists" (Evans et al 2005), encounters with other species (Rautio 2013) and through actively changing landscapes. Theoretically and empirically, we wonder about the contribution of citizen science. When and how can it support environmental learning through schooling?

CSMON-LIFE: data from the people, data for the people

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CSMON-LIFE (LIFE13 ENV/IT/842) is a 42 months long project (2014-2017) co-funded by the European Commission in the framework of the LIFE+ programme. CSMON-LIFE aims at raisinging the awareness on the potential contribution of citizen science in Italy, at increasing cooperation among citizens, scientists and decision makers in collecting and elaborating biodiversity data, and at promoting new and more effective environmental policies.

To achieve its goals, the project relies on both extensive awareness raising initiatives and on the use of modern mobile technologies. An app (for iOS and Android mobile OSs) and a webapp were developed at the start of the project and are being continually improved on the base of suggestions by collaborating scientists and citizens.. These tools allow citizens to take geo-referenced images of several target species (ca.120, related to several environmental issues), and to send them to a web management system for scientific data. The observations are seen through a validation interface, which is accessible to experts (since the start of the project), and to a selected group of citizen scientists (from spring 2016). The community driven validation is always confirmed by

scientists and requires a general consensus. Once a validation (positive or negative) occurs, a feedback is sent to the observer. Scientifically validated data are then aggregated in the Italian National Biodiversity Network, using the BioCASE protocol and the ABCD data schema.

All technologies are available to be used by anybody in the framework of CSMON-LIFE, and will be released under a CC license at the end of the project.

Geofence-driven Crowdsourcing and Citizen Science

Suvodeep Mazumdar, Neil Ireson, Fabio Ciravegna
University of Sheffield, GB

One function of Citizen Observatories (COs) is to collect in-situ observations from the ground through the involvement of citizens. The WeSenseIt project is aimed at developing COs to collectively contribute toward a shared understanding of all water related issues. In this context, citizens and communities are engaged in all aspects of decision-making by sharing ideas, opinions, feedback and contributing as sources of data as well. At the core of our approach is the need for collecting, managing and organizing local knowledge. Citizens and authorities can create their own data collection initiatives by accessing a web service to mark-up virtual regions-of-interests (ROIs, also known as geofences) on a geographical map. A mobile application is provided for citizens, which runs in the background, occasionally checking for location updates. Upon entering a ROI, a notification is triggered which can provide the user with local information or alerts, or make a request for information. Thus citizens can collaboratively contribute to build local knowledge regarding environmental monitoring, events, developments and opinions. This talk will present the geofencing approach focusing on how the information received from and given to the users is processed, analysed and visualized. Information collected from citizens undergo a process of standardization, based on a semantic representation of the domain. This representation, though currently generic, can be extended to address other areas such as biodiversity-monitoring. Upon standardization, the information is presented via an information dashboard, which combines citizen input with data collected from a variety of sensors (low cost, professional and external). Finally, we will present a walkthrough of how decision-makers can then use the heterogeneous thereby collected to arrive at critical decisions. Though the talk will provide examples from the WeSenseIt project (hence, aimed at water management issues), the solutions are generic and can be extended to other domains and application scenarios.

Understanding the barriers between citizens and authorities in environmental monitoring

Fabio Ciravegna, Suvodeep Mazumdar, Neil Ireson
University of Sheffield, GB

In this talk, we will present our experience with a Citizen Observatory (CO) aimed at engaging citizens and communities, so that they can effectively contribute toward a shared understanding of their environment. The CO, developed within the European project WeSenseIt, enables effective real-time environmental monitoring through collaboration between experts (i.e. decision makers within authorities) and citizens and communities. At the core of our approach is a web-based framework where authorities and citizens connect with each other via a web interface, developed as an HTML5 application, which can then initiate a video conversation over standard web browsers. Authorities can request citizens to perform simple actions (e.g. measure surrounding objects), and use audio, video and text to clarify their instructions. In this talk, we will discuss our experiences during an evaluation involving Occupational Therapists (OTs) in a local hospital, in a setting where a bi-directional video communication was established to see how citizens can perform tasks requested by authorities. Our findings indicate there are significant barriers between citizens and authorities, which need to be addressed in order to ensure citizen science and crowdsourcing initiatives can effectively contribute toward a shared understanding of the environment. Although the application was evaluated within the context of Occupational Therapy, the findings are generically applicable to understanding the issues related to developing a collaborative environment involving real-time environmental monitoring requiring interaction between citizens, communities and authorities. In summary, we will provide some suggestions on how citizen science and citizen generated data can effectively contribute toward a shared understanding of local environments.

Landsense: A Citizen Observatory and Innovation Marketplace for Land Use and Land Cover

Inian Moorthy, Juan-Carlos Laso-Bayas, Ian McCallum, Steffen Fritz, Linda See
IIASA, AT

Currently within the EU's Earth Observation (EO) monitoring framework, there is a need for low-cost methods for acquiring high quality in-situ data to create accurate and well-validated environmental monitoring products. The aim of the LandSense project is to build a far reaching citizen observatory for Land Use and Land Cover (LULC) monitoring that will also function as a technology innovation marketplace. LandSense will deploy advanced tools, services and resources to mobilize and engage citizens to collect in-situ observations (i.e. ground-based data and visual interpretations of EO imagery). Integrating these citizen-driven in-situ data collections with established authoritative and open access data sources will help reduce costs, extend GEOSS and Copernicus capacities, and support comprehensive environmental monitoring systems. New LandSense services (LandSense Campaigner, Farm-Land Support, Change Detector and Quality Assurance & Control) will be deployed in three demonstration cases that will address critical LULC issues in the areas of urbanization, agricultural land use and forest/habitat monitoring. Policy-relevant campaigns will be implemented in close collaboration with multiple stakeholders to ensure that citizen observations contribute to EU-wide environmental governance and decision-making. There will be numerous pathways to citizen empowerment via the LandSense Engagement Platform, i.e. tools for discussion, online voting collaborative mapping, as well as events linked to various campaigns involving public consultation. Simultaneously, to improve Europe's role in the business of in-situ monitoring, LandSense will create sustainable business models to support market uptake and innovation of its novel added-value products and services.

Atmos iOS: A Hybrid Weather-Crowdsourcing Application

Evangelos Niforatos

Università della Svizzera italiana (USI) - University of Lugano, CH

The Atmos iOS app utilizes any available sensor found on an iPhone device (e.g. pressure sensor) for collecting weather related sensory input. Additionally, users can manually enter their own observations about both current and future weather conditions. The collected data is clustered by location, centrally processed, and loaded back into the Atmos iOS app for informing mobile users about weather conditions in places of interest. Existing apps in the area of crowd-sourced weather rely only on automated sensor capture to estimate current weather. A few applications optionally support using user input for verifying the accuracy of sensor data. However, our own research shows that users can be remarkably accurate when describing weather with a mobile app such as Atmos iOS, in particular when estimating current temperature, weather phenomena and wind intensity. Moreover, existing weather models often prove unreliable in areas known for their microclimates, such as mountainous valleys, mostly due to the reduced spatial resolution of fixed weather stations. Also, to the best of our knowledge, there is no other approach that is able to utilize the potential of expert users to predict short-term weather conditions (e.g. farmers or fishermen). Atmos iOS app serves as the counterpart of already deployed Atmos android app and Atmos public display app, into what we call "Atmos ecosystem". Eventually, we envision Atmos ecosystem will offer a particular advantage for weather forecasting in places with microclimates, where current weather models prove insufficient. Currently, we are employing machine-learning algorithms for efficiently combining both human input and sensor data and generating our own hybrid weather models. Our approach utilizes the power of crowds, individually (mobile devices) and collectively (public displays), combining both explicit (human input) and implicit (automated sensor readings) sampling to significantly improve the accuracy of weather forecasting in areas with challenging climatic conditions.

Historical data, a web-based platform, and volunteers: Citizen science to reconstruct past species distribution in Zurich region, Switzerland

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The digitization and processing of herbarium specimens for reconstructing the past occurrences of plant species provides important information to uncover changes in distribution and potentially link them to changes in land-use and climate. We have set up a citizen science project to compile data sets of historical plant occurrences relying on herbarium specimens from the combined herbaria of the University and ETH Zürich. The sorting out of specimens from the herbarium collections builds on competence in verifying plant species identifications, the transcription of labels in Kurrent relies on practice in the deciphering of handwritings, and the familiarity with local geographical names is a prerequisite to georeference locality information. Hence, our web-based

citizen science platform guides and supports the coordination and communication among teams with persons that contribute different skills and directs them to open tasks in the processing of label information. A blog-like notebook heads the messaging among the members and teams and assists in the exchange of advise in complicated cases. Currently, some 200 records per week are processed for a planned total of 20'000 records for 400 species. Overall, a dozen members of the Zürich Botanical Society contribute to this project. This presentation introduces the web-based citizen science portal for processing herbarium label information and focusses on discussing the multilayered exchange among citizen scientists and their feedback based on surveys about the portal in place.

