GOSH
PANAMA 2022

COMMUNITY
REPORT

#GOSH2022

Contents

Cover Photo

Nicolás Méndez and Pierre Padilla-Huamantinco assembling the Pipetting bot(attribution: Reinaldo Perez; source; licence: CC0)

Photo of GOSH Panama 2022 participants. (attribution: Reinaldo Perez; source; licence: CC0)

Summary

GOSH global gatherings bring together active users and developers of, enablers for and thinkers about open science hardware worldwide, who are, or have the potential to become, key contributors to advancing open science hardware in their own networks and communities. Open science hardware is about substituting 'black boxes' for transparent ones, about being able to see everything that makes up your tools, knowing how they work and how they can be replicated by anyone in the world.

The Gathering for Open Science Hardware held its inaugural gathering at CERN, the European Organization for Nuclear Research, Switzerland, in 2016. The community has since grown into a global movement we are all proud of today; and three more meetings have been convened in Santiago, Chile (2017), in Shenzhen, China (2018) and the latest one in Panama City, Panama (2022), where participants found a fascinating intersection of ideas and developments in open science hardware and technology.

The GOSH Community, and especially its in-person gatherings, provide opportunities to make connections with very diverse individuals and collectives, who are active and enthusiastic about sharing their tools and ideas, and love finding outlets through which the community can share it all. This 'Community Report' provides a summary of the many activities that were conducted during this latest meeting in Panama. It was made possible thanks to the contribution of all the participants, and especially thanks to the efforts of the Gathering Working Group and Documentation Team.

License

Photos and videos

Photos and videos were taken throughout the week to document this Gathering, some of which are used in the context of this report. They are archived in the following locations:

1. Photos and illustrations are shared on Flickr: https://www.flickr.com/photos/goshcommunity/albums

2. Internet Archive along with b-roll video footage: https://archive.org/details/@goshcommunity

Like this report, these materials are shared under the CC BY-SA license or dedicated to the public domain (CC0). Participants are encouraged to share what they have from the event under similar licences in this forum thread.

Report
Organisers and Documentation Team

Main Organizers (In Alphabetical Order of first name)

1. Ana Julia De Lucia, Independent researcher
2. Andrew Quitmeyer, Digital Naturalism Laboratories
3. Brianna Johns, Gathering for Open Science Hardware
4. Gourav Saha, BITS Pilani
5. Juan Pedro Maestre, University of Texas at Austin
6. Laura Olalde, Artist, Educator and Researcher
7. Karl Kaddu, Environment for Development
8. Maria Frangos, Breathing Games
9. Moritz Maxeiner, Freie Universität Berlin
10. Nat Irwin, OpenTEAM

Documentation Team (In Alphabetical Order of first name)

1. Gourav Saha, BITS Pilani
2. Johanssen Obanda, Jabulani Youths for Transformation
3. Karl Kaddu, Environment for Development
4. Laura Olalde, Artist, Educator and Researcher
5. Marcela Basch, Independent journalist and researcher
6. Martín Szyszlican, Sutty
7. Nicolás Méndez, reGOSH
8. Pen-Yuan Hsing, Gathering for Open Science Hardware
9. Rachel Aronoff, Hackuarium

Sponsors and Local Partners

Sponsors

Local Partners

Major Sponsors

Alfred P. Sloan Foundation – $100,000

The ALFRED P. SLOAN FOUNDATION is a not-for-profit, mission-driven grantmaking institution dedicated to improving the welfare of all through the advancement of scientific knowledge. Established in 1934 by Alfred Pritchard Sloan Jr., then-President and Chief Executive Officer of the General Motors Corporation, the Foundation makes grants in four broad areas: direct support of research in science, technology, engineering, mathematics, and economics; initiatives to increase the quality, equity, diversity, and inclusiveness of scientific institutions and the science workforce; projects to develop or leverage technology to empower research; and efforts to enhance and deepen public engagement with science and scientists.

sloan.org | @SloanFoundation

Advocates

Dr. Kerry A. Kinney – $1000
Gilven Centennial Professor, Department of Civil, Architectural & Environmental Engineering at the University of Texas at Austin.

Acknowledgments

From left to right: Photo of translators posing in front of the GOSH 2022 banner in their iconic yellow shirts (attribution: Reinaldo Perez; source; licence: CC0) ; Photo of illustrator Jorge Medina and Photographer Reinaldo Perez posing together (attribution: Laura Olalde; licence: CC0)

Photo of the Gathering Working group of GOSH PANAMA 2022. From left to right: Maria Frangos, Gourav Saha, Andrew Quitmeyer, Laura Olalde, Juan Pedro Maestre, Karl Kaddu, Nat Irwin, Moritz Maxeiner, Brianna Johns and Ana Julia De Lucia, (attribution: Reinaldo Perez; source; licence: CC0)

Schedule

You can see a full schedule on the GOSH 2022 website.

GOSH

Making open science HARDWARE UBIQUITOUS by 2025

How Gathering Can change and Evolve as we Get closer to our GOAL

Illustration of two GOSHers explaining the goals of GOSH. (attribution: Jorge Medina; source; licence: CC0) ;

DAY 1 - Wednesday Oct. 26 - Presentations and Regional events reports

The GOSH2022 opening session was animated with presentations that unpacked not only the objectives of the four-day event, but also highlighted the GOSH journey, from its humble beginnings to a growing global movement of open science hardware practitioners, enthusiasts and change makers. The session was moderated by Juan Pedro Maestre (aka JP).

Introduction to GOSH and Open Science Hardware - Jenny Molloy

Jenny Molloy set the stage for GOSH 2022 by covering the basics of what Open Science Hardware is and why it is important, how the community has evolved since the very first GOSH in 2016 and the huge potential in the coming years for OScH to become ubiquitous and support the advancement of science.

She defined Open Hardware as sharing hardware designs which are licensed in such a way that the hardware can be studied, modified, created and distributed by anyone.

She summarised the three pillars of the [GOSH Roadmap](), established in 2017: LEARN, SUPPORT and GROW, plus their respective recommendations.

The overall opportunities are advancing technical documentation infrastructure for open science hardware. Broken supply chains during COVID-19 have turned a policy spotlight on equitable access to hardware (specially biomedical hardware), and the world has got better at collaborating remotely on technologies, even while existential challenges are in play. While slow at an institutional level, adoption of open science hardware strategies are currently promising, with high-level policy engagement beginning, and UNESCO recognition. Such support may not be mere 'baby steps' and could mean open science hardware may more generally become not only part of the conversation, but a fundamental part of science.

However, challenges remain, as 'open' does not necessarily mean everything is 'accessible' to anyone. Limited distribution channels still can be problematic, but there are more and more examples of sustainable commercialization. Jenny ended by reminding us of the Roadmap (Learn

Support Grow) and the big goal to have open science hardware in ubiquitous use by 2025 (with thanks also to funders for support).

Find the full presentation [here.]()

Jenny Molloy giving an introductory presentation on GOSH and Open Science Hardware. (attribution: Reinaldo Perez; [source](); licence: [CC0]())

Code of Conduct - Nat Irwin

In this presentation, Nat Irwin from the 2022 GOSH Working Group gave an overview on the GOSH Code of Conduct, and also the accessibility at this gathering. They started the announcement with a quote from the Code of Conduct itself about why we have it for this community. Then, they made a few specific notes regarding points of contact for Code of Conduct violations, translators, COVID-19 safety precautions, bathroom accessibility, media consent, and the wellness area. To be intentional and show respect was emphasised. All comments were meant to ensure that everyone at the gathering felt welcome and included   from the get-go. The Code of Conduct committee ensures compliance to set community guidelines- Open Hardware should be inclusive and accessible to everyone regardless of background, gender or origin.

Nat Irwin presenting the GOSH Code of Conduct (attribution: Reinaldo Perez; source; licence: CC0)

Local Context, Land acknowledgements - Brigida de Gracia Taylor

Brigida de Gracia Taylor, Research Technician at the Smithsonian Tropical Research Institute and a native of the Ngäbe Buglé Comarca, Nedrini Region, Corregimiento of Hato Culantro, gave a presentation for better appreciation of our host country, which delved into the history of Panama and the geographical, pre- colonial formations that shaped it. The Isthmus of Panama was key to the great biological exchange between the North and South American continents. Panama was under Spanish conquest for over 300 years before gaining independence in 1821. Where we met specifically, within the Panama Canal Zone, is a former exclave and colony of the United States of America. The Canal Zone (or Zona, in Spanish) was abolished in 1979 and the land formally returned to Panama in 1999. Only around eight native groups are left in the country, with the Ngäbe and Gura the most populous. There are in contrast still very abundant fish and butterfly species and a special tree – Sterculia apetala – in Panama. Brigida de Gracia Taylor said that was one of the possible origins of the name "Panama" – literally "an abundance of fish."

The emergence of Panama, was key in the great biological exchange

The history of Panamá (attribution: Jorge Medina; source; licence: CC0)

Revisiting the Roadmap

Various actions carried the GOSH community as laid out by the Roadmap (attribution: Reinaldo Perez; source; licence: CC0)

Led by Greg Austic, participants were invited to share what actions they have achieved towards making open science hardware ubiquitous, actions which were set out by our collectively written GOSH Roadmap. Some examples of these actions include:

1. OScH residencies at regional events and gatherings
2. The creation of OScH journals, such as HardwareX and the Journal of Open Science Hardware
3. The Open Hardware Makers program
4. UNESCO recognition of OScH
5. ReGOSH
6. OScH used in response to the COVID-19 pandemic
7. Training sessions for distributed manufacturing

Afterward, Shannon Dosemagen and Jenny Molloy grouped actions by the three categories laid out by the roadmap: Learn, Support, and Grow, and showcased them on a giant piece of construction paper on one of the walls of the venue.

Illustration of Jenny Molloy grouping actions by the three categories laid out by the roadmap: Learn, Support, and Grow (attribution: Jorge Medina; source; licence: CC0)

2022 Session clusters - Jenny Molloy

Sessions grouped by unconference clusters (attribution: Andrew Quitmeyer source; licence: CC0)

Before diving into the session planning, Jenny Molloy introduced us to five unconference clusters to help guide the sessions. The inclusion of clusters was a new addition to the unconference format this year, reflecting that the community has reached a point where it can focus on key areas established by the GOSH Roadmap. The five clusters were:

1.   Understanding the state of play in global OScH
2.   Institutionalising OScH: how to make OScH the norm
3.   Taking OScH to market
4.   Community, collaboration & learning with OScH
5.   Building a future where the GOSH Community thrives

Unconference Session Planning - Greg Austic

Led by Greg Austic, the planning of the sessions made extensive use of sticky notes to get the most out of this collective brainstorming activity. At the end of this activity, ideas were condensed into 60 sessions that ran during DAYS 2, 3 AND 4.

This planning activity was divided in two parts:

Part 1 (Brainstorming)

Attendees placing sticky notes onto the wall to begin the session planning process (attribution: Reinaldo Perez; source; licence: CC0)

Participants were requested to use sticky notes to suggest discussion themes and workshops that they would like to lead or attend. Each person placed their sticky notes onto the wall, turning it into a sea of ideas! For instance, in the context of Learn – open data pools, contextualised metrics, empirical studies, contract templates/licensing etc., open hardware in covid, and training were all part of the guiding suggestion themes as people started filling in their sticky notes.

Session types proposed included: Mapping, Exploratory, Learning, and Getting Work Done.

Greg Austic made a nice visualisation of how everyone should try to leave their ordinary organisational hats behind, to represent only themselves and their passions, as it is individual connections which make communities work.

Part 2 - Synthesis

Once everyone placed their sticky notes onto the wall, the group noted common themes and worked together to organise sticky notes into categories. Each category represented a potential session that could take place during the Gathering. Once participants worked together to group ideas into categories, they then voted on them, and placed them on a blank schedule

Some of these sessions included:
1) How to make OScH the norm
2) Distributed manufacturing
3) Sharing what you know…
4) AI
5) Regional Community Building
6) Reproducibility
7) Peer Review

And much more

Attendees organising the sticky notes into clusters based on common themes, as part of the sessions' process (attribution: Reinaldo Perez; source; licence: CC0)

Sticky notes organised into clusters on the wall behind participants (attribution: Reinaldo Perez; source; licence: CC0)

The whole process in one image:

Governance update: Towards a GOSH Constitution - Liz Barry, Pen-Yuan Hsing

As the Gathering for Open Science Hardware (GOSH) community works towards achieving its aims in the Roadmap and Manifesto, the need to reflect upon and set up a governance structure has become increasingly clear.

To that end, Liz Barry and Pen-Yuan Hsing from the GOSH Community Council gave an update on the governance work the Council has been doing since 2021, and a plan to gather more community input on governance leading to a GOSH Constitution, to be ratified in 2023.

Pen started the session with a recap on how the 2021 election came about and produced the first 2021-2022 Community Council. Three months before GOSH Panama, our second election was held and most of the current Council members were there in Panama.

Liz then explained the plans to have a special table at the conference centre, where someone from the Council would always be present during the gathering. Everyone was encouraged to come by this table and give their input into how the ideal GOSH Constitution would look.

As the GOSH community continues to grow, it is necessary to figure out how to work together and hold power together. Liz Barry emphasised that the gathering days were critical to that process, being a good opportunity to discuss this matter in person with as many participants as possible.

Pierre Padilla-Huamantico and Liz Barry introducing the GOSH Governance and Constitution table on day 1 (attribution: Reinaldo Perez; source; licence: CC0)

GOSH Council listening to GOSH community members at the table (attribution: Laura Olalde; source; licence: CC0)

Reports

AfricaOSH and TanzaniaOSH - Valerian Sanga

Valerian talked about the work with Tanzania OSH and AfricaOSH, and the partnership with the MboaLab in Cameroon and the BongoTech research labs. Localised summits for OSH have been organised, and strategic partnerships have been built, gradually, even getting academic and government collaborators involved. Valerian's SangaBoard also is one central means for Arduino-based motor control in the OpenFlexure microscope system.

reGOSH - Pierre Padilla-Huamantico and Pablo Cremades

Notes by @reGOSH (Pablo Cremades)
Talk by Pablo "Outcomes of GOSH Regional Event at Mendoza, Argentina"

Pablo Cremades told the story of the origin of the regional Latin American network reGOSH. "In 2018, a group of people participating in TecnoX Chile decided to create a Latin American network that would connect people in this region working on open source technology for teaching, research and community science. We got funds from the 'Programa Iberoamericano de Ciencia y Tecnología para el Desarrollo (CYTED),' and [reGOSH] was born, aka the 'latam' chapter of GOSH, as we call it now. The plan was to have annual residencies, where people from every node of the network would meet to work on advancing projects we consider particularly relevant for Latin America.

The first residence took place in Porto Alegre, Brasil, in 2019.

Since the COVID-19 pandemic, a second residence was held in Mendoza, Argentina, in September 2022. Twenty participants from five different countries joined to work on "Tools for agroecology and environmental health." The long term objective is to build an open agroecology laboratory, using open source instruments, to accompany peasants, farmers, students and researchers in the visualisation and documentation of changes produced in farms during their transition towards agroecology.

After the residence, the Regional Gathering was held.. More than 50 people from Argentina, Chile, Brasil, Uruguay and Mexico joined in to outline a common agenda and strategies that allow the consolidation and advancement of this network in Latin America.