Citizen Science Against Globalized Mosquito-Borne Diseases

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This article illustrates the power of citizen science in the fight against globalized mosquito-borne diseases, and it details key innovations for best exploiting citizen science data in this context. Focusing on the Mosquito Alert project (formerly AtrapaelTigre) and the vectors of Zika, Dengue, and Chikungunya, we describe a scalable citizen science system with the potential to transform the surveillance and management of disease carrying mosquitoes by adapting to the complex, human-facilitated spreading processes that characterize mosquito invasions. We catalogue research strategies adopted in Spain since the first detection of tiger mosquitoes in that country and we demonstrate how citizen science has contributed to these. The nature of the spreading process, a combination of small-scale diffusion and large-scale, human-assisted jumps, has meant that members of the general public have often been the first to alert authorities to tiger mosquito presence in new areas. Although this occurred initially through informal channels, since 2013 we have been catalyzing the process and augmenting its scientific reliability with a citizen science system (Mosquito Alert) that combines massive mobile-phone-based reporting with an expert validation mechanism and a background geotracking component for both reducing sampling bias and studying the role of human mobility in vector dispersal.

Citizen Science Technology: Challenges and Opportunities

Alison Parker, Margaret MacDonell, Young-Soo Chang, Kevin Kuhn, Barbara Martinez
ORISE fellow at US Environmental Protection Agency, US

Individuals and civic groups are increasingly involved in collecting environmental and health data with devices ranging from smartphones and smartwatches to do-it-yourself (DIY) kits and inexpensive commercial sensors. Additional innovative tools are being developed that can also educate, engage, and empower the public to contribute their talents to science. Technology innovation can have a profound effect on participatory science efforts, including improving communication between formal scientists and citizen scientists, enabling or facilitating data collection and analysis, and enhancing the experience and education of public participants.

The US Environmental Protection Agency (EPA) is interested in facilitating citizen science efforts in environmental and health research. EPA collaborated with Argonne National Laboratories to gather and synthesize information about technologies being used in or potentially suited for citizen science projects. The report also identifies opportunities for current technologies to be applied in new environmental and health research themes, and for emerging technologies to be developed and applied to citizen science activities.

In this discussion, we will present an overview of this inventory and report, discuss gaps and opportunities in citizen science technology, and seek feedback for future directions and making this information available to citizen science practitioners.

Citizen sciene's contribution to optimizing the potential of greenway nature trails

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The „Greenway: promoting sustainable tourism in Umbria" project concerns the Spoletano stretch of the Spoleto-Assisi (Umbria, Italy) cycle path, which runs alongside the Tessino and Marroggia streams. The route of the Valle Spoletana Greenway partly follows the eco-corridor that flanks the two rivers. This corridor is an essential link for animals, allowing them to move freely

between the mountain and forest eco-systems of the Apennines and the Valle Spoletana flood plains. The primary aim of the project is to regenerate the landscape, protect the area's natural heritage, and promote sustainable tourism. In addition, the project aims to restore abandoned and neglected areas for use by local people.

To this end the project has undertaken the promotion of a series of Citizen Science initiatives, with the dual aim of getting local people and visitors involved, and gathering data vital to the understanding, protection, and conservation of the environment along the Valle Spoletana Greenway. The project includes the installation of information posts, where local people and visitors can find information about the area's natural - and cultural - features, as well as instructions on how they can take part in monitoring activities along the route. The information posts include a section where the citizen scientists are invited to take photographs and post them on Spoleto Town Hall's facebook page. Nature experts evaluate the published photographs, together with the place, date and time they were taken, and then add the resulting information to a database set up for the purpose.

In December 2015 a specific fauna monitoring project was set up as part of the project: alongside the contributions from the citizen scientists, six camera traps were installed. Local schools and other associations were responsible for operating the camera traps, encouraging the active participation of local people.

Design of innovative learning environments in the context of developing a Citizen Observatory

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Citizen science promotes the public participation in the collection of large quantities of observations of a varied nature (the identification of new stars and comets, the detection of cancer cells or the presence of invasive species, to name some examples). Some citizen science projects have a notable success in the advancement of scientific knowledge and the contributions of volunteers are providing a lot of data in different scientific disciplines.

Citizen observatories are technological platforms where people can participate in citizen science projects. These new observatories integrate the latest information technology and communication tools (web portals, social networks, applications and gadgets for smartphones and tablets) to digitally connect citizens. They improve the capacities of observation and facilitate the flow of information. Citizen observatories offer a huge potential as a learning experience and, specifically, for the acquisition of the "21st century competencies", taking into account the opportunities for participation of people from different levels and roles: "makers" will develop new tools, "observers" will participate in data collection using conventional tools or those developed by the "makers", and "analysers" will focus on validating and analysing the data reported by the "observers". The need of this collaborative schema becomes especially evident when we focus on the complexity of the challenges that education must face today in the context of a knowledge society such as ours.

The main objective of this contribution is to analyse and design new methodologies and educational projects around the concept of citizen observatories as an innovative learning environment.

This work is illustrated with a case study in which some educational activities focusing on citizen observatories for the study of aquatic ecosystems are explained, using and expanding the initial results of the FP7 Project Citclops (www.citclops.eu)

Citizens' Observatories in coastal environments: using innovative technologies
(DIY instruments and data sonification) for engaging volunteers.

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In recent years the promotion of monitoring marine ecosystems based on Citizen Observatory's data has provided environmental data with unprecedented resolution and coverage, with the additional advantage to engage people by raising awareness and knowledge of marine environmental problems. One of the critical parameter to assess the environmental status of water bodies is the transparency of the water as it is strongly affected by different water quality related components (such as phytoplankton,

organic matter and sediment concentrations). Within the context of the CITCLOPS project (www.citclops.eu), a Do-It-Yourself (DIY) instrument was developed to monitor changes on water transparency as a water quality indicator. The instrument, named KdUINO, is based on quasi-digital sensors controlled by an open-hardware platform with an Arduino board. The sensors measure the light irradiance at different depths and the instrument automatically calculates the light diffuse attenuation Kd coefficient to quantify the water transparency. The buoy construction is an ideal activity for creative STEAM (Science, Technology, Engineering, Arts and Mathematics) programming. Several workshops in high schools have been done to show the students how to construct their own buoys, and some of them used the buoy to develop their own scientific experiments. In order to engage students more motivated in artistic disciplines, the research group also developed a sonification system that allows creating music and graphics using KdUINO measurements as input data.

Citizen science as a tool for biodiversity monitoring and surveillance: an assessment of patterns in participation

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Citizen science is an ideal way to undertake monitoring of biodiversity, especially for detecting rare events (e.g. invasive species, animal and plant health issues or presence of rare species). At best, through this citizen science, people can be primed and ready to detect across large spatial extents and over long time periods. However, we need to better understand patterns of people's participation in order to effectively use citizen science as a tool for monitoring and surveillance. We consider a range of projects monitoring biodiversity in the UK, from simple mass participation to monitoring by volunteer experts, and quantify the patterns of participation (in terms of retention of participants, spatial patterns of participation, and unevenness of contributions per participant - as in the 90:10 rule). Understanding the spatial (and temporal) coverage of participants is vital when interpreting the data (is a lack of records due to a lack of observers or the absence of the species?) but this is often overlooked. We use this quantitative analysis to provide an evidence base to describe how different citizen science approaches are relevant in different circumstances. We also raise the issue of conflict motivations of participants and project organisers, e.g. providing early detection of pests (for the good of society) versus local negative impacts due to control measures. These issues of patchy coverage and clashing motivations can easily be overlooked by scientists and policy-makers. They highlight the importance of thoughtful enthusiasm (in contrast to uncritical zeal) on the role of citizen science in environmental and ecological monitoring.

Citizen Science and Gamification: Setting the Scene

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To set the stage for this workshop, we briefly examine key themes from the human-computer interaction (HCI) literature that are of relevance to gamification in citizen science [4, 2]. The aim of gamification is to use of game features, such as points and badges, to make non game-activities more fun than they would otherwise be [2]. Researchers including [5] have pointed to citizen science as an opportunity for gamification, noting "motivations driven by interest in technology and rewards, such as online gaming badge and competitions" could support volunteer motivation and retention." Similarly, [9] demonstrated that games can support engagement "by allowing volunteers to participate in a range of social interactions and through enabling meaningful recognition of achievements."

However, when gamification is used in citizen science, such motivators must be balanced with the need for relevant scientific outcomes [7]. A brief review of the literature reveals that the use of gamification in citizen science has raised both enthusiasm and criticism. Some critics question the normative desirability of using games in science and warn against the suggestion of the power-solving potential of internet-facilitated game-like crowdsourcing. Specifically, [3] argued that this "crowdsourcing model of research has the potential to cause harm to participants, manipulates the participant into continued participation, and uses participants as experimental subjects." Of those who advocate and employ games in science, some found that crowdsourced image analysis application can be fruitful [e.g., 6, explores a case of crowdsourced game-based analysis system for quantifying malaria parasites in digitized images of thick blood smears]. Another recent study of two purposeful games for citizen science, [8] found that different reward systems and gamification approaches can influence player recruitment and retention, as well as the way players experience these games, but that these modalities need not adversely impact data quality.

What the Hell are Science Shops? Where do Science Shops, Citizen Science and RRI link

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Science shops have a long tradition, starting from the Netherlands in the 1980ths; either university based or independent they have a lot of experience in community based research and involvement of civil society in research. They are seismographs for societal eruptions and stimulate scientists to engage themselves on matters of pressing environmental and social concern in collaborations with civil society actors. It is their aim to improve the dialogue between science and society on equal footing; their concept goes beyond transdisciplinary research. It intends mutual learning, civil learning and public participation.

Although there is no common definition of citizen science we assume an overlap with science shops: Science can learn from citizens (mutual learning) and the scientific education can profit (service learning).

Transparency and participation are two elements of responsible research and innovation (RRI), which is one of the overall themes of the EU Horizon 2020 programme. – And also here we assume an overlap between RRI and the work of science shops.

Science shops, Citizens Science and RRI are three topics – different but interlinked. All three aim on the collaboration of science with citizens. Each of the concepts has his certain focus and place in the dialogue between science and society.

Science shops reflected and improved their work in several European funded projects, starting with Interacts in 2002 up to now. On international level science shops work together in the Living Knowledge network. WISSNET is a network of north-east German Science shops.

Using this experience and results we want to discuss with the audience the links, differing aspects and potential synergies between CS, RRI and Science shop work.

WISSNET – Verbund Nord- und Ostdeutscher Wissenschaftsläden http://www.wissnet.de/wer-wir-sind/

Living Knowledge – The International Science Shop Network http://www.livingknowledge.org/

Saving the bees through ancient knowledge

Egle Marija Ramanauskaite

Human Computation Institute / Technarium, LT

Bees hold an important status in Lithuanian ethnoculture to this day, including their sacred status and idealization in everyday discourse, and the ritualization of beekeeping practices. As it is often a family-run trade, both the bees and the knowledge of beekeeping tend to be transferred from generation to generation. Perhaps this is why the local beekeepers continue to use ancient "tricks", e.g. only opening the hives at specific times, keeping them at a particular altitude etc. While most of such local knowledge may be dismissed as superstition, some of it could contribute to the relatively high rate of bee survival in the country.

Public participation in scientific research (PPSR) has the potential to extract the rich local knowledge of beekeeping in Lithuania and study the impact of relevant practices in preventing rapid bee population decline. Moreover, introducing local beekeepers to global citizen science (CS) and DIY communities would empower them to further learn from their peers, and implement simple DIY tools in monitoring their own hives.

Planned as an interdisciplinary PhD, the project would consist of four key objectives: 1) create a platform to share local practices & link the data to existing CS projects on sustainable agriculture; 2) suggest applicable DIY tools and encourage beekeepers to monitor and contribute population data; 3) cross the data to evaluate the effect of specific practices; 4) describe the phenomenon of cultural knowledge transmission in the context of beekeeping, and its relevance in modern beekeeping practices.

Approaching the problem via combined biological and sociological methodologies could help us gather unique knowledge on worldwide bee population decline, and unveil the most helpful practices for beekeepers today. Moreover, the platform could become a self-sustaining incubator for peer learning and global monitoring of bee populations, based on continued maintenance by dedicated citizen scientists and DIY beekeepers.

Citizen Science and biohacking: a powerful combination in STEM

Egle Marija Ramanauskaite

Human Computation Institute / Technarium, LT

Citizen Science (CS) and hacker movements are gaining speed worldwide, yet despite overlaps in philosophy, are rarely practiced together. Importantly though, many schools and communities now often have simple lab setups that could help take CS participation further, and the synergy could be leveraged both for the sake of the science and the education of participants.

Presented here is an ongoing project for National Academy of Students in Lithuania, combining elements of CS and biohacking to assess the biosynthetic diversity of local lichens. By taking advantage of local biohacking / DIYbio labs the students have the opportunity to and carry out own experiments, deepening STEM skills in the process.

Lichens are diverse in nature, and have been suggested as rich sources of new natural products. Yet they are poorly researched due to specific growing conditions, inability to propagate in the lab, lack of optimal large scale protocols etc.

Being "in many places at once", students are able to collect diverse samples of lichens via EpiCollect+ app, entering the basic details, geotagging and taking a picture of each sample. Lichens are then lysed and DNA extracted using tools from Technarium BioLab in Vilnius. PCR with primers for biosynthetic molecules (e.g., PKS) and electrophoresis are then carried out in local schools or the BioLab. Since the experiments are carried out at the leisure of participants, and each deals with a relative low number of samples, simple protocols yield sufficient results.

In such a way, the student citizen scientists are starting to explore a problematic, yet promising areal of natural products, gaining both biological and technical knowledge in the process. A similar approach could be useful in a different types of CS as well, including environmental, biodiversity research, invasive species monitoring, sustainable agriculture and others.

"Citizen Tongues" – enriching the spoken languages of Citizen Science

Egle Marija Ramanauskaite

Human Computation Institute / Technarium, LT

Citizen Science (CS) creates ample opportunities to practice and learn about science, and is often open to the worldwide public, particularly in case of online CS. Unfortunately, most projects have their roots in the English-speaking world, and use English as their main language. Depending on the country of origin and/or initiative of project owners, some may be translated into one or two foreign languages (e.g. French and Spanish), or use Google translate add-on on their websites. While this improves accessibility to an extent, more could be done to ensure non-English speaking audience can participate in CS effectively. Moreover, removing the language barriers to participation might help to introduce the concept of CS to populations that are not well aware of it, particularly is less developed countries and/or where less popular languages are spoken.

"Citizen Tongues" is a conceptual idea of a one go-to platform for project owners, citizen translators and the global community of citizen scientists, that would catalogue and crowdsource translation of CS projects. The project would have three main objectives: 1) develop a platform for microtasking project translation, i.e. documentation and webpage content uploaded by project owners and/ or volunteers; 2) define recommendations for CS project design, which would allow new content to be compatible with translation microtasking (e.g. recorded on a standard spreadsheet); 3) create a gamified interface to facilitate translation and popularization of CS worldwide (e.g. badges for translated content, published articles or posts, events organized in one's native language etc.).

Ideally, the project will go ahead via the effort of volunteers and/or facilitated by crowdfunding. It is presented here to begin recruiting volunteers and hackers who could kick-off the development of the interface and microtasking algorithm, help establish the workflow for mining existing CS project content etc.

Saving crops and catching falling stars – citizen science in Western Australia

Jay Ridgewell, Gina Pearse

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Agriculture and planetary science in Western Australia are benefiting directly from public participation. School students are increasing the reach of fungi-fighting science in Mildew Mania and with Fireballs in the Sky star gazers are building a world-best database of fireball orbits in two unique citizen science programs.

Mildew Mania is an agricultural citizen science project for schools. It is a state-wide science experiment where students grow barley to "catch" powdery mildew at their school and send samples to researchers for further investigation.

Researcher Dr Nola D'Souza said the samples played an important role in staying on top of powdery mildew. "We've received samples from all over the state, which means we are getting a much better cross-section of what's actually out there. We can now watch for the development of new pathotypes, as well as ensuring resistant barley varieties retain their resistance," Dr D'Souza said. A regional school science specialist says that Mildew Mania "... Added a relevant context to what we were learning about in science and allowed the students to participate in something bigger than just at the school level".