Several organisations joined the event: CoSensores], PreserVamos, Our-Sci LLC, [Trabajadores Rurales Sin Tierra (UST)] and the Red Puna (both belong to Movimiento Nacional Campesino Indígena - Somos Tierra), the quality management team of the Central Market of Buenos Aires, and the association of producers Crece desde el Pie.

We had four keynotes by guest speakers, three debate panels and more than ten workshops. During the event, we discussed problems related to the extractivist productive model in Argentina and its consequences in the food industry, like monoculture and the use of excessive amounts of agrotoxic compounds. We also discussed the nature of the scientific paradigm that supports such a model.

Additionally, some community experiences related to nature conservation activism were presented. Some participants talked about their experience in the transition to agroecology. We talked about how science could help and what tools we need to help communities. We presented the outcomes of the Residence, in particular, the idea of an open agroecology lab based on open source tools that we built collaboratively during the Residence.

Dates:

Residence: 5-19 September, 2022
Regional Event: 20-23 September, 2022

Links:
General Information
Final Report
Twitter
GOSH Forum Thread

Lightning talk on Round 2 Regional funding - Rachel Aronoff

Rachel Aronoff reported on 'Jump-starting community lab open science hardware with Hackuarium,' a GOSH-funded event to excite local people about electronics and held in Hackuarium, a public service community lab in Switzerland. She told how Mitch Altman led the workshop 'Hacking electronics for peace,' the progress in builds of the OpenFlexure microscope for epifluorescence imaging, and steps ahead. Complete presentation:

['Open-Sourcing' DNA Damage Detection using Open Science Hardware](#)

The first day of the meeting ended with discussion around the Round 2 Development Grant, by Liz Barry, and questions around Hardware developments and manufacturing, by Greg Austic.

A very dense schedule of sessions, both unconference and workshops, was put together for the following day.

DAY 2 Thursday Oct. 27

A google spreadsheet with the day's program was presented to participants, who then chose where they would go and participate. The second day began with many unconference activities: Lab Hardware 1, Shake your body (you nerd!), OScH global emergency strategies, and So crazy it may just work, while Conservation biology, Redirecting research funding to OScH, Business Models for OScH, and Open Hardware for Academics, were some of the choices for the afternoon.

The complete schedule can be found here.

By the close of the second day of the Gathering, 22 sessions were held. Eight sessions were arranged to run concurrently at a time in six spaces spread over the conference centre area, including outdoors.

Juan Pedro Maestre, Shannon Dosenmagen , Andy Quitmeyer as part of an unconference session (attribution: Reinaldo Perez; source; licence: CC0)

Attendees constructing some of Alquimetricos' ecotechnological didactic toys during the Shake your body (you nerd!) session (attribution: Reinaldo Perez; source; licence: CC0)

Facilitation on how-to

Liz Barry gave a talk on how to facilitate, to help individuals and groups reach their potential. This talk to all participants of the event was key in laying common ground about the dynamics of facilitation so that anyone could assume that role if they wished to do so.

Why is the role of the facilitator important? Facilitation disrupts some cultural patterns of interaction that often go unnoticed, especially within engineering and science.

How to facilitate?

As a quick intro:

1. Call for intros (especially the first day of the sessions)

2. At least make one full round to hear al voices ("what is your starting place for this topic?")
3. Stack (note who wishes to speak next, then call in order)
4. Stack, progressive (invite people who have spoken less)
5. Make every minute count:
6. Speak only for 1 minute (timekeeper)
7. Within your minute, speak only on 1 topic ("bike rack")
8. Anyone can call for a minute break (take a breath)

Facilitator can repeat back and summarise to ensure that the exchange of ideas is clear.

Public Event - Demo day

Time: 14:30 - 16:30

Free fluorescent proteins in
Escherichia coli

Illustration of Isaac Núñez presenting the FluOpti during the Demo Day   (attribution: Jorge Medina;
source; licence: CC0)

Soil Microbial Activity Meter (Soil metabolites meter)

Semi automation of 24hr CO2 burst measurements of soil samples

In this demo session George Albercook and Greg Austic showed open hardware to measure the bacterial and fungal content in soil, which provides valuable insight into the vitality of the soil and can help agronomists plan and evaluate soil management practices.

The standard method is to rehydrate a soil sample, place it in an incubator for 24hrs and measure the amount of CO_2 produced. In this open instrument, they demonstrate several innovations that improve accuracy and reproducibility, while reducing sample preparation time and processing costs. Samples are rehydrated automatically and placed in large syringes, where CO_2 sampling is automated by depressing the syringe body and forcing air through a NDIR (non-dispersive Infrared) analyzer.

George Albercook (attribution: Reinaldo Perez; source; licence: CC0)

Contact information: Greg Austic and George Albercook

Open resources for molecular biology and synthetic biology

Note : As this session was reported originally in Spanish as follows, it has been translated to English after the original Spanish version:

Recursos abiertos para biología molecular y sintética

Tamara Matute e Isaac Núñez mostraron diferentes recursos abiertos para biología molecular y sintética, como un ensamblador de ADN y FluOpt, desarrollados en el Laboratorio de Tecnologías Libres de la Pontificia Universidad Católica de Chile.

Se presentaron recursos para biología molecular/sintética que involucraron tanto hardware cómo wetware.

Por un lado se presentó el sistema uLoop para efectuar ensamblaje de ADN de manera combinatoria. Este involucra una colección de componentes genéticos libres que permiten construir circuitos genéticos para cualquier tipo de aplicación (ya sea académica o comercial), a la vez que se simplifica el número de partes requeridas para su operación (más detalles en https://www.uloop.org/). Relacionado a esto, se presentó un equipo de hardware abierto y bajo costo para llevar a cabo la reacción de ensamblaje de ADN, efectuando ciclos de temperatura entre 16 y 37°C. A diferencia de la mayoría de los termocicladores OSH, el sistema de enfriamiento de este esta basado en una peltier (y no un ventilador), lo que permite bajar la temperatura por debajo de la temperatura ambiente (incluso incubar las muestras a 4°C una vez finalizada la reacción). Además, incorpora una tapa caliente para evitar la evaporación de las muestras. Este equipo está pensado para ser utilizado en hacker spaces, laboratorios de bajo costo o para fines educativos en una lógica de "un equipo por estudiante/grupo" en lugar de "un equipo para todo un curso". Además, se presentó un colorímetro de ultra bajo costo para medir OD de cultivos bacterianos, el cual puede ser utilizado para elaborar bacterias quimio-competentes. Con estos recursos se pretende no sólo dar acceso libre a los componentes biológicos, sino que también facilitar su uso mediante hardware abierto de bajo costo especialmente diseñado para ello.

Por otro lado se presentó una nueva versión del FluPi (https://github.com/LabTecLibres/FluoPi) que incorpora la posibilidad de efectuar experimentos

de optogenética. Este equipamiento está diseñado para registrar la fluorescencia de cultivos bacterianos en medio sólido a escala de placa petri (una escala que no es cubierta por ningún equipamiento comercial de manera directa) mediante el registro de series de tiempo. La nueva versión incorpora luz blanca (para separar la medición de crecimiento de la expresión de fluorescencia), y la capacidad de iluminar con luz verde y roja desde la parte superior para controlar la expresión genética de los cultivos bacterianos en estudio. El proyecto incluye software libre para el análisis de las imágenes y así extraer de manera semi-automática información relevante de ellas. Así, es posible utilizarlo tanto para fines de investigación cómo para educación en cursos de biología molecular o bio-ingeniería. Finalmente, este equipo ha mostrado ser muy versátil, encontrando aplicaciones para actividades rutinarias de biología molecular como visualización de geles de electroforesis, cuantificación de ADN por fluorometría y registro de reacciones in-vitro. Es un proyecto activo, que ha sido replicado en por diversos grupos en todo el mundo.

La demostración fue facilitada tanto en español cómo inglés, en la cual los participantes podían ver el funcionamiento de los equipos e inspeccionarlos.

English version:
Open resources for molecular biology and synthetic biology

Tamara Matute and Isaac Núñez showed different open resources for molecular and synthetic biology, such as a DNA assembler and FluOpt, developed at Laboratorio de Tecnologías Libres, Pontificia Universidad Católica de Chile.

Resources for molecular/synthetic biology, involving both hardware and wetware, were presented.
On the one hand, the uLoop system for combinatorial DNA assembly was shown. This involves a collection of free genetic components that allow construction of genetic circuits for any type of application (whether academic or commercial), while simplifying the number of parts required for its operation (more details at https://www.uloop.org/). Related to this, a low-cost, open hardware device was presented, which can carry out the DNA assembly reaction, performing temperature cycles between 16 and 37°C. Unlike most OSH thermal cyclers, the cooling system of this one is based on a peltier (and not a fan), which allows temperatures below room temperature (even incubating the samples at 4°C, once the reaction is finished). In addition, it incorporates a heated lid to prevent evaporation of the samples. This equipment is intended to be used in hacker spaces, low-cost laboratories or for

educational purposes in a logic of "one device per student/group" instead of "one device for a whole course." In addition, an ultra-low-cost colorimeter was presented, to measure the optical density of bacterial cultures, which can be used to make chemically-competent bacteria. The aim of these resources is not only to provide free access to biological components, but also to facilitate their use by means of low-cost open hardware specially designed for this purpose.

On the other hand, a new version of the FluoPi (https://github.com/LabTecLibres/FluoPi), FluoOpt, was presented, which includes the possibility to perform optogenetic experiments. This equipment is designed to record the fluorescence of bacterial cultures in solid media at petri dish scale (a scale that is not directly covered by any commercial equipment) by recording time series. The new version incorporates white light (to separate the measurement of growth from fluorescence expression), and the ability to illuminate with green and red light from the top, in order to monitor gene expression of the bacterial cultures under study. The project includes free software for the analysis of the images, to semi-automatically extract relevant information from them. Thus, it is possible to use it both for research purposes and for education in molecular biology or bio-engineering courses. Finally, this equipment has shown to be very versatile, with applications for routine molecular biology activities such as visualisation of electrophoresis gels, DNA quantification by fluorometry and recording of in-vitro reactions. It is an active project, which has been replicated by several groups around the world.

The demonstration was provided in both Spanish and English, in which participants were able to see the equipment in operation and inspect it.

Links to further information:
https://doi.org/10.1371/journal.pone.0187163
https://doi.org/10.1093/synbio/ysaa001 https://gitlab.orosticaingenieria.cl/biopuc-group/assembler/

contact information:
innunez@uc.cl – Isaac Núñez
tfmatute@uc.cl – Tamara Matute

Further images of the demo:
https://www.flickr.com/photos/196900583@N04/albums/72177720304177246
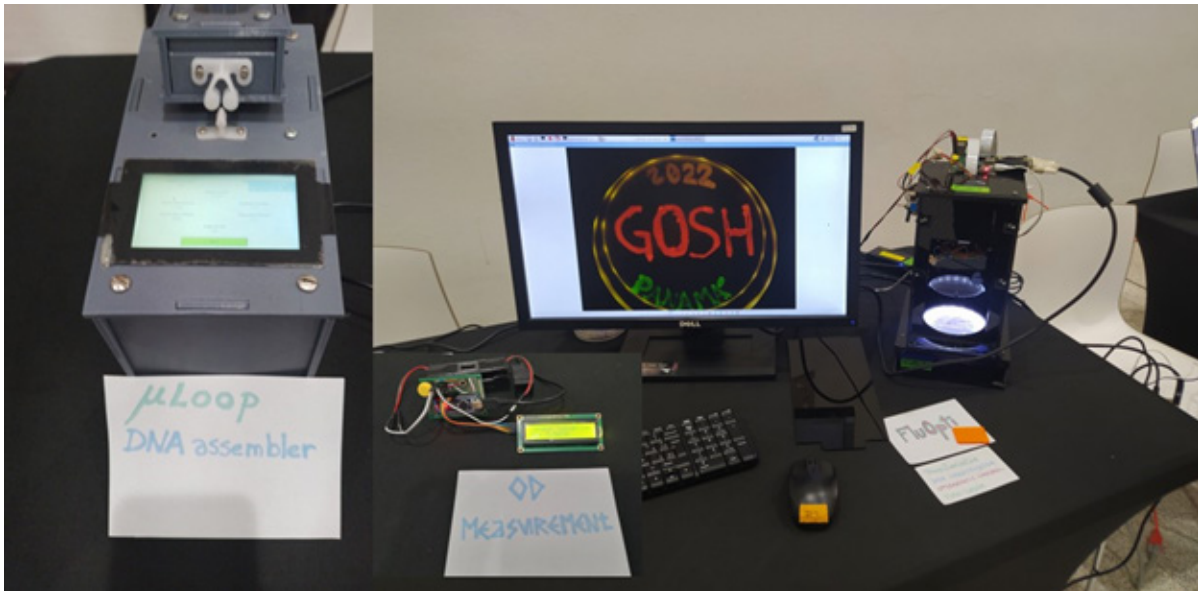
The DNA assembler and FluOpti presented by Tamara and Isaac during the demo (attribution: Isaac Núñez; source; licence: CC0)

Plastic Bottles to 3D Prints

Andy Quitmeyer showed how to use open source tools to turn everyday PET plastic bottles (like a 2L cola bottle) into strong plastic strings and then into precise filament for 3D printing.

This demo was extended even over the lunch break and was attended by high school students who attended the demo sessions and also other sessions in the afternoon that day with great interest.

1. Links to further information: Motorized Plastic bottle stringer attachment: https://hackaday.io/project/185827-motorized-plastic-stringer
2. Filament making machine: http://recreator3d.com/
3. Contact information: andy@dinalab.net

Andy Quitmeyer showing participants how to make plastic string from PET plastic bottles (attribution: Reinaldo Perez; source; licence: CC0)

Whole Communities Whole Health Bevo Beacon

Juan Pablo Maestre presented this project, developed at University of Texas at Austin.