Fireballs in the Sky is a unique outreach project fronted by an award-winning smart phone app enabling fireball sightings the world over to be recorded and analysed. The app uses augmented reality technology, magnetometers, accelerometers and gyroscopes inherent in smartphones to provide the most accurate and easy to report fireball sightings in the world.

In March 2015 a rare daytime fireball burned over Perth city during the morning rush hour, sparking huge community data input. This led to accurate triangulation of the fireball's path. "It's fantastic to be able to share the excitement of planetary research with the community, we all get results, and a real kick out of it!" says Professor Phil Bland.

A Review of Citizen Science in Irish Schools

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Science Education in Ireland is facing a period of dramatic change due to long-overdue curriculum reform as well as recent policy changes in science funding and technology in schools. As scientists and science teachers attempt to cope with the increasing pressures of being expected to drive economic growth and innovation, citizen science represents one of the most logical routes for scientists and science teachers to work together towards shared goals. Although there is no national policy on citizen science yet, a number of initiatives have started to gather momentum that could highlight the need for citizen science to be given due consideration in the current curriculum reforms. We will present the initial findings of a national review of the role of citizen in Ireland with a view to assessing the readiness of schools to take part in large-scale citizen science projects. Case studies of smaller scale citizen science projects in Ireland will be highlighted. This research is funded by the Irish Research Council New Foundations scheme.

Listen, share and learn - school teamwork for nature observations with PlutoF platform

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Direct nature observation is one of the simplest ways for citizen scientist to engage in research. This method is also easy to apply when combining outdoor activities and traditional teaching in schools. Applying citizen science approach for school settings can be beneficial both for science and education.

University of Tartu Natural History Museum (UT NHM) has developed an online biodiversity data management platform called PlutoF (http://plutof.ut.ee), which will make it easy to record, manage and share observations. Scope of PlutoF is not limited to the observations - it has mass of features for annotating and linking biodiversity data including specimens, references, DNA sequences and much more. For regular user the platform incorporates a workbench for working with data and also for organizing projects and workgroups. One of the latest developments and contribution to the FP7-funded EU project EUBON is the citizen science module. This a dedicated tool for managing citizen science projects.

In 2015 UT NHM together with Estonian Natural History Museum launched a mobile application called "Minu loodusheli" (My naturesound). The application, running both on Android devices and Apple mobile devices, allows to record and report personal nature observations with added feature of sound recording, rarely used in observation applications. Sound recordings of animals make it easy to verify taxon identification and allows also to report taxa which are unfamiliar to the observer.

The application is integrated with PlutoF platform and its citizen science module. For teachers this is an opportunity to create their own class projects, follow individual participants, give feedback, and visualize results. Additional benefit is the possibility to engage experts via PlutoF user network to help validate observations and identify bird, frog or insect species by listening to the submitted sound recordings.

'Researcher in ecology for a bit': An international experience with students

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Citizen science and information communication technology are key to connect science and education, expanding ecological research frontiers and public engagement. An international experience involved European secondary school students in the Research Game project (LLP-Comenius), introduced them to the scientific method by sharing the excitement of research. The project combined theoretical activities with ICT and requested the production of practical and didactic works related to biodiversity and ecology. It comprised a two-phase competition: one, offline, required students and teachers to collaborate across Europe in producing research works that applied the scientific method; the other, online, involved the participants in a serious game competition. A moodle platform (www.researchgame.eu/platfrom), the focus of all activities, constituted both the game-based platform and the social community. Students were asked to build hypotheses, carry out research work, test the validity of their hypotheses and finalize a findings-based theory. Thereafter, organized in teams, they synthetized their research activities in papers, presentations or videos, and shared their findings with other teams, making comparisons and exchanging information. Over 400 students from 8 countries participated in the project. One of the 70 products about their biodiversity research experiences concerns the Presidency of the Italian Republic Castelporziano Estate, a natural reserve where a school tested whether pollution or other anthropic impacts affect the ecological system. Analysis of meteo-climatic and air-water pollutants data revealed adverse effects due to the vicinity of Rome and major roads.

The enthusiastic feedback from students and teachers proves the success of Research Game as experience in the use of informal educative approaches for teaching the scientific method. Importantly, all the material and the serious game can be played on the platform or downloaded, becoming a tool for interactive learning sessions, that can be used in the framework of curricular activities, independently from the competition dimension.

Citizen Science and learning: formal, informal or at scale?

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Citizen science involves the public in different types of collaboration with scientists. The growth of this activity has consequences for the way in which science is carried out. It also has a potential impact on what, and how, citizen scientists learn about science. This paper reflects on the links between formal and informal learning, the growth of such learning opportunities and the approaches that have been taken to crossover from science to learning.

Citizen science learning is a manner that resonates with the learning seen in Massive Open Online Courses (see McAndrew and Scanlon, 2013.). There cohorts are brought together, encouraged to carry out structured activities, and achieve assessed tasks. Citizen science also brings people together and they work towards a shared mission, and gather or analyse data as part of a scientific enquiry. For the volunteer citizen scientists [Rotman et al.,2011] found that a motivation for many was to increase their scientific knowledge, i.e. participation was seen as a learning activity.

Participants take part in a form of crowd learning, defined in [Sharples et al., 2013] as the process of learning from the expertise and opinions of others, shared through online social spaces, websites, and activities (p20). With careful design the learning experiences can be built into the citizen science. For example (Silvertown et al., 2015) describe iSpot where the task to observe (spot) organisms is structured as a step towards learning more about them and engaging with observation as a learning process.

The multiple purposes of citizen science activities makes a complex and rich setting in which to study learning at scale. As with MOOCs this requires further tracking of journeys between formal and informal learning, identifying persistent concepts that help encourage and identify learning that can act as an explicit motivator in developing citizen science.

Data management practices in Citizen Science projects – results from a survey

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The management of citizen-collected data is perceived as a major barrier to the re-usability and integration of these contributions across borders. During the summer of 2015, we investigated this assumption with a survey that addressed Citizen Science projects world-wide. The questionnaire covered major data management principles related to data discoverability, accessibility, usability, preservation and re-use conditions. Among other findings, the 121 responses clearly underlined the diversity of projects in terms of topicality, funding mechanisms and geographic coverage, but also provided valuable insights related to the access and re-use conditions of project results. While, for example, 60% of the participating projects follow a dedicated data management plan and a majority of projects provides access to raw or aggregated data, the exact use conditions are not always put into place or miss well-defined licenses. Apart from replies from all across the globe, this activity also helped us to connect to the relevant players. Discussions on data management in support of Citizen Science could already be initiated with representatives of the European, American and Australian Citizen Science associations. This talk/poster will stimulate further debate by presenting central outcomes of the survey and highlighting essential areas that require action or further examination. We will also provide references to the full survey report, the anonymized raw data that was collected via the survey, as well as the script that we used as part of our analysis.

Open Source Based Sensor Platform for Mobile Environmental Monitoring and Data Acquisition

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The desire to obtain a better understanding of ecosystems and process dynamics in nature accentuates the need for observing these processes in higher temporal and spatial resolutions. Especially with regard to the process dynamics and heterogeneity of urban areas, a comprehensive monitoring of these effects remains to be a challenging issue.

Open source based electronics and cost-effective sensors are offering a promising approach to explore new possibilities for environmental monitoring. Our project aims the development of new strategies for mobile data acquisition and real-time processing of user-specific environmental data, based on a holistic and integrated process. To this end, the concept of our monitoring system covers the data collection, data processing and data integration as well as the data provision within one infrastructure.

In technical terms, our monitoring system consists of mobile sensor devices, which can be controlled and managed by a smart phone app (Android). At the moment, the system is able to acquire temperature and humidity in space (GPS) and time (real-time clock) as a built in function. In addition, larger system functionality can be accomplished by adding further sensors for the detection of e.g. fine dust, methane or dissolved organic compounds.

In September 2015, an initial city monitoring campaign based on the mobile monitoring platform was performed by five independently driving cyclists through the city center of Leipzig (Germany). As a result we were able to instantly show a heat and humidity map of the inner city center as well as an exposure map for each cyclist. This emphasizes the feasibility and high potential of open source based monitoring approaches for future research in the field of urban area monitoring in general, citizen science or the validation of remote sensing data.

One Picture Post is Worth A Thousand Pictures: OR How Can Outdoor Digital Photographers Become Citizen Scientists Locally and Join in an Environmental Monitoring Network

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Improvements in technology, network bandwidth and access to WiFi, plus the excitement that surrounds using mobile devices for environmental monitoring, have opened up unprecedented possibilities for supporting environmental science and stewardship activities among learning environments and citizen scientists. With cameras and smart phones, people are collecting meaningful information about the well-being of their communities as part of an effort to understand local effects of global climate change. Participants take repeat digital photographs of the landscape from a fixed platform, the Picture Post, and create a visual record in time and space. As most people do not consider their digital cameras as scientific tools, this is a valuable starting point for thinking

about how the camera and other mobile devices can be used to collect data, make measurements in the field, and communicate stories and findings to others.

This paper will demonstrate technology enhancements to Picture Post made in collaboration with the US National Park Service. New features engage park visitors and returning users in making and sharing observations of change by improving the registration process and allowing photo uploads directly from mobile devices. Additional features allow the post sponsor, such as a National Park, to directly connect picture post activity with their program's webpage or social media site. Web-enabled content has distinct advantages over traditional print and video media, in that it enables the two-way flow of information. People in the field can now make observations, upload data, receive information, and interact with others. These features take advantage of expanding WiFi capability, while also supporting Picture Posts in remote locations that are not yet internet-connected.

Next steps are to create web tools for time-series analysis of photos. The Greenness Index indicator of climate change will be demonstrated as an example of how a Picture Post is worth 1000 pictures.

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brot.socientize.eu - a citizen science tool for mapping cultural concepts

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In this case study we look at five different varieties of bread (Weißbrot/white bread, Mischbrot/"mixed bread", Graubrot/"grey bread", Schwarzbrot/"dark/black bread", Vollkornbrot/"whole wheat bread") and their particular regional connected concepts (type of flour, shape, colour, …). In the German speaking areas (Austria, Germany and Switzerland) the concepts of the different types of bread vary greatly among speakers, and the words naming the same types of bread may even be used interchangeably (e.g., Mischbrot/Graubrot; Graubrot/Schwarzbrot).

By means of the citizen science tool PyBossa delivered by the Socientize project, we evaluate the distribution of the terms across the German speaking areas. A set of preselected words describing the types of bread can be matched with each of the five types, and the citizens can also add their own descriptions. As a second step, participants click on a set of pictures which they associate with a specific type of bread.

Socientize is the project funded by the European Commission which delivered the White Paper on Citizen Science. In addition to the community-based policy recommendations, Socientize deployed several citizen science experiments including CellSpotting, MindPaths, Sun4All or the CollectiveMusicExperiment among others. Socientize instantiated the open source platform PyBossa developed by Crowdcrafting. Currently, Socientize is maintained by the Ibercivis Foundation and this project is the first project in this new phase for the platform.

A pilot study is in the process of being conducted until mid May. The survey can be accessed at the following link: http://brot.socientize.eu

Here we demonstrate the tool and present the results of the pilot study.

"I try to work with these people" - learning from scientists' citizen science stories

Jennifer Shirk
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Stories are a uniquely human way of making sense of the world, a natural and powerful currency of communication. People irrepressibly turn to stories to be understood, describe the unseen, and frame what is significant. But storytelling isn't frivolous. StoryCorps founder Dave Isay has reflected that over his decades of work, regardless of the time or place, when people take the time to tell a story, "they talk about the things that matter."

In this session, I'll channel several scientists who have shared with me their stories about "the things that matter" in their citizen science work. I have turned to stories – narratives – as part of a research effort to explore how scientists are able to make citizen science a meaningful part of their careers in conservation research. Too often we oversimplify our understandings and expectations of professionals. Stories reveal scientists who are moving beyond what we often expect of them as technical experts, and show individuals stepping into additional, publicly-engaged roles. I'll share stories of scientists engaging diverse values, listening and responding, and facilitating learning and action – conducting integrated, relational work.

Most of all, these stories reveal moments of science that are funny, touching, unexpected – human. Together, we will consider

how these insights from individuals can enrich, complicate, and challenge societal understandings of how scientists can address complex problems, as well as the opportunities of citizen science to make a space for humanity in research.

Let´s talk about bread and much more

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The current case study "Brotzeit" (2015-2016, sponsored as a Sparkling Science project by BMWFW/Austria) focuses on the cultural sustainability and the manifold agricultural and manual practices of the cultivation and processing of grains and the production of bread. The goal of the project is the analysis, protection and documentation of local knowledge and practice related to the immaterial cultural heritage of "Lesachtal Bread". The Citizen Science project is organized along with institutes of higher education (students in the age of 10 to 20 years working together), local associations (charities, community) and individual persons in the region Lesachtal/Austria.

The project idea comes from a ten year old student, the research question and the project design were formed from the different perspectives and interests of the involved partners. Data generation, evalation und the transfer in products (performances as well as media products as an app, an animated movie…) takes place together.

The collaboration allows the intergenerational transfer of know-how and direct inclusion of students in traditional practices concerning bread.

Living traditions change in quotidian action, integrating the new and the foreign, altering with living situations – these traditions are thereby shaped anew again and again.

This dynamic process of transfer and application of local knowledge and practice, as well as the meaning of these living traditions for the local community, lies at the center of the research focus. The reflection of intergenerational encounters with local cultural heritage requires a manifold process of communication and interaction; it culminates in the individual and collective learning experiences of the participants.

See the research diary of the students: www.lesachtalerbrot.wordpress.com

Mobile Apps in Environmental Education and Citizen Science –
Good Investment or a Waste of Time?

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In the past few years citizen science activities have become supported increasingly by digital tools. In various projects mobile applications are used to communicate to potential volunteers and to guide them in their action. Mobile devices seem to be perfectly suitable for environmental education and citizen science because of their ubiquity, capabilities and personalization options. But Typhina (2015) shows environmental applications rarely "create a uniquely mobile learning experience that is unlike learning from a book, in-person presentation, or website". We think the choice to use an app shall be considered thoughtfully.

Depending on the intention of the project, the motivation of the potential user, the context of use and the form of interaction different communication tools adress the needs and targets of the projects and its target audience best.

Therefore we propose an easily comprehensible decision tool on how to choose the right medium for communicating the project targets and interact with volunteers.

On the example of the development of the application "Naturblick", we show which questions arise and how they can be answered, when developing and communicating an app in a collaborative environmental education and citizen science project .

For more information: http://stadtnatur.naturkundemuseum-berlin.de/ (only in German)

Participants' motivations in a citizen science project: a Portuguese case-study.

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Citizen Science, as the general public involvement in scientific research activities, has recently become a mainstream approach to collect data for different scientific studies. Researchers realized that citizens involved directly in their research rapidly increased their scientific literacy and interest in science. Citizen science has been thus recognized not only as a methodological tool for a given research experiment, but also as an education and outreach tool for researchers. Yet, participation levels on citizen science studies are very different across countries and projects; existing little information about what determines citizen's participation and motivation. Here, we wanted to understand citizens' intrinsic motivation (IM) to participate on a biodiversity-related citizen science project – www.biodiversity4all.org, a Portuguese nationwide project – which represents the motivation to engage in an activity purely for the sake of the activity itself.

The online survey asked about Interest/Enjoyment, Perceived Competence, Effort/Importance, Perceived Choice, Value/Usefulness, Relatedness and Group Relatedness, to evaluate intrinsic motivation for being involved and participating in the project and the way people participate. We also want to know what improvements can increase participation.

A total of 149 answers were obtained, being most participants with higher education (83%). Relatedness was one of the highest subscales, people valued the feeling of relationship with the project, while the Effort/Importance was the subscale less important. People who participate more have the highest levels of Perceived Competence.

Citizen science projects use many tools to induce citizens' participation, as incentives, certificates of recognition and challenges, which can stimulate people's interest in the project. Nevertheless, these mechanisms should recognize the different potential motivations. Other values and emotional responses are needed by participants to support and maintain their involvement in a citizen science project after their initial participation, which is particularly important for the project's long-term sustainability.

Modelling species distributions with citizen science data - benefits and limitations

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Conservation biology and biodiversity monitoring programs can greatly benefit from citizen science initiatives. In particular, species occurrence records by citizen scientists could allow filling information gaps on geographical ranges once the number of citizen science projects collecting opportunistic records of species occurrences are increasing throughout the world. However, there are concerns about data reliability and temporal and spatial biases.