Summary:

Over the past decade, there has been a rapid influx of affordable, commercial sensing technologies. In addition to understandi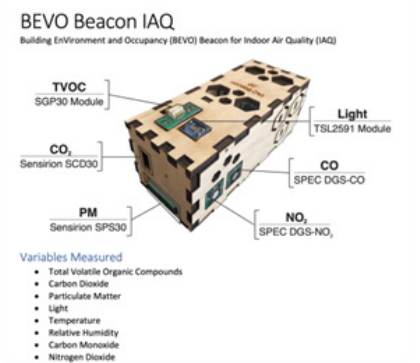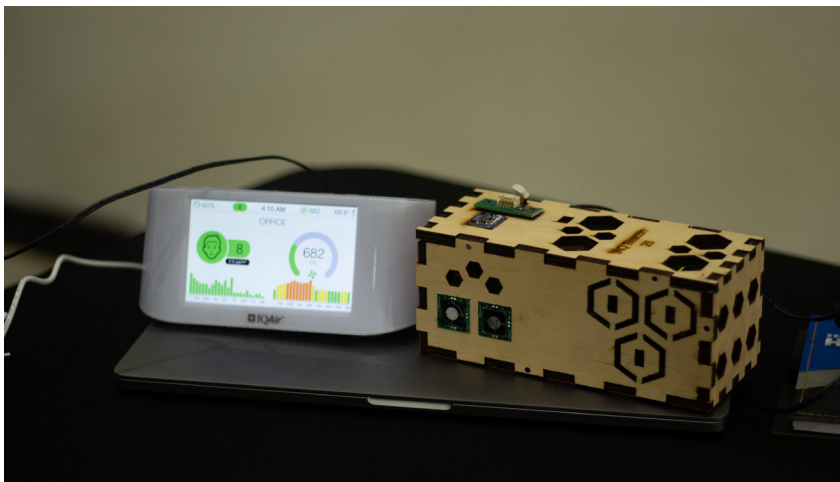ng more about a particular environment, researchers can scale up their studies in both time and space with the same data collection frequency. High-grade instruments are still more accurate, but they are less affordable for community studies. To help further explore environmental exposures, in the Whole Community Whole Health program, we have developed our own monitoring device called the Building EnVironment and Occupancy (BEVO) Beacon. The BEVO Beacon consists of 5 pollutant-detecting sensors, 2 environmental sensors, a small fan, and a real-time clock all tethered to a Raspberry Pi 3B (RPi) microcomputer. These sensors allow the BEVO Beacon to measure carbon monoxide/dioxide, particulate matter of multiple sizes, nitrogen dioxide, total volatile organic compounds, temperature, relative humidity, and light levels. The RPi is also capable of detecting WiFi and Bluetooth signatures of nearby devices. The BEVO Beacon takes one-minute averaged measurements for each variable and stores the data locally or pushes it to an online server if connected to WiFi. The BEVO Beacons have been tested, calibrated, and successfully deployed for multiple studies to collect robust indoor air quality data from 100+ unique home environments to date. In the future, we want to further improve the documentation, the hardware, software, and reliability of these devices.

Contact info: BridgingBarriers@austin.utexas.edu
https://bridgingbarriers.utexas.edu/whole-communities-whole-health
https://repositories.lib.utexas.edu/handle/2152/84869

The BEVO Beacon presented by Juan Pablo Maestre and developed at University of Texas at Austin. (attribution: Reinaldo Perez; source; BridgingBarriers; source; licence: CC0)

Alquimétricos eco-technological toys

Fernando Daguanno showed Alquimetricos, an Open Source building blocks system toy and a STEAM-DIY-oriented socio educational community that we had used in his session "Shake your body! (you nerds)" that morning.

1. es.alquimetricos.cc (ES), lab.alquimetricos.cc (PT), instagram.com/alquimetricos.
2. Pictures! https://www.flickr.com/photos/goshcommunity/52476333778/in/photostream/
3. Contact information: fernando@alquimetricos.cc +5491162379455 twitter.com/alquimetricos
4. CC BY 4.0. Open-source product and educational content, open-business-model, open-brand project based upon Argentina and Brazil.

Alquimétricos table at the demo sessions (attribution: Reinaldo Perez; source; licence: CC0)

Water quality testing with chromogenic microbiology cards

Rachel Aronoff set up for the demo session with R-Cards and some printouts around the lake water quality monitoring organised by Hackuarium as part of the 'Montreux Clean Beach Project' and Harold Tay's small and simple Incubator made the first day of the meeting. This was also the basis for a workshop to be described below. Some further documentation can be found here in the second section of the wiki page, Water Monitoring at GOSH 2022.

Rachel showing a group of attendees her demo set-up (attribution: Reinaldo Perez; source; licence: CC0)

PUMA Open Source Multimodality 3D Printed Microscope

On left Darin in front of the microscope build, and source for the design, on right: (attribution:Rachel Aronoff; source; licence: CC0)

SnapperGPS

Amanda Matthes presented SnapperGPS, a small, low-cost, low-power location data logger designed for wildlife tracking. SnapperGPS was developed by Jonas Beuchert, Amanda Matthes and Alex Rogers at the University of Oxford. The entire hardware, firmware and software stack is open source. Amanda has already organised deployments on sea turtles and seabirds, and they're currently working on making the tech available to the wider wildlife tracking community through group purchasing campaigns.

1. https://snappergps.info/
2. https://twitter.com/SnapperGPS
3. https://twitter.com/AmandaMatthes
4. Preprint under review with the Journal of Open Hardware (JOH): https://arxiv.org/abs/2207.06310
5. GroupGets pre-launch campaign: https://groupgets.com/campaigns/1056
6. Contact: theteam@snappergps.info
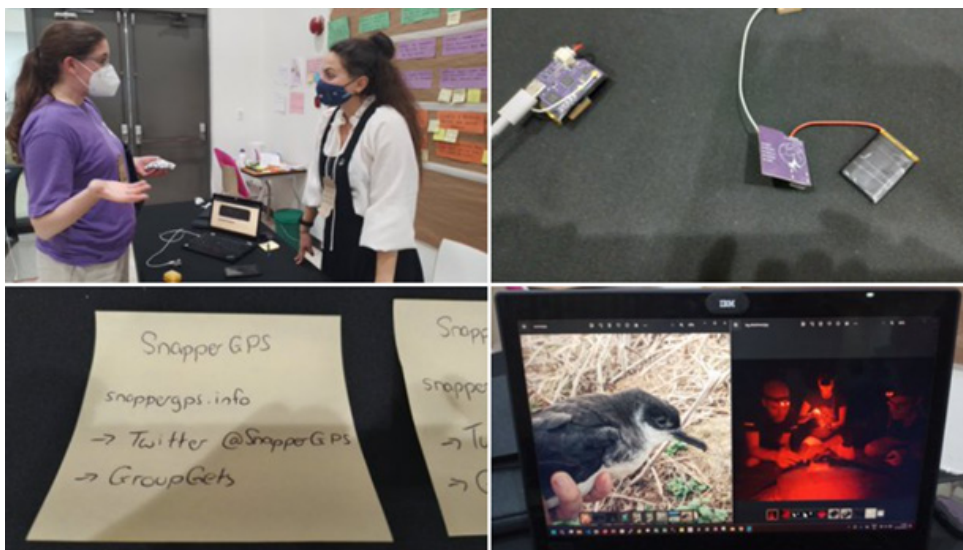
Amanda Matthes presenting the low-power location data logger at the demo day (with Jenny Molloy top right) (attribution: Reinaldo Perez; source; licence: CC0)

Pipetting bot

Nicolás Méndez showed a pipetting bot: Hardware, software, and documentation for automated laboratory protocols. What sets this project apart is its focus on documentation, accessibility, and hackability, so anyone can use and build it anywhere.

1. Gitlab repo: https://gitlab.com/pipettin-bot/pipettin-grbl#pipetting-bot
2. Documentation: https://pipettin-bot.gitlab.io/pipettin-grbl-docs/
3. Contact : nmendez.ar@gmail.com

Nicolás Méndez's Pipetting bot during the Demo Session. (attribution: Laura Olalde; source; licence: CC0)

Hacia el desarrollo de herramientas libres de relevamiento ambiental participativo: instrumentos de medición basados en arduino para la determinación in situ de variables físico-químicas en cursos de agua superficial.

Note : **As this session was reported originally in Spanish as follows, it has been translated to English at the end of the original Spanish version.** Notes by @laraja
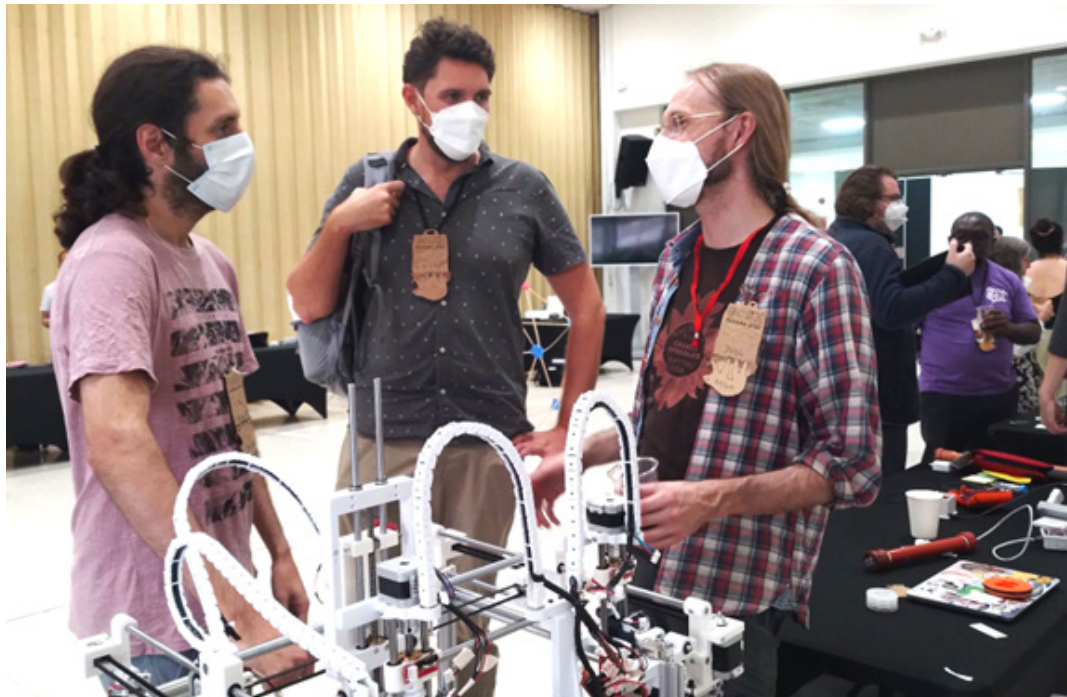
Descripción: Se compartieron 2 experiencias, una situada en la Primera Sección del Delta del Paraná, pcia. de Bs.As. en conjunto con la Cooperativa Isla Esperanza. La otra en Saladillo, pcia de Bs.As. en conjunto con la comunidad de Saladillo. En las experiencias se propuso la incorporación de herramientas a instancias de participación comunitaria para la adquisición de datos y toma de decisiones, haciendo uso de tecnologías accesibles como por ejemplo, el uso de teléfonos móviles acoplados a sensores de bajo costo, técnicas de mapeo colectivo y la aplicación de sistemas domiciliarios de tratamiento de agua de río. Se ha demostrado que este tipo de prácticas fomentan la participación e incorporación de las comunidades que se encuentran inmersas en problemáticas socioambientales en lo que respecta a la toma de decisiones y búsqueda de soluciones, contribuyendo positivamente a la comprensión y resolución de las problemáticas vinculadas a los efectos de la contaminación sobre la salud de la población y el ambiente.

En particular, se presentó el diseño e implementación de instrumental científico para el desarrollo de tres herramientas libres de medición: un colorímetro, un turbidímetro y un conductímetro. Se presentó la calibración realizada que fue comparada con equipamiento comercial, discutiendo su aplicación para la determinación en campo de parámetros físico-químicos de relevancia ambiental aplicados a

experiencias de monitoreo participativo de calidad de agua. También se compartió el desarrollo de dos metodologías de tratamiento de agua de río de aplicación domiciliaria.

Towards the development of free participatory environmental survey tools: arduino-based measurement instruments for in situ determination of physicochemical variables in surface water courses.

Description: Two experiences were shared, one that happened in the First Section of the Paraná Delta, Province of Buenos Aires, together with the Isla Esperanza Cooperative. The other one was in Saladillo, Province of Buenos Aires, together with the community of Saladillo. The experiences proposed incorporating tools for community participation in data acquisition and decision making, and made use of accessible technologies, such as cell phones coupled to low-cost sensors, collective mapping techniques and the application of home systems for river water treatment. It has been demonstrated that this type of practice encourages the participation and incorporation of communities immersed in socio-environmental problems in decision-making and the search for solutions, contributing positively to understanding and resolving problems related to the effects of pollution on the health of the population and the environment.

In particular, the design and implementation of scientific instruments for the development of three free measurement tools was presented: a colorimeter, a turbidity metre and a conductivity metre. The calibration carried out was presented and compared with commercial equipment, discussing its application for field determination of physicochemical parameters of environmental relevance, applied to participatory water quality monitoring experiments.

The development of two methods for treatment of river water for domestic use was also shared.

CoSensores table on Demo day: tools and infographic of their actions in territory (attribution: Lara Jatar; source; licence: CC0)

Links
https://gitlab.com/cosensores/turbidimetro;
https://gitlab.com/cosensores/conductimetro;
https://gitlab.com/cosensores/color-metro;
https://tap.bio/@cosensores
Contact Lara Jatar, ljatar@unsam.edu.ar
https://www.instagram.com/cosensores/

Stereo camera traps

Harold Tay showed everyone how to modify camera traps to tap into their triggering circuitry. By soldering a wire to the right place on a camera trap's circuit board, then exposing the other end of the wire outside the case, you obtain a way to either trigger the camera from an external source or using the camera trap's built-in trigger to trigger something externally. Harold Tay also developed a small board to attach to the wire outside the camera trap to serve as a common "interface" board for connecting external equipment.
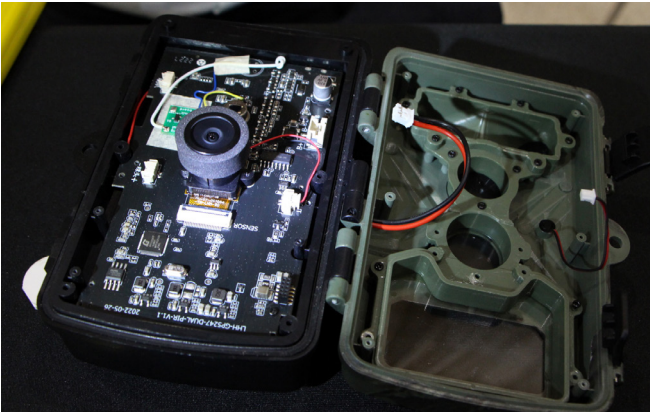
A camera trap that Harold Tay opened and modded to link it to another one. (attribution: Laura Olalde; source; licence: CC0)

2. Harold Tay showing how to to open the case of a camera trap and tap into its triggering circuit (attribution: Laura Olalde source; licence: CC0)

The camera trap session was bigger than we expected! (attribution: Andy Quitmeyer; source; licence: CC0)

Remote demos
Plantoverce

The Art & Science research of a human phenomenon called "plant blindness" and optical properties of the plant epidermis. The project aims to rethink the established attitude towards plants as inferior and simple objects.

Extended description: The concept of the project is based on the phenomenon of "plant blindness", which means a human's tendency to underestimate the importance of flora due to its non-anthropomorphism. Creating an emotional connection with plants can change our relationship with nature, species unlike us.
The study of plants at different levels of organization allows us to approach a new vision of plants, their interaction with each other and within the ecosphere. Within the framework of the project, a number of experiments were conducted to determine the optical properties of the upper epidermis of plant leaves, where cells act as collecting microlenses. Viewers can see themselves in real time, thanks to the image formation algorithm based on the optical characteristics of the dermal tissue of the leaf.

· Contact: Veronica Prizova v.priz.v30@gmail.com Maria Moshenskaia mariia.moshchenskaia@gmail.com Dmitry Kadyrov (aka Ippolit Markelov) ipppolit@gmail.com.
· Links:
Link to .mp4 video presentation, with sound, duration 2.6 min
Link to .pdf presentation

Sculpture Plantoverse

· science research on the topic of optics
· biomorphic 3D modelling based on plant cells pattern
· technical implementation
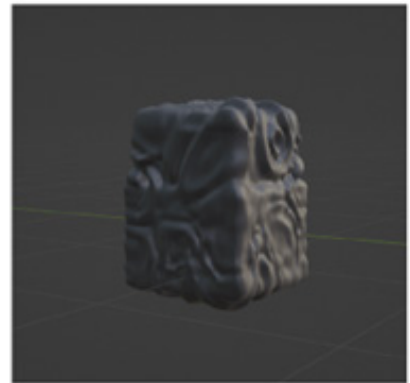
Some renders of Plantoverce, shown at the demos day (attribution: ---; source; licence: CC0)

Universal Biopotential Amplifier UBP-3

Wideband multichannel differential amplifier with modular design and adjustable analogous commutation. The UBP-3 device can be used in electrophysiological studies. For instance the device can provide long-term round-the-clock cardiogram registration of laboratory animals in a stationary laboratory.

The prototype of this amplifier was firstly used by Ilya Kuzmin and colleagues for recording ECG of rats on a treadmill: Tarasova OS, Borzykh AA, Kuz'min IV, et al. [Dynamics of heart rate changes in rats following stepwise change of treadmill running speed]. Ross Fiziol Zh Im I M Sechenova. 2012; 98(11):1372-9.
It is used by Georgy Nikolaev and his students for recording EEG in the research of audiogenic epilepsy on rat models: Fedotova IB, Surina NM, Nikolaev GM, Revishchin AV, Poletaeva II. Rodent Brain Pathology, Audiogenic Epilepsy. Biomedicines. 2021; 9(11):1641. https://doi.org/10.3390/biomedicines9111641

1. https://github.com/comcon1/UBP3
2. Video presentation on the demo day: https://www.youtube.com/watch?v=Itqa7mGAqyA
3. Contact: Ilya Kuzmin kuzmin.ilya@gmail.com; Alexey Nesterenko comcon1@pm.me; Georgy Nikolaev humanoid5@yandex.ru; Dmitry Kadyrov (aka Ippolit Markelov) ipppolit@gmail.com.
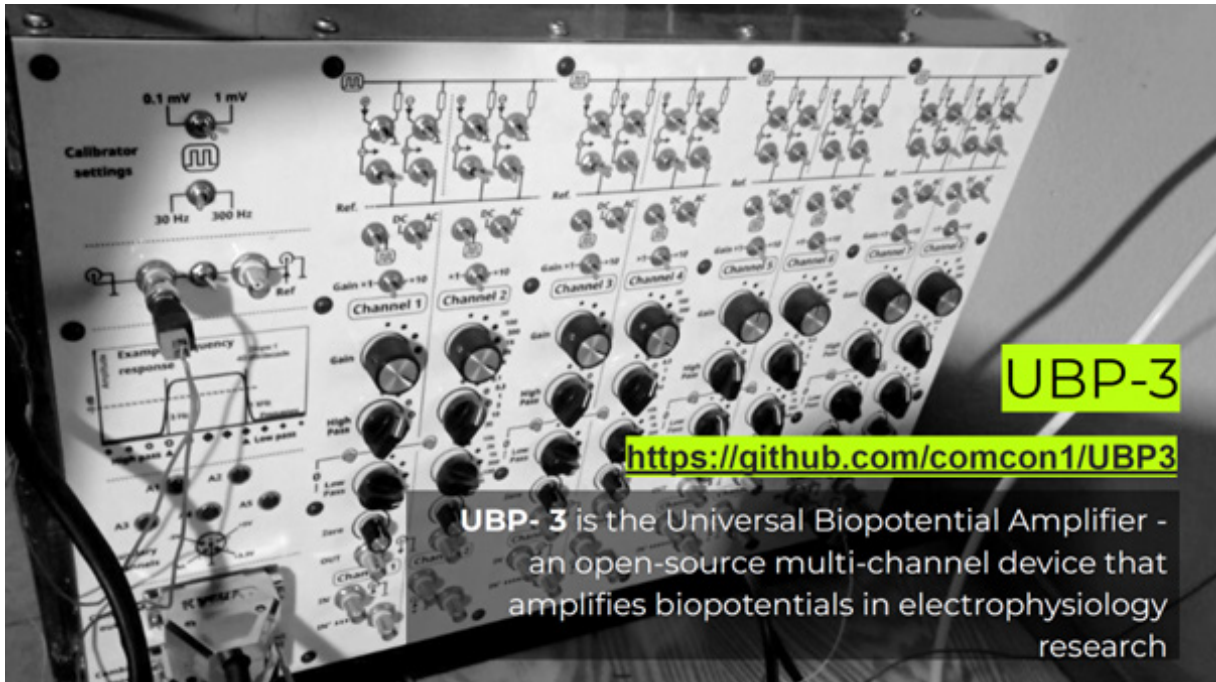
Universal Biopotential Amplifier UBP-3 (attribution: Ippolit Markelov; ; source; licence: CC0)

OPEN ASIC (Application-specific integrated circuit) design flow

Design simulation and characterization of microchips using fully open EDA (Electronic design automation) software and Open PDK (physical design KIT). The main goal is to develop the first microprocessor (RISC V) with fully open software in Ecuador.

Contact:
Byron Tarabata, btarabata@gmail.com, btarabatat@usfq.edu.ec

Link: https://www.usfq.edu.ec/es/institutos-de-investigacion/instituto-de-micro-y-nanoelectronica-imne
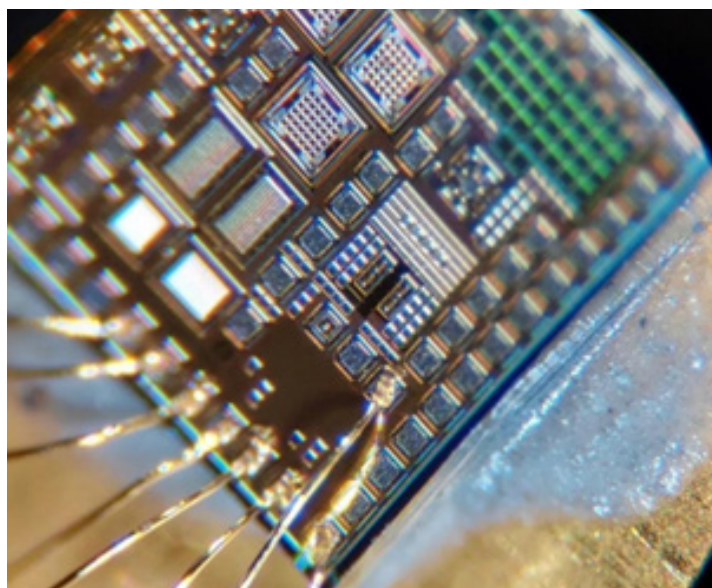
Micrograph of the 180-nm temperature sensor microchip (attribution: Byron Tarabata ; source; licence: CC0)

Workshop

Water Quality Monitoring
Begun after the public demo session (5pm, 27 Oct).
Results were presented the last day (11am, 29 Oct).

Rachel Aronoff described some of the water quality work that has been done as a participatory research project at Hackuarium and showed people how to do it - inoculating water samples on special bacteriological cards (more 'green' than your average plastic petri dishes, and taking up much less space) and incubating them at 35°C in a low cost incubator made by Harold Tay the first evening of the conference. The bioindicator bacteria telling that raw sewage got in the water, E. coli, can be seen as dark blue spots and general coliforms (bacteria, for instance, from other animals' guts) were seen as pink spots on these cards, due to each species' metabolism acting on chromogenic substrates included in the media. Counts of numbers per 100 ml of each bacterial type found in water samples, the *E.coli* bioindicators in blue and such general coliform colonies in pink, are used as the basis for many water quality standards. If there are too many found, for instance, a public beach might be closed for swimmers.

The scientific method, problems of getting others to take results from community labs and participatory research seriously, and best practices (taking 3 replicate samples, for instance, not just doing replicate cards from single water samples, as done for this workshop) were all discussed.

In the end, after 48h incubation, the numbers of colored spots were assessed and results were calculated. The tap water was clean (with no bioindicator colonies per 100ml), a toilet contained some bioindicator bacteria (300 bioindicator colonies per 100 ml), two of three water bottles from people were clean, and one was a surprise, showing tons of coliform pink colonies (That result was clear after the overnight incubation, and the bottle got washed right away the morning after the workshop!) For context, drinking water should have no bioindicator (blue) or coliform (pink) colonies, while recreational swimming areas are allowed to

Water quality monitoring with special microbial "cards"
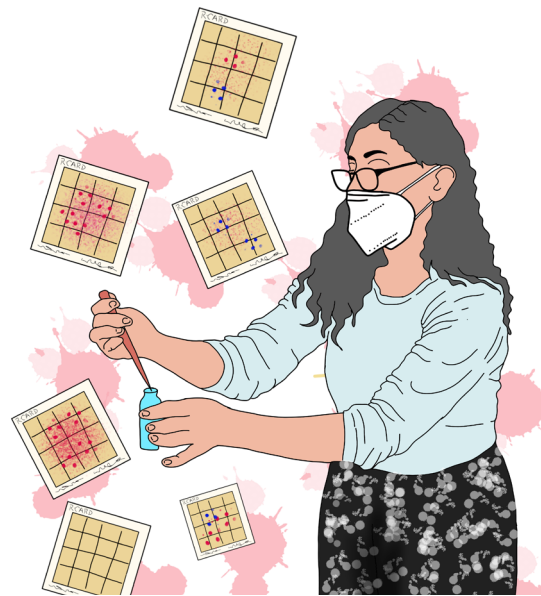
have up to 100 bioindicator bacteria per 100ml.

The canal water was relatively dirty (700 bioindicator colonies per 100ml), but a puddle in the grass outside the meeting session was dirtiest with about 5000 bioindicator colonies per 100ml. The participants speculated that animals that scavenge human waste also have a similar bioindicator, as demonstrated last summer, surprisingly, as part of the Montreux water study in Switzerland... (Seagulls have E.coli, too, we learned - and previous work by others had also demonstrated this before!)

Participants: Fernando Daguanno, Isaac Núñez, Goldjian, Raja2, Elias, Gourav Saha, Linda Aidoo, Jay Poh Wei Jie, Guillermina Actis, Lara Jatar, Katie Hoeberling, Paola Larrauri-Aguilar, Harold Tay, Martin Szyszlican.

On left Lara and Katie inoculating R-Cards and overview of results on right: (attribution: Rachel Aronoff; source; licence: CC0)

Discussing water quality results the last morning: Andy Quitmeyer, Carolina Borrero, Luis Felipe R. Murillo , and Adrian De Gracia (attribution: Rachel Aronoff; source; licence: CC0)

DAY 3: Friday Oct.28 Field Trip

Sessions continued

The third day was a blend of sessions and field excursions. 11 sessions were held in the morning with facilitators following any of the possible formats: mappings, exploratory, get the work done or learning.

In the afternoon, we had a 'seeing is believing' field trip to Gamboa. We split in three groups and visited the Summit Animal Sanctuary , the Smithsonian Tropical Research Institute (where butterfly, bat and ant research groups were visited), the Pipeline Road on Soberania National Parkand and the Digital Naturalism Laboratories (DinaLab), led by Andy Quitmeyer, the main local organiser of the event.

Field Trip

Photo of participants listening to a volunteer at the Summit Park Animal Rescue (attribution: Reinaldo Perez; source; licence: CC0)

The field trip was an experimental, new part of the gathering. It was organised for two reasons. First, we wanted to make sure that, while we had these participants visiting from all around the world, they would be able to get practical exposure to the actual field sites, rustic labs, and animal and research facilities in which important biological field work takes place. Second, the field trip was a way we could include more local participation by biologists,

conservationists, and animal caretakers, who were unable to otherwise take time off their jobs to join us for the conference. The field trip activity on day three succeeded at both these tasks.

Via an elaborate choreography, we managed to rotate 80 participants in groups of around 20 between several key sites:

Photo of Gasolinera, where attendees had their evening dinner (attribution: Andrew Quitmeyer; source; licence: CC0)

"Gasolinera" Cresolus Tropical Sustainable Architecture HQ - http://www.cresolus.com/

The Gasolinera served as the base station for the field trip's choreography and also the location for hangouts, the evening dinner, and ultimately dancing party. Ordinarily, the Gasolinera serves as the future offices and current workshop for Andrew and Beth Coates's Tropical Sustainable Architecture company, Cresolus, and is based around an old gigantic crane. Cresolus works to develop long lasting, cost effective means of doing construction for conservation and field sites. They do this in tropical regions around the world and work with national park infrastructure, while also spearheading massive reforestation projects, such as with Earthshot. They have furthermore decided to release their national park designs as Open Source.

Summit Park Animal Rescue https://turismo.mupa.gob.pa/parque-municipal-summit/

This is a governmental park (formerly a US botanical research garden), which serves as an animal rescue and rehabilitation for the unique, endangered fauna of Panama. Our primary contact host was Dr. Angie Estrada, whose team introduced us to their work and the specific challenges they face in their workspaces with wild animals, some rescued from various 'domestication' scenarios and others brought in from the jungle.

Photos of participants visiting Pipeline Road (attribution: Reinaldo Perez; source; licence: CC0)

Pipeline Road - Oleoducto Volunteer Services
https://www.instagram.com/oleoductovolunteerservices/

Beth Coates and Andrew Coates gave tours of Pipeline road to our group. Pipeline road is a historic site of active field research, and one of the most famous birdwatching sites in the world (https://en.wikipedia.org/wiki/Soberan%C3%ADa_National_Park). They also showed the work they have been spearheading with a rogue volunteer group that has been maintaining this neglected field site for the past 4 years (as it had been almost entirely abandoned by the institutional bodies that used to maintain access to these research areas). They showed the bridges rebuilt (also through the help of GOSH participants before the gathering), paths uncovered, and areas made accessible and safe, through the work of volunteers.

Smithsonian Tropical Research Institute
https://stri.si.edu/
Bat Lab
The Gamboa Bat lab gave tours of their experimental flight cages for studying the behavior and learning abilities of many types of Wild bats in Panama.
This lab is led by Rachel Page of the Smithsonian Tropical Research Institute. The tours were led by lab manager Gregg Cohen and other members of the Bat lab.

Butterfly Lab - https://www.instagram.com/gamboaheliconius/
The Gamboa Heliconius Butterfly lab gave tours of their rearing and experimental facilities for doing behavioral and genetic experiments with a specific type of butterfly, the Heliconius. This lab is led by Owen McMillan of the Smithsonian Tropical Research Institute. Dr. Denise Dell'Aglio, Sylvia Garza,

and other members from the lab helped lead the tours.

Ant and Fungus Lab - Alissa Geisse https://www.instagram.com/argeisse/
Alissa helped introduce participants to her unique ants that cultivate fungus and take over nests of other species.

Digital Naturalism Laboratories (Dinalab) - www.dinalab.net
Kitty Quitmeyer and Andrew Quitmeyer founded

Dinalab as an "institute for interactive jungle crafts" in 2020. It's a local makerspace that has been leading volunteer efforts to develop technological and scientific agency in the local community. They work on helping scientists build their own tools for biological field work, and strive for 100% upcycled solar-powered prototyping in the rainforest in Gamboa.