In this work, we address the question of whether species records in opportunistic citizen science projects can improve existing knowledge on species geographical ranges. This is done by comparing the observed climatic niche using data from an opportunistic citizen science project in Portugal (www.biodiversity4all.org) and a scientific data set having the same area and taxonomic coverage. The climatic niche of each species for the two sources was delimited by means of a convex-hull enclosing the species occurrences in a standardized bi-dimensional climate space. We calculated the percentage of the climatic niche width of the scientific Atlas that was captured by opportunistic citizen science data. We also collected a set of variables plausibly explaining the differences found. The percentage of the climatic niche that was captured differed markedly among species. About one third of the species had more than 50% of its known climate niche captured by BioDiversity4All data. Generalized linear mixed models relating explanatory variables and variation in the percentage of climatic niche captured by the opportunistic data revealed that species with wider distribution ranges and making use of forest habitats were better surveyed opportunistically.

We conclude that data collected in citizen science opportunistic projects can provide valuable data for the understanding of species environmental requirements, ultimately aiding in the determination of their geographical ranges. However, the comprehensiveness of the data collection is strongly taxa dependent. We identified a few species-related factors associated with a better/worst opportunistic sampling.

Local stakeholder contributions to the Red-listing of Europe's medicinal and vascular plants

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The IUCN Red List of Threatened Species™ is arguably the most widely recognised tool for assessing the global conservation status of species and plays a central role in decision-making in conservation. It represents an authoritative list, thereby inevitably influencing access to natural resources by local stakeholders. This raises questions about the extent and right of local stakeholder participation in conservation initiatives and policy processes that affect them. In order to obtain an understanding of how local stakeholders enter the Red List process and to evaluate their contribution to conservation assessments, the recently elaborated Red Lists of European Medicinal and Vascular Plants are taken as case studies. Experts contributing specifically to these Lists are asked about the contribution of three groups of local stakeholders to the Red Lists (local resource users, resident professionals and citizen scientists) by means of semi-structured interviews and an e-mail survey. Ninety-four percent of respondents (n=93) consulted some group of local stakeholders either directly (through interviews or participating in assessment workshops), or indirectly (by using literature based on local knowledge). Resident professionals were the most consulted group, providing important information on all aspects of the Red List. Local resource users and citizen scientists played a minor role in providing data, except for information regarding plant use and species distribution, respectively. Despite the high reporting of local contributions, experts expressed scepticism regarding their meaningful integration, raising questions about hierarchies of knowledge and about what counts as authoritative knowledge. This has impacts on how to operationalise local knowledge in Red Lists and other conservation assessments.

Crowd Science from Coast to Coast

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Extreme sea levels are a major threat to coastal communities and associated risks are expected to become more severe in a warming climate. Despite the importance to adapt coastal zones to increasing sea levels, decisions on the implementation of adaptation measures are often hindered by the severe lack of information on coastal physical characteristics. Though images of coasts can provide this information and exist in abundance in a digital world, they are scattered, subject to copyright and require individual analysis. To address this barrier and the magnitude in numbers, we are currently developing an online platform that streamlines the process of collecting and analyzing digital images of coasts with the help of citizen scientists worldwide. The acquired data will support the application of integrated assessment models used to assess the risks associated with rising sea levels. The results of which will inform policy makers at international and national levels regarding the implementation of adaptation measures.

Participants can remain anonymous and choose their level of involvement, ranging from uploading or analyzing images from their homes to collecting data on site. Given this low barrier to entry, the attractiveness and global nature of coasts, the trust placed in science and a global awareness of sea-level rise, we expect participation to be geographically widespread. By furthermore framing this project in terms of public accountability and governance, it serves as a case study to expand the scope of citizen science for the purpose of climate change communication, and specifically to promote climate change action.

Enhancing Community-Based Climate Resilience and Conservation in the Context of China's Western Development Drive Through Citizen Science

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Western China contains the country's (arguably the worlds) most critical yet fragile ecosystems and is the headwaters for fresh drinking water for over 1 billion people. Local indigenous communities have long been marginalized in the process of economic development and conservation planning, and are therefore the most vulnerable groups when facing the challenges of climate change and ecological degradation. In addition, there is little connection between government policies and what is actually happening on the ground in terms of climate change impacts, because government data systems all use top-down approaches. The Global Environment Institute in collaboration with the Commons Lab at the Wilson Center plan to create a citizen science data system which will be a bottom-up information system that collects and analyzes climate change and livelihoods related data at community level to assess on-the-ground actual impacts of climate change on people's livelihoods and biodiversity. The system will form a database network, which can draw comparisons between or among different villages, areas or regions to inform climate

adaptation and conservation policies and shift the current "one size fits all policy-making approach." In addition, the project will also explore a new concept of ecosystem services-based economy which will include allocation of government funding based on conservation proposals with sound monitoring and evaluation mechanisms to assess actual eco-services.

Excreta: Citizen Science on a borderline subject

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Using an exhibition on the biology of the different kinds of excreta in the living and fossil organisms and its representation in society, arts and the humanities, shown in Madrid and presently in Sevilla, visitors were asked to answer a survey on their personal excreta habits.

The survey, based on another carried out by Paul Spinrad in 1996 in San Francisco (USA), was divided into four section: nose hygiene, urinating, defecate and gas.

Analysis of answers convey different kinds of information: a) factual information on the 'rituals' and customs regarding or own excreta; categories of excreta where reticence to tell about habits that are considered private is more common; information of what is considered jokingly and, those that some consider should be subsumed into the unmentionable.

Our communication offers a brief overview of the content of our exhibit and a summary of the public answer variation to the survey by gender, age and omissions.

IBEIS & Wildbook: Computer-assisted identification of crowd-sourced wildlife imagery

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Citizen science can greatly increase the volume of data for wildlife studies and support more detailed analyses, but only if data can be successfully integrated into structured studies and data processing can scale correspondingly. We present IBEIS (Image Based Ecological Information System), an open-source software system for collecting and organizing wildlife data, focusing on imagery as a primary source. Incorporating computer vision techniques, machine learning, and species-specific matching algorithms, IBEIS aides in processing large volumes of crowd-sourced wildlife photos into usable biological data. IBEIS is the core technology behind the recent citizen science project, the Great Grevy's Rally in Kenya, where 120 distributed teams attempted to photograph the Kenyan Grevy's zebra population (99% of the world's Grevy's) to perform the first complete census of this endangered animal. Wildbook, the data management layer of the IBEIS system, has a long history supporting crowd-sourced photo identification projects, such as MantaMatcher and Wildbook for Whale Sharks, which also use computer-assisted photo identification to match individual animals in photos submitted by the public. IBEIS and Wildbook represent a flexible, reusable, and modern architecture for sophisticated wildlife research using crowd-sourced data, computer vision, and machine learning.

Science in public libraries: The Library Living Lab

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This contribution describes the case study of the The Library Living Lab (L3), an open, participatory, experimentation and co-creation space, situated in the public library "Miquel Batllori", Sant Cugat del Vallès, Barcelona, Spain.

The activity in the Library Living Lab calls into question the role of public spaces such as libraries, and proposes the innovation in services as a participative task joined by library users. Among the activities scheduled in the Library Living Lab there is a regular series of experiences which bring together users and scientists in the discussion and development of on-going scientific projects and the implementation of scientific experiments.

We analyse the impact of such experiences from 3 different perspectives:

1) The methodology used for science communication and user engagement.

2) The process of definition of the returns that the participation on the scientific experiments and activities must have in the community of participants.

3) The potentiality of novel ways of funding for science that the model of the Library Living Lab allows.

We will describe and discuss different types of challenges that arise when ALL the stakeholders (administration, research organizations, companies and users) are gathered around a common scientific project in public spaces. These open challenges will be contextualised in the specific mission of L3, which is to explore how science and technology can transform the experience of users by enabling new experiences, services and applications in the cultural domain. The role of technology as enabling factor will be discussed and a number of activities prototyped at the Library Living Lab will be presented.