*Note: time restrictions with the field trip meant that not everyone was able to visit Dinalab during the field trip.

"The Field Trip had an ambitious schedule, with several buses and visits in and around Gamboa planned after a couple of unconference sessions.

Butterfly, Bat and Ant lab visits at the Smithsonian were amazing. A short walk up the Pipeline trail and Radio hill with the nice guide, Andrew, and his wife, Beth, was very interesting. The path's secret history may have helped make it the animal biodiversity center it is today.

The Summit Animal refuge was a last visit for some groups, before the dinner party night at Andrew's special place along the canal shore in Gamboa." Rachel Aronoff

A sleepy 2-toed sloth at the animal refuge, in a hammock with 2 others (attribution: Rachel Aronoff; source; licence: CC0)

At the end of the journey, we enjoyed an extraordinary sunset at the Gasolinera, and we were delighted by a great dinner, music and party late into the night.

DAY 4: Friday Oct.29

Governance update: Community Council and GOSH community governance – Liz Barry, Pen-Yuan Hsing

To achieve our shared mission as described in the GOSH Roadmap and Manifesto, we need to reflect on and develop a way for good community governance. In this session, Liz and Pen reported on what the GOSH Community Council has learned this week at the governance and Constitution table. The main question throughout the week was: "How do we hold power together?"

Pen set the stage with a review of how the first 2021 Community Council election was set up, which used almost exclusively open source tools like EUSurvey for voter registration and STAR Voting for more expressive voting. This was followed by introducing and giving thanks to the 2021-2022 and 2022-2023 Community Council members. In fact, the GOSH Community Council had their first in-person meeting since almost all of them were here in Panama. Pen expressed especially gratitude from the Council members to Bri for their incredible dedication and effort helping the Council do what it does.

"Our governance work included an election "autopsy" in early 2022 where we reached out to the wider community for feedback. We did this through in-depth conversations and surveys conducted in 4 languages across 7 communication channels (forum, Whatsapp, Telegram, etc.) to reach our global community. This helped improve the process for our 2022 election.

That said, we face more challenges as we not only improve the elections but also think about governance more broadly. For example, some questions that came up were "who is a community member?", "how to handle conflicts of interest?", or "which decisions should be made by the whole community?" Pen-Yuan Hsing

Liz then gave a report on what washeard during this week at the special table:

"We wanted to get community feedback on ways to be and work together and how to improve information flow. This is on top of elections for the Community Council.
The prompt that started each conversation was: "How have you previously experienced group decision-making?" There were diverse responses from experience choosing a restaurant for 6 people to go to, running hackerspaces, or remote coordination of disaster response.
Some messages we heard:
● GOSHers need enough information to meaningfully participate in governing
● Processes should be always open (like GitLab issues) to feedback
● Newcomers should be explained about the Community Council & about the linked organisations supporting GOSH, so they can look ahead to becoming more involved
● Make GOSH safe for failure → failure has to be OK and include a path to redemption
● Allow people to step up to decision-making and fail in smaller ways, so that they can learn how to manage more responsibility

- Respond to conflict in the moment in a way that is not primitive and punitive
- Decision-making should include running scenarios, test ideas assessing risk, and acting accordingly
- Build relationships between power structures and community because formal communication will never be enough" Liz Barry

What happens now? The Community Council will process what's been heard this week, while keeping the listening process open via this forum thread. It will also enlist the community's help as we draft the Constitution in 2023 and get it enacted. This is a delicate process that requires professional work. It's lucky that we are part of a community with many talents.

Before the session ended, we asked all Community Council members past and present to come to the stage, and thanked them for all they've done!

The presentation slides Liz and Pen used are archived here.

Some GOSH Community Council members, past and present, from left to right: María Frangos; Pen-Yuan Hsing; Liz Barry; Pierre Padilla-Huamantico; Laura Olalde and Harold Tay on stage fielding questions on the last day (attribution: Reinaldo Perez; source; licence: CC0)

First in-person meeting of the GOSH Community Council (attribution: Pen-Yuan Hsing; source; licence: CC0)

Roadmap session - Shannon Dosemagen and Jenny Molloy

Illustration of the GOSH Roadmap (attribution: Jorge Medina; source; licence: CC0)

Attendees work together to prioritise actions in line with the GOSH Roadmap (attribution: Reinaldo Perez source; licence: CC0)

Both during and after the 2017 GOSH Gathering in Chile, the GOSH community came together to collectively write the GOSH Roadmap, which outlines the concrete actions needed to make open science hardware ubiquitous by 2025. Now that five years have passed since it's inception, it was time to revisit the Roadmap and make adjustments based on the outcomes of the sessions that took place over the past 4 days.

To do this, Shannon Dosemagen and Jenny Molloy led a collaborative session where participants could collectively document and prioritise actions that can be taken after the Gathering to make open science hardware ubiquitous.

They began by giving participants a few minutes to write down ideas as Shannon and Jenny began organising them into the three categories established by the Roadmap: 1) Learn 2) Grow and 3) Support. Once all the ideas were categorised,

participants were broken into small groups to arrange ideas into actions with common themes, and prioritise them. Once this was done, the actions were laid across several tables, and participants were given a chance to view them and "sign-up" to any actions they wanted to contribute to. Some examples of actions include:

1)   OScH ambassador handbook
2)   OScH project directory
3)   Elevator pitch for OScH
4)   Pilot distributed manufacturing collaborative

The complete list of actions, and participants who signed up for them, was given to the GOSH Roadmap working group, who is overseeing the management of GOSH roadmap actions.

The working group has now released a plan for managing these actions, which you can view here.

Modding Camera Traps To Do Better SCIENCE

Illustration of Pen-Yuan Hsing during the Field Hardware (Camera Traps!) session (attribution: Jorge Medina; source; licence: CC0)

SESSIONS

Sessions Day 2 - Thursday Oct. 27

Block 1: 10:00 am

1. Software for Hardware

Date: 2022-10-27
Time: 10:00
Place: -
Facilitator: Clint
Notetaker: Josh (jyseltz@gmail.com)
Participants: Josh x2, Clint, Nicole, Andrew, Nicholas, Byro, Joaquin, Nat

Discussion notes
- Survey Stack is a good example of a software that can interact (in principle) with many types of hardware
    - different hardwares require different scripting resources, which is lacking maybe in documentation
    - do we have anything that can interact with ALL types of open hardware?
- Code that interfaces with hardware (via APIs) versus code that runs on hardware
    - to what extent do we need to account for both when trying to build software platform/ ecosystems that can handle any sort of hardware
    - "Machine Shops" -> if we think in terms of implementation interfaces, standards, and various levels (e.g. transport vs analysis), it might be natural to visualise it as a network
- Open Manufacturing platform
    - there is a problem with trying to aggregate data (or other output artefacts) that can result from the SAME TYPE OF HARDWARE distributed in many places; but also different types of hardware in the same location
- Vertically integrated stacks — proprietary hardware has traditionally been coupled with proprietary software.
    - it's very important to be smart about making decisions about where interfaces exist, and not re-inventing the wheel
- camera trap example: lots of devices distributed over geography, need to aggregate data and analyse in central platform
- Closed System vs Open System (IoT) Hardware -> to what extent are "closed systems" meaningful today (or in 5 years)? Even "closed systems" like a roomba which don't actively input or output data are still trained on data which has been taken from other environments.
    - even in cases where we want to deal with data ingress, but not necessarily sharing (e.g. a home thermometer that we don't want to share for privacy reasons), layers of standards are helpful if we want to do comparative analysis (or apply machine learning)
- What are the layers of interest?
    - Data collection
    - Data transport
    - Data analysis
    - User interface
- Standards for these already exist, right?
    - We need to distinguish between standards as in "high standard / low standard" versus standards as in "everyone is using a common format"
    - Exchange formats
    - ...
- Control and management of devices
- Open data is hard enough to find in the first place, but then without a clear understand of HOW THE DATA WAS COLLECTED there is a much bigger challenge
- Software Supply Chain (software provenance) e.g. OpenChain Project

Links: Please include in these notes any links to resources used and things created as part of this session. For example:
·   https://app.surveystack.io/
·   https://en.wikipedia.org/wiki/OSI_model
·   https://www.openchainproject.org/

2. Global Emergency Strategies - Lessons from COVID-19

Date: 2022-10-27
Time: 10:00
Place: Tucan room
Facilitator: Amanda Matthes (amanda.matthes@gmail.com)
Notetaker: Amanda Matthes (amanda.matthes@gmail.com)

Participants: Amanda Matthes (University of Oxford), Gabriel Naor (International School of Panama), Andres Colmenares (Open Climate), Rajas Poorna (Georgia Tech), Lenin Rueda Torres (occupational and environmental health)

Discussion notes (grouped by topic not chronological)
- Who are we?
- Gabriel: Student in school, encouraged to come to GOSH by teacher
- Amanda: PhD student working on open source hardware for biologists
- Andres: Strategist
- Lenin: Technology and medicine, works for the government on topics of occupational health
- Rajas: PhD student working on diagnostics with Raman spectroscopy
- How did COVID-19 impact our work?
- Amanda: Global Chip Shortage
- Amanda: Affects smaller projects disproportionally
- Andres: Drought in Taiwan is a big cause → climate change connection
- Lenin: Facemasks
- Availability and efficiency testing was difficult in many countries
- Lenin used open source hardware to test face masks
- Rajas: Built cheap PCR during the pandemic and a way for healthcare workers to take blood without air exposure (https://www.rajaspoorna.com/covid-kiosk)
- Geopolitics in an emergency
- Andres: We need to be able to work across borders
- Climate change
- Andres: Climate change is a climate emergency. Not enough action is being taken.
- Education
- Andres: COVID-19 shutdowns gave me the opportunity to learn new skills and space to think and do lots of things. But I also know people whose education suffered.

---

3. Ensuring Open Hardware is captured in Open Science recommendations

Date: 2022-10-27
Time: 10:00
Place: Outdoors
Facilitator: Jenny
Notetaker: Greg

Participants: Jenny, Alison, Katie, Shannon, Dorn, Dario, Greg, Paula, Moritz, Gina Leite (gleite@wcs.org), Guillermina

Discussion Notes
Initial round of discussion (who, what do they want to achieve)
- Jenny - open science has gotten into a lot of rooms that were inaccessible... and we need to piggyback on that success.
- Alison - is seeing changes in open science and wants hardware to be involved. Wants to do a policy series on this topic after this trip - that'd be an opportunity to implement those.
- Katie - seeing in funding spaces talk about open science (NSF as example). Same idea - how to capitalise for open hardware
- Shannon - +1 to above. Environmental space open hardware is the 'stepchild' of the open science movement. Lots of misunderstandings and blank spots - OScH needs to be part of / central to / understood completely by. 2023 will be the year of Open Science... OScH HAS to have a place in that.
- Dorn - OpenTEAM + GOAT is ag related and should be focused on hardware and software. Wants to look at foundations, private, and others to better understand that full ecosystem. Need to think about the vertical structure, and how do we get it into contracts (hacking the system).
- Greg - +1 I want people to connect - there are experiences, strategies, and stuff we should share.
- Dario - with CZI on the funding side with Open Science program... currently lacks a portfolio focused on OScH. They've seen similar problems apply to parts of outputs which they see as critical. Preprints and open access publications... Despite the fact that their impact is massive, they are virtually absent from the standard recommendations. Open source research software is similar.
- What strategies worked. What can be generalised to OScH.
Paola - wants to include these ideas in her thesis work working in Fernan's Federici lab, Laboratorio de Tecnologías Libres, in Pontificia Universidad Católica, Chile
Diego - Works in different projects with universities, wants to ensure more people have access to open

science

Moritz - Wants to further OScH, Berlin University Alliance wants to push OS generally, and that may be an opportunity of OScH

Gina - (with WCS host or for Cit Sci for Amazon Network) How to institutionalise OS culture within their Amazon Network, and create a culture for innovation?

What are the conversations we need to be in

Prompt: What are the words / arguments one could use to get OScH (Open Science Hardware) into OS (Open Science) conversations?

- (Alison) had a workshop around this a year ago. Here were the arguments that worked.

   - DON'T FUND THINGS TWICE - this was an argument that seemed to connect

  - NEW WAY OF COLLABORATIVE SCIENCE - this is one key element of a drastically collaborative approach.

- (Shannon) but the problem is we keep having a message that it's education only... that really limits OScH applications... we need to get people to understand that it's broader and applies to real actual infrastructure. Luis Fillipe - hardware is critical infrastructure!

Question

- (Dario) (a) should we coordinate messages across a leader and let them run, or (b) should we create general principles that everyone can pick up.

  - (Shannon) We need (a)... we need case studies!!!! We need narratives and evidence

  - (Jenny) We need evidence to point to... case studies also.

  - (Moritz) We are assuming that people in power are acting in good faith... Some do, some do not. You can engage

  - (Greg) We can't generalise success because it's so custom. We need to find those good faith actors (as Moritz said) to unlock how you actually 'do' the process in any given situation

- (Dorn) Here's a case example

  - Inspire - you have to have successful examples (culture)

  - Equip - here's the toolkit you can use (contract language, tooling, design standards)

  - Enforce - enforce bad actors or people who get off track (back to non-FOSS) (contractual enforcement)

- (Shannon) Similar examples in EPA and their experiences

  - a main problem is the siloing of spaces... and they need a support group for those people who have 'drank the cool aid'... how do we get them together to recognize they are not alone.

  - (Dorn) it's important to help people find you, so

they can start

  - (Moritz) look to Research DAta Alliance

- (Alison) this is all about people! How do we broaden the community! Is there room for new professionals, professional development, fellowship?

- (Katie) can we also ensure that narrative includes not only how things are better/easier/etc. but also DEI.

What rooms are there and are we in it, or can we get in it?

- US

  - UNESCO - we're in the room!

  - RDA - we're in the room!

  - NASA - they are interested

    - HDF (see next steps)

  - USDA -

    - Open Data Act created a cross agency act, and data interoperability is a key, so connecting with that.

    - Waldo - working on state level software contracting strategies.

    - Globe.gov project (NASA, State dept, NSF). Natural fit but definitely could be an ally.

- Outside US

  - European Commission

    - (Guillermina) Horizon 2022 or other funding schemes. Lines of funding that recognizes bridging of OS projects. And European policy is very influential in South America as well, so there's a broader impact there.

    - (Moritz) European Parliament (know an MEP)

    - (Guillermina) previous discussions with MEP weren't very successful, but maybe through Horizon or other things.

    - (Dario) ED of creative commons was an MEP - may be a connection

  - Direct European Govts.

    - France, Netherlands,

  - La/referencia - engaged already in expanding OS, maybe a conversation with OScH could help

  - African Academy of Sciences, influential on the conference

  - Science Foundation of Africa (competing with AAS)...

Wrap up

- (Katie) involved in climate action conversations

- (Diego) fellowship programs are a good idea, young professional in latam

- Meet people where they are... how to reach out?

- (Moritz) Jobs... Workshops used to create tech in universities (in Germany)... how could we integrate makers into this and focus on Open Hardware. Lack of trust is a problem.

- (dorn) 1) Hardware and climate is a huge

opportunity. 2) Professional Development 3) FAIR and CARE.