Smart Emission: A citizen-sensor network in the city of Nijmegen, connecting low-cost sensors, Open Data and citizen questions aimed at doing fine-grained, collective urban sense-making from the ground up

Linda Carton[1], Hester Volten[2], Cécile Kerssemakers[1], Michel Grothe[3], Peter Ache[1], Sietske Veenman[1], Paul Geurts[4,] Henk Nijhuis[4], Janus Hoeks[5], Robert Kieboom[6], Just van den Broecke[7], Peter van der Voorn[4], Giel Vermeulen[8], Matthijs Kastelijns[9], Bas de Greef[5], Antoine van de Crussen[5], Freek Thuis[1], Ron Wunderink[1], 35 citizen scientists in the city of Nijmegen, DE
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[4]City of Nijmegen, NL
[5]Intemo, NL
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[7]Geonovum and Just Objects, NL
[8]HAS Den Bosch, DE
[9]TU Delft, NL

This paper presents the project Smart Emission, a current research project executed by a consortium of Dutch knowledge institutes, government, (ICT- and sensor) companies together with citizens in the city of Nijmegen. In this project, an innovative set of low-cost outdoor sensors and related Open Geo Data infrastructure is being developed. The objective is to monitor, visualize and communicate a real-time, fine-grained 'environmental footprint' of the city. Simultaneously, a participatory process is organized to collaborate with citizens and consortium professionals with the shared purpose of 'collective sense-making'. The future vision is to combine bottom-up and top-down communication and governance for the purpose of increasing urban health. The project consortium aims to innovate and learn about low-cost sensors, shared citizen science in an urban setting, and Open Data applications through standardizing the data models and dataflow (according to Inspire and OGC standards). Research questions: Can we investigate citizen's questions, called 'use cases', about urban pressures with help of the cost-effective organizational-technical setup of a citizen-sensor-network? Can citizens together with (air, noise, data) experts make sense out of the sensor data, and for what purpose is the sensor data applicable? Can the big data collection be aggregated to form an accurate 'big picture' of the urban environmental footprint? On March 1st 2016, the second 'Smart Emission citizen participants' meeting has been held. At that time, 24 sensors have been installed at people's houses and gardens, and pilot-version viewers have been developed (see http://smartemission.nl/smartapp/ and http://smartemission.nl/heron/). While the sensor-network is being extended and technical bottlenecks are being resolved, the first data streams are being calibrated and analysed --by citizens and professional analysts. At the ECSA conference, we will present the first findings. We hope to learn about similar citizen-sensor-network projects in (European) cities.

"On the wings of knowledge":
a Citizen Science Project as a case study of public participation in entomological research

Alessio Vovlas, Daniela Clemente, Enrico Altini
A.P.S. Polyxena, IT

In this work we discuss the conception, the set-up, the development and the preliminary results of "On the wings of knowledge" citizen science program as an example of public participation in butterfly conservation, started in Puglia (South Italy) in 2011. We recruited and trained volunteers to provide a preliminary inventory of butterfly community occurring in the Riserva Naturale Orientata "Laghi di Conversano e Gravina di Monsignore" protected area. This volunteer-based project aims to acquire data at local scale resolution and detect any natural or anthropogenic environmental changes. Volunteers acquire new learning and skills, and are involved in collecting and analysing scientific data directly in field with the researchers. Our results emphasize the

high natural values of this area of south-eastern Apulia, where 38 species of butterflies belonging to five families were recorded during the study and Zerynthia cassandra is probably the most important species occurring in the area. The adults' mobility of Z. cassandra have been also studied by volunteers, with the aim of integrating autoecological information on dispersal capacity of this species into recommendations for future habitat management of this species. This approach can promote the participation of local people in monitoring biodiversity and can deliver direct benefits to the ecosystem, improving knowledge on environmental threats. Results are therefore useful to suggest possible interventions to improve the management of the area and bring direct benefits to the inhabitants. Not only a citizen science, but also a science for citizens.

Mosquito mapping in Germany by the citizen science project ‚Mueckenatlas'

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To support the collection of spatiotemporal distribution data, the 'Mueckenatlas' (mosquito atlas) was launched in 2012 as a passive instrument of mosquito surveillance in Germany. This citizen science project calls upon the general public to collect and submit mosquito specimens to the research institutions involved. Details on how to participate and process captured mosquitoes are provided on the project's website (www.mueckenatlas.de). After examination of the submitted mosquitoes, these are incorporated into a voucher specimen collection, and the participants receive personal information by the scientists on the species identification, together with some biological facts on this species. On demand, the collectors' names or pseudonyms can be added to an interactive collection site map on the homepage of the project. First preliminary mosquito distribution maps are presently being generated to be put on the website as well.

Between 2012 and 2015, close to 30,000 mosquito specimens were submitted, among them several rare and newly emerging species. The 'Mueckenatlas' particularly contributed to the detection of introduction and establishment of four invasive species in Germany, with the Asian tiger mosquito Aedes albopictus and the Asian bush mosquito Aedes japonicus being potential vectors of human and animal pathogens.

The success of the 'Mueckenatlas' is attributed to the direct communication between scientists and the public at eye level. The feedback by the scientists in response to the mosquito submissions is essential for obtaining maximum output for research and education.

Nature in your backyard – which schools perform best at citizen science?

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Gardens are important habitats for many species that declined in modern agricultural landscapes. Citizens can easily observe wildlife in their gardens, while biologists may not get access to these sites. The citizen science project "Nature in your backyard – citizen science for schools" joins scientists, NGOs and government departments with 16 schools from Austria. The aim of this project is to link presence and relative abundance of hedgehogs, a set of bird and butterfly species, as well as wild bees´ activities, to garden structure and management as well as to the surrounding land use. Pupils use online or printed survey forms to gather information on garden type, management and structures as well as on wildlife observations in their school and private gardens. The scientists provide identification guides, experimental protocols and hands-on trainings of teachers and pupils at the respective garden sites. Pupils and teachers perception on project tasks and organisation were evaluated by online surveys (pupils) and interviews (teachers).

Within the first project year pupils performed 300 garden interviews, set up 77 hedgehog tracking tunnels, and observed wild bees in 54, butterflies in 83 and birds in 50 gardens. Although on-site training focused on adhering to the protocols, the minimum observation frequency and time limits were not always followed. Exiting tasks with special equipment were favoured, while online data entry was the most unpopular duty. Teachers preferred tracking hedgehogs, which was a relatively simple task yielding high data quality. The variety of animal groups was attractive for pupils but challenging for ensuring data reliability especially regarding identification skills of bird and butterfly species. Children from primary schools had the highest intrinsic motivation and collected most data. However, teacher's dedication to the project had a larger influence on data output and quality than school type or pupils´ age.

Social Science – Citizen Science?

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When talking about citizen science, projects in the wide field of Natural Sciences come to mind first. Can social science also connect to citizen scientists? Can schools be a viable ground to do so?

The project 'YouTest – Young people performing technological impact assessments' tried to approach these questions during a school year for the exemplary topic direct-to-consumer (dtc) genetic testing. In a collaboration of natural, social and political scientists, pupils from two different types of schools were accompanied and supervised in critically reflecting a new technology and forming a well-informed opinion about it. The students passed through the whole research cycle from finding research questions to presenting the results.

The main focus lay on the gaining of knowledge and competences by the students, and their finding a position towards the treated topic, which was successfully done in the course of the project as will be shown in our presentation. The students conducted a web-based media research, designed their own interview guidelines, and conducted qualitative social science interviews with experts. The interviews were then exemplarily analysed by the students, while the extensive analysis was done by the project team. Following the specific research interest of some students, a quantitative mini-survey was done amongst potential customers of dtc genetic testing. The results were presented to a wider audience of other school classes in a final event.

The project was realised in the scope of the funding scheme Sparkling Science by the (then) Austrian Federal Ministry of Science and Research, which supports the connection of science and schools. Several challenges arose during the project, especially connected to implementing the project into the school curricula. These learning experiences shall be addressed in our talk as an exchange with other citizen science projects that want to work with schools in the future.

Analysis of existing experience, results and preliminary guidelines on participatory mobility campaign patterns.

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Before the emergence of the ubiquitous smartphone-device, participatory campaigns relied on the data collection through a variety of specialized and often costly devices. Present-day transport planning still relies for a great deal on data that is collected through specialized equipment limiting data collection to specific points of time and locations in space. We carried out an analysis of existing participatory mobility campaign patterns in order to develop an application that can combine on the one hand participatory campaigns by using sensing equipment integrated within a smartphone, and on the other hand transport planning to tackle mobility-related problems. This paper aims to explore the state-of-the-art of participatory mobility campaign patterns, in order to develop the Flamenco platform, an online application which empowers civil society to compose and organize independent campaigns through participatory sensing. We demonstrate best practice and the shortcomings of current applications through case studies by looking at 1) the campaign's purpose, 2) the campaign's coordination, 3) the monitoring tools used, 4) the data representation and report to stakeholders, 5) the level of abstraction and the results obtained. Special attention goes to reporting on validation of the monitoring tools used, and representativeness of the acquired results for the intended purpose. This will lead to a set of proposals for the typology of data and potential campaign patterns for data collection through citizen observatories. Finally, limitations and challenges of using crowd-sourced data (e.g., accuracy, coverage, and interpretation) for mobility purposes will be investigated based on the current state of the art, listing also open questions in this area.