ACTION: New Ideas
- Could we propose training programs, fellowship, etc. (that big orgs like) specifically at the policy or large govt. level.
- ?? - We need well evidenced case studies! Let's create them to support additional change.

ACTION: Rooms we need to be in
- Consider joining RDA, work to get FAIR implemented.
- Pen - to think about how we can connect OScH in NASA...
   - Consider going through HDF Group University of Illinois, they are working with the software and data standards side... could we work with them to engage Open Science Hardware!
- Dorn - connect with Waldo about how his contractual software success could be applied to the USDA case.
- Jenny - connect with MEP, how do we get involved in that.
- Dario - ED of creative commons was an MEP -

may be a connection
- Guillermina - La/Referencia connection
- ?? - In Africa... what options are possible.
   - African Academy of Sciences, influential on the conference
   - Science Foundation of Africa (competing with AAS)...
- Gina - Capes organisation (brazil)

Talking more about it
- (everyone interested) Professional Development concept... flesh it out!
   - feel free to make a session on this!
- (Filipe, everyone) Strategies to reach out to new folks... talk and write up... there's a session on that!
   - there's a session, join!
- (Moritz) Workshops used to create tech in universities (in Germany)... how could we integrate makers into this and focus on Open Hardware.
   - Talk with Josh - he's creating systems to replace tech transfer, he'd have interesting ideas. Open Software Programs
   - There's a session on this, people should join!

---

4. Collaborating with Small Communities

Date: 2022-10-27
Time: 10:15
Place: Outside the eating area
Facilitator: Marcela
Notetaker: Johanssen Obanda

Participants: Brianna, Ian, Juan Pedro, 5 Participants

Discussion notes
- Collaboration is important in growing the impact and outreach of OSH work.
- It is based on equal access, where all the community members who do not have OSH in their hands can access it and collaborate equally.
- The community is made up of people with common interests, common challenges, self-organised groups, shared contexts (vulnerability,

underserved, small, ...)
- Examples: JAY4T collaboration with local schools in Kisumu, Kenya https://www.youtube.com/watch?v=DcLqyc5n6tc
- Collaboration is not about we vs them, but us together. Good collaboration means fixing things at a local level; community engineering and embracing/integrating traditional knowledge. No to "helicopter help":
- Indigenous communities have for a long time contributed OSH knowledge throughout their communities. However, socio-cultural protection is needed to preserve local knowledge and OSH practices.
- In community collaboration for osh, it is ideal to create an environment for active listening and self-directed science research (community science, and participatory approach).

5. So crazy it might work!

Date: 2022-10-27
Time: 10:15
Place: Neque room
Facilitator: Ryan
Notetaker: Ryan/Niko Obanda

Participants: Ryan, Niko, Ernesto, Constantin, Amanda, Bill Hatcher, Shannon Hicks, David, Jay, Genesis, Linda, Alexandra, Rachel

Discussion notes

Some ideas were websites with more teardowns of scientific equipment, government sponsored open science hardware, assistive tech for scientists with handicaps, an open microfluidic cloudlab and marketplace, and ways to biohack health (cheek cell chip? Digital self peeps?).

6. Shake your body! (you nerd)

Date: 2023-11-27
Time: 10:30
Duration: 20 minutes
Place: Outside park
Social media links and hashtags: @alquimetricos
Facilitator: Fernando Daguanno, @alquimetricos

Participants (15 to 17 participants): Rachel Aronoff, Goldjian, Martín Szyszlican, Linda Aidoo, Tiago Lubiana Alves, Alexandra Covor, Isaac Núñez Quijada, Tamara Matute Torres, Rajas Poorna, Elio Challita, Carolina Borrero Arias,and many more!

Notes:
Outdoor playful activity. After some physical warm-up, we learned the basis of Alquimétricos hubs connections and started linking sticks and pentagonal hubs together. After breaking up into groups of 3 members, we built big equilateral triangles. After all of them were verified, we joined all triangles together into a big icosahedral structure, not without some puzzling here and there. All participants went through the collective experience of building a predetermined geodesic structure without knowing it, with bare instructions of the individual pieces' link (but not the plans for the whole figure).

Then, a brief introduction of the Alquimétricos project mission and vision was presented, and we all shared a photo or two and the joy of being collectively shaked nerds.

Block 2: (Thursday, 11:00 am)

1. Environmental monitoring and conservation

Date: 2022-10-27
Time: 11:00
Place: outside
Facilitator: Shannon Dosemagen, Alison Parker
Notetaker: Katie Hoeberling

Participants: Andr (open climate), Luis Felipe, Mara(synthetic bio), Isaac (synthetic bio), Amanda (wildlife tracking), Lenin (enviro health PM in Lima), Guillermina (cit sci./enviro sci.), Lara (local organising), David (org that funds scientists, underwater robots), Rachel (water monitoring), Shannon (water quality research, EnviroDIY, Elio, bioengineering, insects), Martin (open data, civic tech, water quality, evidence --> courts), Valeria (teach science prototypes), Diego (biotech hardware), Clint(high school students), Gaurav (synthetic bio), Laura (visual artist, intersections b/n art + molecular bio), Josh (conservation, camera traps), 22 people

Notes:
- Look at themes from roundtable on OSH + low-cost tools in environmental monitoring
- What is happening outside the US?
- Choose 3-4 key messages, work through them in smaller groups
- Building trust b/n communities and gov't, and tools and their data
- Interconnected resources
- Coming together for tool evaluation standards
- Trust
- Will communities, lawyers trust devices enough? Gran Morelos canal, Mexico to connect airports and create industry hub, using Raspberry Pi to collect data, Martin is part of group creating dashboard
- Using water from river to cool gas, heating up rover
- turbidity, heat, pH, conductivity
- Water quality; jazz festival effect --> more people, more pollution in Lake Geneva
- open data related to PM in Lima
- When you choose a low-cost sensor, try to export the data, can't compare data from other parts of the world
- Use Chinese sensors, European sensors;

different platforms; standards in Peru
- water quality research lab, works w/ fishery and bug people who use expensive instruments for testing
- But want to do real time monitoring, which gets very expensive
- Used to use low-cost sensors, but people started questioning the data. Had to use expensive sensors for people to take their data seriously
- have an amazing record from high-quality instruments at very different costs, can validate cheap sensors
- road salt for melting snow/ice --> washes into streams, town discovered their stream was saltier than ocean at several points in winter, reduces stream health
- power company funded them to do controlled lab tests, then apply in streams
- If you can point to research that others have done, even if you can't do it yourself, gives your data some meaning
- Can't just show raw data, how can your data be backed up by other data/studies they can trust
- Can you recommend validated low cost sensors -- list on website, other groups maintain lists
- point to list of validated sensors
- Lake Victoria, Kisumu in 3 countries, high polluted
- fish farming is a large source of cash, pollution interferes with this
- innovation hub came up with sensor to monitor pH, not necessarily low cost but easy to use because doesn't need internet, took 5 years to test prototype
- desperate to see what works
- gov't not very involved in this conversation
- Take a baseline before changes (e.g., before power plant is constructed)
- Make sure your research is on policymakers'/ agencies' radar
- Sparks
- Establishing a common language to truly understand needs
- German standardization body: established std. for OH documentation, history of standards, how to advance standards that are needed

2. Environment / Conservation Biology – SubGroup about "Interconnected resources and pathways to shared solutions"

Date: 2022-10-27
Time: 11:00
Place: Outside Tables
Facilitator: Shannon and Allison
Notetaker: Gourav

Participants: Gourav, Clint, Laura, Isaac, Lara, Allison, Josh, Guillermina, Tama, Andres

Discussion notes
What is needed to make progress into making interconnected resources and pathways to shared solutions. What can be do to make the community be more interconnected
What are the interconnectedness of the people currently in the session group?

The different parts of our conversation is:
- Interconnecting Resources + Pathways
- Shared Solutions
- Needs:
- Finding the common language in the context of languages as well as in the context of the interdisciplinary nature of the research that we do. In a way, a biologist and an engineer speak two different languages and we have to translate that to a common language in order for everyone to understand the conversation.
- Finding boundary options (a part of social science) that are okay with all the stakeholders
- Listening is an important aspect of someone who doesn't necessarily have the same needs as someone else.
- Communication is one aspect but we should "look at our differences differently". Paulo Tiere also connected to interconnecting.

Opportunities

Boundary Objects - we have translations but we need to translate the idea and the field itself not just the language. Maybe make something like google translate that translates ideas

Instead of trying to establish interconnectedness, we should look at the needs first and actively listen to the stakeholders. When working with communities, the engagement with these communities should be established as very important roles.

Interconnectedness would mean checking up with the stakeholders of the solutions you are providing to get feedback and go through iterative design to further better your product.

---

3. LAB HARDWARE-1

Date: 2022-10-27
Time: 11:00
Place: Large Room
Facilitator: George (Albercook@gmail.com)
Notetaker: Dorry (owinoadhiambo@gmail.com), Pierre (pgpadilla@uc.cl)
Participants: –

Notes:
Multivoting process was done to select which topics would be discussed in the sesión.

Do/Have:
- 3D metal printing
- Soil Respiration Meter
- Passive Acoustic Monitoring
- Flow-through Colorimeter
- Open Flexure Microscope
- Microscope
- Incubator (Large door)
- Aperture Adjustment Knob
- Pipetting robot
- Motorized XY scanning stage
- Portable Gas Detection Sensor
- RasPi/Arduino based Data Collection

Work in Progress
- UV/Vig
- HPLC
- Spec
- Spinning Incubator
- DNA electrophoresis (cheap electrode)
- Micropipettes
- Digital BPM tube connector (ensure proper connection between internal + external blood pressure monitor)

Want
- Microbiology incubator *
- Rudimentary Mass Spec
- PCR
- Electroporation Device
- Low RPM Centrifuge
- Position encoder

· Droplet microfluidics pump
· Fluorescence microscope electronic control + focus
· Bioreactor- mammalian cell
· CO air quality sensor
· Raman, FTIP, ATR, Maldi-TOF, NMR, HPLC
· Water Distillation Stills

· OptoElectrowetting

*one made by Harold Tay during the Gathering for R-Cards for the Water Monitoring Workshop
**many of list are part of Hackteria network goodies. i.e. https://www.gaudi.ch/OpenDrop/

---

4. Artificial Intelligence (AI)

Date: 2022-10-28
Time: 11:00
Place: Ñeque
Facilitator: Constantin - Zalmotek.com
Notetaker: Alexandra - Zalmotek.com

Participants: Niko, Linda, Josh, Alexandra,7 students from Panama school with their robotics teacher

Exploratory session

Discussion notes
In the last few years, AI has been evolving rapidly, solving lots in tedious or overly complex tasks. We invite you to participate in this exploratory session to find out how we can use AI to our advantage.

What aspect in your day to day work do you hate the most/consider tedious and it could be automated with AI?
Answers:
- spelling correction (Grammarly)
- AI assistant - general tasks
- AI assistant for answering questions from domains we are not interested in and we don't have knowledge about
- note taking, captions
- writing, generating new content
- personalised recommendations - social media learning about our passions
- self-driving cars
- speech to text for meetings when too many people are talking
- AI for design, Photoshop, correcting pictures, video editing
- e.g Disney uses AI + 3D modelling for 360 video generation
- animations, making 3D animations look real (cleanup) → Stability - open source tool
- searching for a word you don't know when reading in another language takes a lot of time

- long time lapses take hours to edit
- field biology, going to places far away is complicated because you have to carry so much equipment to analyse big species - make the equipment smaller
- making the BOM and searching for components in stock when designing PCB
- research before starting a hardware prototyping project, checking compatibility between components and sensors
- video editing: lights + colours are very hard to match manually, maybe an AI could read the whole scene, and decide the right combo and how to imitate from other scenes
- when switching from an IDE to another the buttons are not the same/the interface is different, maybe AI could be use to "google" the function you're looking for
- AI for writing code, software copilot
- AI in medical areas - language interface.
- AI in agriculture - direct integration

Open source tools for AI:
- Hugging face (https://huggingface.co/) - open source AI models (speech recognition, image recognition etc)

How do we feel about AI?
Answers:
- we should be working hand in hand with AI
- AI can fail for you faster - automated testing to discover what works and what doesn't work
- You would rather trust a human than an AI

How can we interface with an AI?
- Blocks, nodes - visual programing

Conclusions:
- Any type of AI has to be done in a hybrid way in the beginning: human decisions + AI. After it learns it can be used by itself, without human help.

5. Business Models for OSH

Date: 2022-10-27
Time: -
Place: -

Facilitator: Ryan
Notetaker: Obanda

Participants: Rajas, Greg, Ian, 5 participants

---

6. Hardware for Academia

Date: 2022-10-27
Time: 11:00
Place: Outside
Facilitator: Moritz
Notetaker: Pablo, Juul

Participants: Juul, Bill, Harold, Byron, Pablo, Ernesto, Pablo, Juan P. Maestre

* Ernesto: a bit of behaviour, bit of molecular biology, high school biology teacher
bill: panama, innovation stem teacher in Panama
* Harold: Singapore, engineer by training. passive acoustic monitoring for wildlife monitoring. never been academic but find them to be very strange lot
* Pablo: physics teacher, work in development of open science hardware for teaching science also agro science for land management, water monitoring
* Byron: work in developing microchips. Only one university can design chips. trying to involve more people to break the barrier between this one uni and other universities.
* JP: work as research associate at UT Austin. Science, microbiology and health.

Notes:

What do people talk about in Academia? Participants share their experience with open source hardware and proprietary hardware at the academia.

Juul: 1. transfer office barrier. 2. if no one is selling a piece of equipment then it doesn't matter if it's open.

JP: production after you have a prototype. Scaling.

Ernesto: difficult to compete at high level using open source hardware. Difficult to get reactives in Panama.

Bill: not thrilled with how much we depend on corporate tech. better educate educators about open source tools, e.g. how to manage a network and how to teach kids

Pierre: from Peru. supply chains. We deal with customs in chile. i have to pay maybe 10% more and if you have a small budget then it's a problem. hard to reproduce any open hardware design. from local supplies you often can't get the components you need

Harold: I think what I bump up against most is the fact that academic scientists are _the_ scientists. The way science is practised now cannot be practised in any other way than in an academic setting. Scientists are academic firsts and scientists second. subject to an incentive structure that discourages the ... science.

Pablo: universities sometimes use very expensive equipment for research and also for teaching. an open source spectrometer for teaching doesn't need to be the same. we have had some struggle with getting equipment for teaching physics. We've also developed all the equipment we need for 1st year and 2nd year.

Byron: Sometimes you have a piece of equipment but the person who knew how to use it has left and no one knows how to use it. They are very worried because they have very expensive equipment no one knows how to use. trying to do reverse engineering to figure out how to use it.

Moritz: as an academic it's publish or die. You can't overestimate how that shapes every action you do. We want to make everything in our lab as open as possible. There are other labs that work on similar things. If someone else can take our hardware design and snipe us by skipping that step. We want to be open, but we have to keep it closed for some amount of time in order to get funding for the future.
Motivation: - If we disregard the "publish or die" and perverse incentive structure of academia what would you actually want to be doing

JP: empower communities to air quality monitoring. We don't publish because we didn't do it, we used the info from the open hardware community. We want to publish about the benefits of the open hardware experience.