Levels of engagement in citizen science projects for management of smart cities

Paweł Wyszomirski (PL)

Idea of smart cities is usually connected to high-tech solutions with little participation of inhabitants (eg. Masdar City). In fact effective and inclusive process of smart city management requires high level of engagement from its users. Several citizen science projects implemented around the world demonstrated that people engagement could be crucial for management of city thanks to cheaper solutions in the field of setting objectives, data gathering and its processing.

In 2010 after BP oil disaster a group of people lofted "community satellites" made from balloons and cameras to track oil spread. No other US government institution was able to do it and to collect and process 100 000 aerial images to understand scope of disaster. This is one of the best example of citizen science project initiated, developed and evaluated by local group (extreme/up science) with support of scientists. On the other hand we have simple crowdsourcing projects like Bike Study Week in Amsterdam, where in 2015 more than 6000 bicyclists helped to gather data about everyday transport behaviours.

The paper will try to demonstrate different levels of engagement in citizen science projects developed in urban environment and present its results as sustainable elements of smart city management process.

DisCoPar: A Reconfigurable Citizen Observatory Platform

Jesse Zaman

Vrije Universiteit Brussel, BE

Participatory sensing allows people-centric contextual monitoring by way of smart mobile devices. It is the driving technology behind citizen observatories, sets of ICT-tools to collect, analyse and visualise sensor data, with the aim of improving the quality of life of citizens. An important concept in these observatories is the notion of a campaign. A campaign is defined by a stakeholder through constraints on the data that needs to be collected. Subsequently, the campaign is enacted through the stakeholder's citizen observatory, which also monitors campaign progress in terms of incoming data, and orchestrates activities in case progress is not as expected. Finally, the campaign is analysed by producing the requested output. Citizen observatories all share a similar structure, yet in the current status, constructing a new citizen observatory for a new type of campaign requires all software infrastructure to be rebuilt from scratch. The lack of a systematic, easy and reusable method for setting up new citizen observatories and for defining new campaigns poses a unsurmountable hurdle for communities and organisations as they usually lack the specific technical ICT-skills and programming knowledge needed to create the necessary server infrastructure and mobile applications. This often forces organisations to opt for a non-technological approach (i.e. pen and paper) or to spend big chunks of their restricted budget on external ICT-consultants. In this talk, we present the DisCoPar platform. Through this platform, ICT-agnostic stakeholders themselves can instantiate new citizen observatories for the particular application area they have in mind. Web services and mobile apps are generated through a user-friendly visual programming model. In this scalable approach stakeholders see their concerns translated into procedures for successful participatory campaigning without having to rely on platform engineers.

Who'd like to see the Milky Way again?:
The potential volunteer community to support dark night skies in Europe.

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Citizen Science (CS) platforms such as "Zooniverse" have grown in popularity, enabling individuals to volunteer their free time to discover and classify astronomical phenomena in "Galaxy Zoo" and "Spacewarps", or biological diversity in "Seafloor Explorer" and "Bat Detective".

Along with the CS projects spectrum expansion, citizens are starting to contribute own data to support scientific endeavours. In particular, there has been increasing enthusiasm towards taking part in initiatives pertaining to light pollution of night skies, and its influence on wildlife. As a focal point of this community energy, the total solar eclipse this year promises to attract thousands of volunteers interested in astronomy - and thus potential contributors in citizen initiatives - with the aim to reduce light pollution. Communities of contributors are currently emerging at social media platforms and dedicated discussion forums to perform their own community-led analysis. Our former studies have shown that CS platforms feature different information sharing and communication patterns than typically found in online and peer-production communities. Rather than person to person communication we observe task specific, but cross-platform, message broadcasting yielding implicit work coordination.

Interested in those investigations, our work focuses on the constitution of the volunteers' communities. We first examine Zooniverse projects related to astronomy and biology and then review insights into potential ad-hoc social media communities by

monitoring Twitter during the broadcasting event of the actual total sun eclipse in March 2016. Our analysis will concentrate on the interaction and (cultural) diversity between CS volunteers and participants using social media. We will also discuss the success criteria of such initiatives with respect to the original project goals, as specified by the scientific team.

 The outcomes of our research will help to design new citizen science projects around the European dark skies initiative and improve the community engagement in this context.

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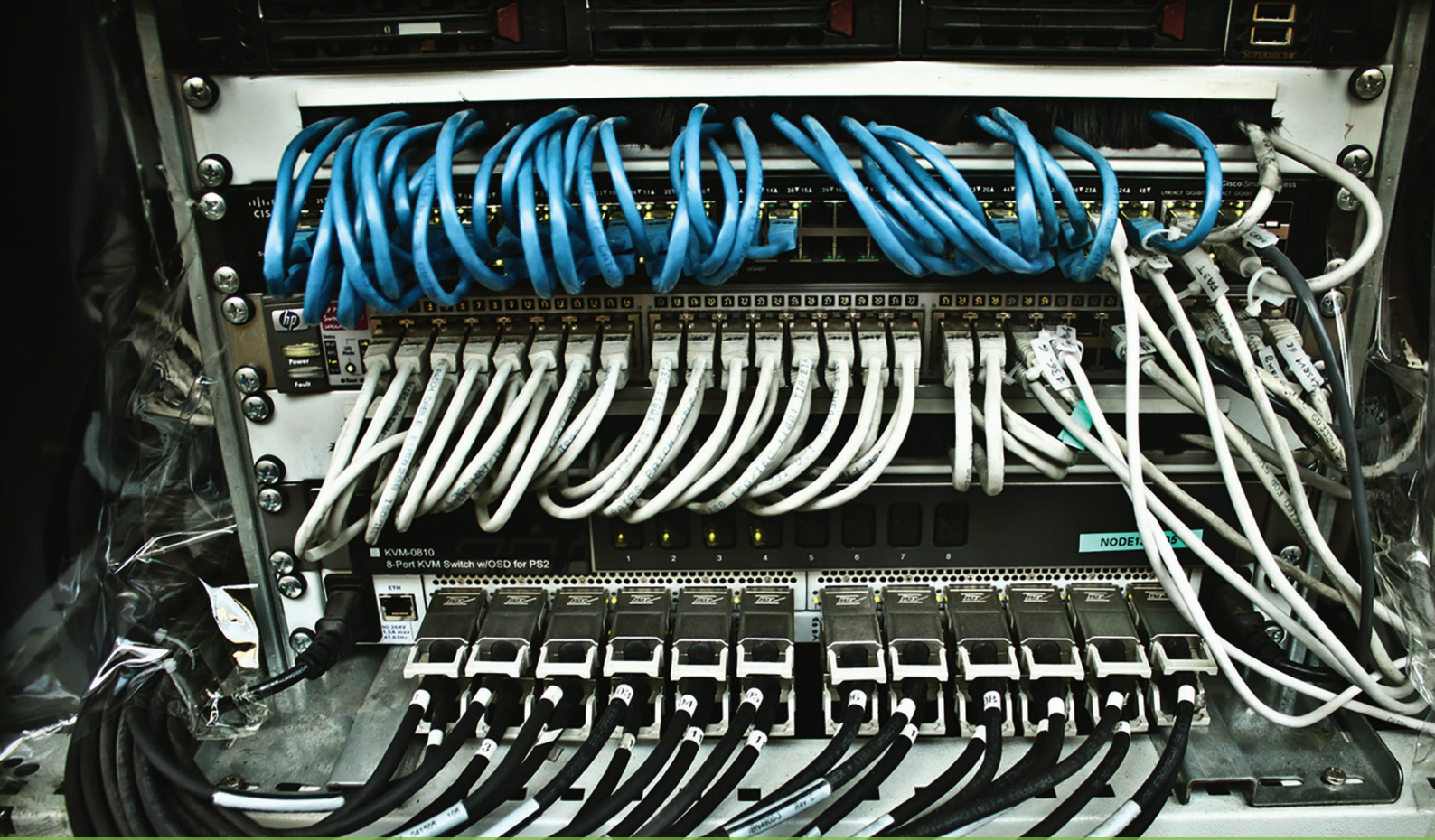
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