Juul: make it easier to build their own labs.

Ernesto: Transition between academia to make an impact in the general public and that's a gap, and part of it is funding. In the paper they want to have an impact outside of academia but in reality it's not happening. It would be useful to convince universities to have a maker space. On the contrary, at high school we have maker spaces.

Bill: not a researcher. k-12 educator. finding ways for research to happen outside of academia is important. As a K12 educator we are restricted

in what we teach based on what the universities want/expect the students to know. they have a specific skill set they expect

Pierre: in some courses for undergrad students. They have not only proprietary tools but also open source tools. After discussing with students That's not always the case. Often students are only trained in a proprietary tool so that's all they know. If you teach them both they can pick whichever tool they think is appropriate and often I see them pick the open choice. In terms of research in the institute where I work they try to develop these hardware tools for understanding human microbiome to understand single cell interactions. Sometimes when you want to perform new and complex experiments then you need a lot of money to buy the equipment. If you could put all of the equipment in a small space and control it remotely. That's why we are trying to design this microfluidic design that could help. We need to tell the story of successful projects like Arduino.

Harold: pass

Pablo: The only way to teach science is by using open science hardware. We need the people who use the equipment to understand how it works. Sometimes we also use very expensive equipment where cheaper and open equipment could do the job. Also repairability.

Byron: pass

Moritz: Agree with you on cutting costs. IN the electrofish project we're building hardware to talk to a fish (open hardware that you can buy with open hardware you put on top of that). Buying one of the units for scientific instrumentation would cost 16k euro per unit. It's not even that this thing is exactly what you need. E.g. We need 4 channels but the only unit available has 128. We want to have hardware that is exactly what we need for our s. Specific use case. Goal: Cutting costs and limiting resource usage (don't use a bigger piece of equipment than needed). How to build a maker space that would live even if you get funding for 3 years with no warranty you will continue after that. We need a certification from the IT department to connect our equipment to the grid.

Harold: part of the perverse incentive structure is that no PI wants to be part of a low cost project. They want to be part of a high budget project. **So, let's make OScH projects expensive**.

GitLab/GitHub repository:
-	Open hardware for teaching physics: https://osf.io/e7nxd/
-	TU Delft Makerspace: https://www.makerspacedelft.nl/
-	Open tools for chip design https://theopenroadproject.org/
-	Open FPGA design https://f4pga.org/
-	open microprocessor architecture https://riscv.org/
-	ElectroPEN lighter igniter based electroporator

---

7. Right to Repair

Date: 2022-10-27
Time: 11:00h
Place: Back of Toucan Room
Facilitator: Nat
Notetaker: Mihnea

Participants: Nat, Mihne, Mada, Goldjian, Jay, Jason

Notes:
This was an exploratory session in which we tried to identify what are the main barriers that stand against Open Source and Right to Repair becoming the norm.

The main culprits were rather obvious:
corporate greed
perceived profitability
legitimacy
liability issues
misinformation
The real challenge was trying to find a blocker that only applied to one of the movements, and the consensus was that Right to Repair is embedded in the Open Source philosophy

8. Open Science Hardware - Wikipedia

Date: 2022-10-27
Time: 11:24
Place: Tucan Room
Facilitator: Tiago (wiki nerd), contact info: @lubianat (twitter) tiago.lubiana.alves@usp.br (email)
Notetaker: Nico M. (levadurologist)

Participants: Marcela (Buenos Aires), Joaquin (Mendoza, estudiante), Andy (Gamboa, dynalab), Dario (Italy/US, volunteer contributor, works at wiki foundation research team), 6 participants

Notes:

Tiago presenta la Wikipedia con su computadora. Se puede editar fácilmente desde una computadora, pero también desde el celular con limitaciones.

Hablamos sobre la desigualdad de cantidad y calidad de artículos en diferentes idiomas.

Crear una cuenta es muy fácil, no es necesario ni un email.

Entramos al sitio del "Open Design Movement" en inglés, y vimos la diferencia con el artículo en español. El artículo en español tiene menos contenido. La página de "Open Hardware" es más similar entre idiomas.
(Tiago presents Wikipedia with his computer. You can edit it easily from a computer, but also from your mobile phone with limitations.

We talk about the unequal quantity and quality of articles in different languages.

Creating an account is very easy, you don't even need an email address.

We went to the "Open Design Movement" site in English, and we saw the difference with the article in Spanish. The Spanish article has less content. The "Open Hardware" page is more similar between languages.
Translated with www.DeepL.com/Translator (free version))

Wikipedia shapes public discussions a lot!

Each page belongs to categories, shown at the bottom of each article.

It's better to add to an existing page than create a new one. New pages will have lots of errors and will probably get deleted.

Good first contributions:

Add links to articles.

Edition summaries are important when changes are "controversial" - even slightly.

We browsed articles around open hardware, and learnt how to add links with the editor. We also realised that there are two list articles on open hardware, and proposed a merge.

To create an article about GOSH, it must have independent coverage in reliable secondary sources. For example: mainstream news, scholarly articles (not self-written), books, etc.

There is a "beta" feature of wikipedia to translate pages.

---

9. Assessment

Date: 2022-10-27
Time: 11:30
Place: Outside
Facilitator: -
Notetaker: -

Participants: Andrew, Dorn, Gina, Jenny, Josh

Reference document: An open toolkit for tracking open science partnership implementation and impact: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6904887/

Work document: https://docs.google.com/document/d/1rKOl6jYKkY4a5mWxZ8bvO0xTK-9-le7LU4vF30bk8C4/edit

Block 3: (Thursday / Jueves, 01:00 pm)

1. Ethics

Date: 2022-10-27
Time: 13:00
Place: Back of main room
Facilitator: Martín @martinszy
Notetaker: -
Participants: Bunch of people, around 4

Enemies to allies (it's a gray area):
- Corporations
- Nation-states / war (eg: russia-ukraine, crisis in sri lanka, etc)
- War
- Neo colonialism
- Intellectual property copyright mafia
- Centralisation of power / hierarchy

Protect common goods:
- Open science hardware medical devices
- Accessibility >> government subsidised really expensive devices || purchasing of goods
- Customizability >> "fake" customizability, open core, expensive modules, limited modules
- Access to information
- Manufacturing
- Repairability
- International collaboration > borders, immigration policy

Solutions :
- International collaboration networks for communities
- "Research" visas by GOSH like digital nomad visas with UNESCO sponsorship
- Focus on """"OPEN"""" countries
- Anti-censorship technologies
- Project licensing, debates on GPL4 and exclusion vs compatibility
- Project collaboration frameworks: standardisation and inclusivity

---

2. Field Hardware (Camera Traps!)

Date: 2022-10-27
Time: 13:00
Place: Tapir room, back table
Video-conference: N/A
Facilitator: George, Pen, Darin, Jason
Notetaker: Josh (jyseltz@gmail.com)
Backup of raw notes: http://txti.es/gosh-2022-camera-trap-notes-20221027 (Internet Archive snapshot)

Follow-up forum threads:
- Depth Sensing Technologies for Camera Traps
- Camera trap hacking thread
- Near-sighted camera traps

In this session, Pen-Yuan Hsing ("Pen") (@hpy) and Harold Tay (@Harold) showed participants about their work on hacking motion-sensing camera traps to improve biodiversity monitoring.

Pen began the session by introducing what camera traps are, and how they are used to monitor wildlife populations, using observing species in a forest as an example. These cameras are built with weather-resistant housings that include a night-vision camera triggered by a passive infrared (PIR) sensor. As animals move past the camera trap, their movement triggers pictures to be taken. Scientists use these pictures, plus metadata like the location of the camera trap and timestamps, to estimate population parameters.

To go from a bunch of photos to estimating population (specifically "abundance"), scientists have developed mathematical models that would take these observations as input. These models also need some other parameters, such as (but not always limited to) the distance of an animal from the camera when the picture was taken, or the angle of that animal relative to the camera. There are various ways to estimate these spatial parameters, such as with computer vision, or painstakingly putting equally-spaced poles into the ground in front of the camera at known distances and manually estimating the distance/angle of each animal relative to those poles.

A solution Pen and Harold are working on is linking two camera traps together, side-by-side, and triggering them at the same time to obtain stereo images. Thanks to the principle of parallax, you can use the difference between these images to calculate spatial information, including what's needed for the mathematical models to estimate population.

Harold showed us how he rigged two camera traps together to get these stereo images. This approach is designed to be flexible, so it's not limited to two cameras, but could be many. Or, you can use the camera trap to trigger other things, or use an external trigger for the camera.

We also discussed methods and technologies that

may support this effort, such as other distance-sensing sensors, how to scale up this hack, does it work with animals that are not endothermic? We also briefly discussed other sensors for biodiversity monitoring.

Additionally, Denise (@denisedd) showed us her work using camera traps to observe butterflies at the Smithsonian. We briefly discussed, and developed a solution (thanks to Andy @hikinghack) to add "eyeglasses" to fix the nearsightedness of her cameras so that they can clearly see the butterflies even when they are very close. This solution was successful as described by Denise in a follow up forum post, and is a game changer for their research. This is another example of the spontaneous collaboration that could only happen at GOSH.

Through the session, we reflected on Pen and Harold's proposed solution as an engineering review, and it seems to be sound. Therefore we believe this was a productive session that provides confidence in further pursuing this open science hardware project, was also interesting for all involved, and a good use of the valuable time at this Gathering.

The camera trap session was bigger than we expected! (attribution: Andy Quitmeyer; source; license: CC0)

A camera trap that Harold opened and modded to link it to another one. (attribution: Laura Olalde; source; license: CC0)

On day 2, Harold demoed how camera traps can be linked together (attribution: Laura Olalde; source; license: CC0)

The GOSH illustrator, Jorge Medinacreated this drawing from the show-and-tell during the session (source: Jorge Medina; license: CC0)

---

3. Art & Science

Date: 2022-10-28
Time: 13:15
Place: outside tables
Social media links and hashtags:
- https://www.instagram.com/zalmotekdotcom/
- https://twitter.com/GOSHCommunity/status/1585704391033688067?s=20&t=7Lx-xVhHQ-2waeVtZFFkUQ
Facilitator: Alexandra Covor https://www.instagram.com/alexandra.covor/
Notetaker: Mada Banica https://www.instagram.com/mada_elena_b/

Participants: Gourav, Linda, Gabriel, Elio, Bri, Rajas, Dorry, Rachel, Goldjian, 11

Notes:

Alexandra: embedded engineer → loves pcbs and art
Gourav: synthetic biology
Linda: Data analyst → colorful graphs/Canva
Gabriel: Student → Graphic design
Student → art class
Elio: PHD in bioengineering → structures of insects
Bri: Community coordinator Gosh → drag performer
Rajas: Bioengineer → diploma in animation
Valeria: industrial engineering → kids courses
Dorry: software engineering → performing arts

Rachel: Hackuarium → democratising research and presenting data artistically
Mada: electronics engineering → drawing/photography

Intro

PCBs are hidden in the final product, so usually they are plain/boring with no special designs.
Molas are quite similar to PCBs, you need to go through layers to expose the ones that work for you.

Art & PCBs
Hands-on experiment to understand how PCBs are designed. Every participant gets 3 sticky notes, each one representing one layer of the PCB:

- PCB layers
- Base - pink
- blue - copper
- green - solder mask

- Exercise for creating PCB
- Done is better than perfect
- Rajas: PFB: printed flower board (one of the project created by a participant was a flower form)
- Everybody would be curious to actually try to do PCBs after this exercise

- kicad → the place to start learning PCBs

- Where are PCBs made?

- Usually in China because it is cheaper
- There are some other local ones in Europe and US (example: EuroCircuits, OSHPark)

How do we use art and science to empower our communities?
- Projects made by students in Kenya:
- https://youtu.be/Z9SkApXBsCs
- https://youtu.be/wdhbIJXGKyA
- LED bracelets: https://www.instagram.com/p/CV84koaszyf/

Art in STEAM education

- Workshops or education experiences that the participants had:

- Electro Luminescent paint (https://www.youtube.com/watch?v=eUUupR-ongs)
- It is a way to attract more people/ young people to the field
- Collective empowerment for repairs
- Bio lego pieces that the students need to auction for with fake money. With the pieces they needed to build a solution to a problem
- Leading students to publish peer reviewed studies
- Using the laser cutter in classes in highschool
- UNICEF workshop: 3D printing with recycled plastic
- Genomicintegrity.org

---

4. Public Policy

Date: 2022-10-28
Time: 13:15
Place: -
Facilitator: Guillermina
Notetaker: Alison (alison.parker@wilsoncenter.org)

Participants: Guillermina, Alison, David, Mario

Discussion notes

Key points:
    – Local governments
    – Funding without framing too much
    – Communicating
Open Science Policies
    – Argentina
    Law OA & OD
    Program funding OD
    – US
    Bill OD & CD
Funding
    – Infrastructure
    – Projects
Legal Frameworks

    – Legislation
    – IP

Open hardware
    – What to do with limited resources
    – How to connect community/open spaces with academia?
Community spaces/grassroots initiatives
    – Connecting funding schemes and mechanisms
    – Funding spaces without conditioning results – open innovation
Academic institutions
    – "Fast grants", narratives and stories, exemplary cases
    – Public purpose, general interest
    – Acknowledge current practitioners in academia (publishing?)
Technology development disciplines/areas
Hardware for disciplines/research areas
"Indirect" funding – grants are being used to contribute to OSH/OH projects

New institutions!
Open collectives!

5. Maker / Hacker Spaces

Date: 2022-10-27
Time: 13:20
Place: Ñeque
Social media links and hashtags: #makerspace #hackerspace
Facilitator: Clint Martin @cmartintx
Notetaker: Clint Martin @cmartintx

Participants: Ernesto, Joaquín, Amanda Matthes – amanda.matthes@gmail.com @AmandaMatthes, Alejandro

Discussion notes

The main takeaway is that we should use the GOSH community/network to recruit GOSH Ambassadors to present some kind of OSH demo at local maker spaces to illustrate the community benefits of the movement. If the demo were standardised, potentially it could also be a shorter, lower-risk curricular unit for teachers to present to demonstrate possibility to students.

The group felt that there should be more maker spaces, more used, more frequently. They feel that costs, liability, and limited funding were a barrier. We discussed various ways of showcasing and funding maker/hackerspaces: pop-ups as a demo, a road map for incrementally building a makerspace + community from free materials to a developed facility independently sustaining staff. Funding could come from a variety of sources; prototyping as a service, "make-sales", public-private ventures. Showing OSH related science & education externalities could fund proposals.

---

6. Quality Control / Quality Assurance

Date: 2022-10-27
Time: 13:30 hs
Place: Table outside
Facilitator: Pablo Cremades (pablocremades@gmail.com)
Notetaker: Lara Jatar (lara.jatar03@gmail.com)

Participants: Lenin (ResearchGate: Lenin Rueda Torres), Byron (btarabata@gmail.com), D, Minhea (LinkedIn: Minhea Stoica]
Discussion notes

Topics:
- Standardise
- Support trust
- Government Adoption
- Calibration
Quality assurance of parts
- Reproducibility

We are going to interview people who have experience with software. We take 15 minutes to think of the questions together:
1. Are you a user or developer?
2. Do you know about any community development on the QA/QC system?
3. Do you have any type of benchmarks?
4. Whether you have a solid calibration process?
5. How to ensure long term support?

Interviewers:
- Mihnea (Responsable: Lara)
- Lara (Responsable: Byron)
- Tamara (Responsable: Lenin)
- Amanda (Responsable: Pablo)
- Nico (Responsable: Lenin)
- Harold (Responsable: Pablo)
- George (Responsable: Byron)
- Pierre (Responsable: Lenin)

Answers:
Mode: Audio
1. Most of the people we found were developers or developers+users.
2. QA/QC: group fair; DinSpec; OSHWA (only one person knows about).
3. Benchmarks: Nobody has a bencharm system documentation.
4. Calibration: there a few projects that have well documented calibration process
5. Long Term Support: documentation, forum of faq, use long term support components.

Conclusions:
- We are not in a good current state of QA/QC. Most people know nothing about QA/QC related to open source hardware.

Images/videos/audio:
- Audio: https://drive.google.com/drive/folders/1OUih3Rvnb0SiEgedW7VTG-6qR9ObNYY2
- Imágenes: –

7. Developing electronics with SenseCAP Kit from Seeed CC

Date: 2022-10-27
Time: 16:30
Place: Ñeque
Facilitator: Mario De Los Santos (madlsh3517@gmail.com)
No. Participants: 13

Discussion notes

Using the senseCAP K1100 to develop an IoT environmental monitoring station using the sensors available in the kit, the user will be able to choose the sensors to use following the workshop's objectives. The workshop will demonstrate the versatility of the K1100 equipment for Internet of things for good projects, where the participants will be able to orient the environmental monitoring to the desired field.

Objectives:
-        Develop an IoT solution prototype for environmental and wildlife conservation
-        Record and send data to the cloud using Ubidots.
-        Send data using Helium through senseCAP M2 using LoRA.Using a no-code alternative SenseCraft.

The idea of sending SenseCraft to the end of the workshop is to remark on the bonhomie of the platform to create a project in just minutes compared with the code development. That would help us to expose the system more.

Sessions Day 3 - Friday Oct. 28

Block 4: 9:30 am

1. Lab / field hardware #2

Date: 2022-10-28- Friday
Time: 9:30
Place: Main room
Facilitator: George
Notetaker: Juul
Participants: -

Discussion notes

Talking about how to do open hardware mass spec

Types of mass spec

* Quadrupole
* Magnetic and electric sector
* Time of Flight
* Cyclotron (probably not)

Vacuum technology

How can we get a good enough vacuum at a low enough cost?

Ideas:
* Re-usable metal materials (maybe combined with purging with nitrogen)
* Purging with oxygen and oxygen e.g. steel wool (not reusable but cheap. potentially dangerous)

Community and existing projects

* Applied Science built one
* Young person on youtube who makes his own chips from scratch and the community around him
* There is a CERN group that made a DIY mass spec for teaching

We decided to create a matrix channel and collaborative notepad, so we can collaborate on a literature search.

Matrix/Element chat: https://app.element.io/#/room/#mass-spec-madness:matrix.org

Note pad: https://md.opensourceecology.de/_FLGWTh9SHiukuVOmt4NBg#

---

2. Lab Hardware 2.5 (split from Lab Hardware 2)

Date: 2022-10-28
Time: 09:30
Place: Tapir room
Facilitator: Amanda Matthes (amanda.matthes@gmail.com)
Notetaker: Amanda Matthes (amanda.matthes@gmail.com)

Participants: Amanda Matthes, University of Oxford, working on SnapperGPS, amanda.matthes@gmail.com, Byron Tarabata Universidad san francisco de quito working in semiconductor analysis and chip design btarabata@gmail.com, Niko Arranz – NYC Designer w/ Genspace.org – Syringe pumps/tiny microscope - NKArranz.Studio@gmail.com, Lenin Rueda Torres – CENSOPAS/Peru – Open Point of care test for diagnosis , Dario Taraborelli, Chan Zuckerberg Initiative – Open Science program / @readermeter - dario@chanzuckerberg.com, Moritz Maxeiner, Research Assistant – Free University Berlin, moritz.maxeiner@gmail.com, Shannon Hicks, EnviroDIY and Stroud Water Research Center, shicks@stroudcenter.org, Rajas Poorna, PhD Bioengineering Georgia Tech; Frugal 7$ ultrafast 7 min PCR, 100$ Raman Spectrometer rajaspoorna45@gmail.com

Discussion notes (not necessarily chronological, grouped by topic)

Labs constantly build cool hardware for themselves. Why isn't it common for labs to make this hardware open?
- Rajas: It just doesn't occur to many. Personally, I have some projects that were just never uploaded anywhere.
- Shannon:
- Some academics might be embarrassed thinking it's "not good enough", e.g. loose cables or glued parts
- Many will also be worried about unpublished results.
- Moritz: Academics are often worried about sniping when publishing tools and methods.
- Rajas:
- Some might be worried that their UI is not "idiot proof" yet.
- Hardware can be intimidating to replicate, especially electronics.
- Niko:
- Also documentation is hard and requires organisation.
- If it's something particularly good, some

academics may consider selling it later.

- Dario:
- It takes effort to make something usable and presentable
- But there are also some examples of success. Protocols.io is like Wikipedia for methods (e.g. wet lab protocols). It lets you give a method a doi and supports version control.
- Shannon: You can also create this for GitHub.
- Amanda: It can be really hard to discover open hardware projects. For example, I have been co-developing SnapperGPS, an open source location data logger for wildlife tracking. But without knowing the name it's impossible to find because the search results are flooded by proprietary GPS tech.

Does an indexing platform like protocols.io exist for OSH? If not, can we build one?

- Moritz:
- There is OHO (https://en.oho.wiki/wiki/Home) for open hardware in general.
- It would be cool to have a platform that tracks trust in hardware projects.
- Need to be aware that copyright and makers rights are different in different countries.

Conclusion notes
We believe that there are multiple reasons why academics often do not make the hardware they build open. These include:

- Not even considering that someone else might be interested
- Being worried that the things they build are "not good enough" or too "amateurish"
- Not wanting to document the project (or not knowing how to)
- Wanting to avoid another group publishing results first
- Hoping to eventually sell the project
- Not knowing how to make something open

Some of these points can be tackled by introducing academics to OSH early (e.g. 1st year of grad school or even undergrad) and explaining the upsides of making things open as well as explaining how to do that.

We also think that it's currently hard to know what open lab/field tech is out there already. There is no single place that indexes existing open science hardware projects.

Suggested action points
1. Reach out to academic institutions to introduce an introductory course for their students (e.g. "How and why to share the stuff you build"). A one-off 45 min session in the first year of grad school could be a great start. For this purpose, it would be good if GOSH could provide a "starter package" with materials (e.g. slides, links, videos) on

- Why is it good to make things open?
- How do you make things open? (Publishing platforms, documentation, license...)
- Examples of great OSH projects.

This could be useful for other outreach projects, too.

2. Create a platform that indexes open science hardware projects. Perhaps build on protocols.io?

---

3. Legal

Date: 2022-10-28
Time: 9:30
Place: Back of main room
Facilitator: Martin
Notetaker: Alison (alison.parker@wilsoncenter.org)

Participants: Martin, Alison
Number of participants: 2

Discussion notes
International context:
  – Free software laws in Bolivia
  – Previous law in Uruguay
  – Argentina – if the state is funding, needs to be licensed openly; not always followed because of the incentive system of academic work globally

Standards-based solutions
  – e.g. ODS ODT LibreOffice
  – Multi-government standards bodies
Need to require:
  – All source to be published
  – All schematics published
  – License to reuse
  – Efforts made to promote reuse

Government procurement ideas
  – Military is most hardware intensive
  – Medical supplies

Hardware has the potential to be more transparent – e.g., open source voting machines
Ideas
The problem of centralised manufacturing - idea for pilot community demonstrating distributed manufacturing

4. Opening the Learning Process

Date: 2022-10-28
Time: 10:00
Place: Outside tables and Grass
Facilitator Goldjian

---

5. DEI (Diversity, Equity and Inclusion) of GOSH

Date: 2022-10-28
Time: 09:45
Place: outside
Facilitator: Bri
Notetaker: Laura Olalde

Participants: Nat, Bri, Gourav, Guillermina, Laura, Katie
Number of participants: 6

Discussion notes

Here some of the **highlights** during the discussion:

The code of conduct is usually related to a couple of people, so it is necessary to find ways to involve people.
Nat: Instead of establishing a code of conduct, try to improve practices that reflect the values expressed in the code of conduct. Also, at the time of registration, ask people to read some highlights from the code of conduct.

Guillermina: It is important to take into account language barriers: We are discussing the concepts of diversity, equity and inclusion, to welcome new members and make it as inclusive as possible and to attract people. At the end of the conference it would be good to reflect privately on the aspects of the meeting that did not work well in relation to the code of conduct or any other aspect. It may be to provide some box where people can anonymously put their thoughts by writing them down on papers,

Participants: Obanda, Dorcas, Lara, Rachel

Collective mind map with stickies around learning methods and the process - goods and bads - and physical expressions of learning.

---

also an online source where people can put their thoughts after the event.

Nat: The structure of the meeting consists of very long days. And if we set a session to be in Spanish, another in English, to attenuate the linguistic stress?
Gourav: It is a good idea to have sessions in Spanish. Also Gourav was thinking if he was good enough to facilitate a session or if there was someone better for the job. As there were more technicians than biologists, he did not feel able to facilitate most of the technical discussions. There was a lot of content to digest and no time for it.

Guillermina: By the end of Thursday, some facilitators were a bit overwhelmed and tired, and there is no point in continuing like this. It may be necessary to find a way to cancel some of the sessions.
Nat: There is no opportunity to say if things feel bad. Maybe a thumbs up as a check methodology.

Guillermina: It is important to find a way to wrap up the content of what happened in each session during the day. There is not enough time to disconnect for a while. It would have been nice to post a summary of what was going to happen the next day. Yesterday I facilitated a session, but only one person showed up, perhaps because it was not communicated properly the day before.
Nat: How about scheduling the session by different topics per day?

Guillermina: The idea is to experiment in order to fix spaces such as the one in the council.

6. Participatory / Community Science

Date: 2022-10-28
Time: 10:30
Place: outside
Facilitator: Lara Jatar and Niko Arranz
Notetaker: Lara Jatar

Participants: Nat, Guillermina, Rachel, Niko, Lara

Discussion notes

Links
Images: https://drive.google.com/drive/u/0/folders/1RMAm_CPJfeJEpiePS3DETTZaVRqnJtwD

Comenzamos la sesión construyendo binoculares (https://www.flickr.com/photos/goshcommunity/52461202402/in/album-72177720303226220/) hechos con papel con el objetivo de ir a recorrer parte del predio viendo a través de esas "cajas". En el camino nos encontramos con un árbol muy antiguo que fue talado y allí nos quedamos un rato observando.

Encontramos una tarántula muerta y hongos. Luego volvimos a las mesas del exterior a trabajar sobre distintas preguntas:
1. What does participatory/community science mean?
2. Why participatory and/or community science?
3. What tools do we know to create participatory spaces?

Conclusiones:
Guillermina especially wants to decentralise the discourse with an extra focus on research.
Flexibility and reflexivity of knowledge production processes, getting all to participate.

Environmental justice and reframing citizen science as a collective thing - providing synergies and connections.

Maybe have a big plan, but need to be prepared to put it aside, too. =)

---

7. Participatory / Community Science

Date: 2022-10-28
Time: 10:30
Place: outside
Facilitator: Lara Jatar and Niko Arranz
Notetaker: Lara Jatar

Participants: Nat, Guillermina, Rachel, Niko, Lara

Discussion notes

Links
Images: https://drive.google.com/drive/u/0/folders/1RMAm_CPJfeJEpiePS3DETTZaVRqnJtwD

Comenzamos la sesión construyendo binoculares (https://www.flickr.com/photos/goshcommunity/52461202402/in/album-72177720303226220/) hechos con papel con el objetivo de ir a recorrer parte del predio viendo a través de esas "cajas". En el camino nos encontramos con un árbol muy antiguo que fue talado y allí nos quedamos un rato observando.

Encontramos una tarántula muerta y hongos. Luego volvimos a las mesas del exterior a trabajar sobre distintas preguntas:
1. What does participatory/community science mean?
2. Why participatory and/or community science?
3. What tools do we know to create participatory spaces?

Conclusiones:
Guillermina especially wants to decentralise the discourse with an extra focus on research.
Flexibility and reflexivity of knowledge production processes, getting all to participate.

Environmental justice and reframing citizen science as a collective thing - providing synergies and connections.

Maybe have a big plan, but need to be prepared to put it aside, too. =)

Block: 5 - 9:30 am

1. Supply Chain

Date: 2022-10-28
Time: 11:00
Place: -
Facilitator: Juul
Notetaker: Rajas

Participant: Saad Bhamla - Prof At Georgia Tech (GT), Elio Challita - PhD Bioengineering GT, Rajas Poorna - PhD BioEngineering Frugal Raman Spectrometry (GT), Amanda Matthes- GPS tracker, George Albercook - Many projects, Marc Juul - Open Spectrometer, Martin - OSS, Open Contracting, Water quality

How politics is affecting supply chain

Saad: Is here because he has been doing OSH stuff and wanted to connect with GOSH for the sake of community. Synbio is well documented; translate to hardware?

Elio: During covid, was building face shields. Interested in scaling, transportable, low-cost, available, effective

Amanda: Affected constantly, replacing parts constantly because of chip shortage. Specs are the same but the new part = risky.

Rajas: Wants to compress the supply chain, make things work locally. Manufacture Too interconnected.

George: Just-in-time warehousing: mismatch between optimising and brittleness

Juul: Was in Sri Lanka, Crisis everywhere.. Got MOSFETs from Alibaba, didn't work. Works on anti-censorship.

Martin: Got a faulty pH sensor. Usually China to Mexico takes 3 months. The dream is that each river will have a device to measure water quality. Would be nice to manufacture locally. How to do QA on that locally manufactured sensor?

George: Sharing didn't really happen during the pandemic.

Saad: Adafruit: They add QC. Consider biomedical products. There was this guy who had 65 innovations for maternal care: how many can you translate for use in Africa? Problem for translation is that the QC for biomedical stuff is insane. 0.1 degree C change is ok in most cases, but in BMed not easy.

George: Medical best practices standards are pretty hard. When some group made a baby holder, plastic holders, they needed a NIST traceable metre stick.

Amanda: People bought
Rajas: Can use mass-manufactured stuff to standardise hardware. Use Coke to standardise pH for instance. Or use their bottles for plastic because they will use standard plastic.

George: Google bought some fab
Saad: Moderna and Pfizer could find the standardised *process* to make the mRNA vaccine. Everyone knows the mechanism of the lipid nanoparticles.

Martin: Nixon era modifications to patent law: you don't need to put calibration info in your patent.

Saad: US WW2 made the best process to make battleships, so scaled up battleship production in 8 years. Focus: the process is something we are all underestimating.

George: Manufacturing revolution.
Scaleup and scaledown is interesting.
Can we make a transport container size fabrication machine? For 10k$ put one in the city and have it be able to build things.

Field Ready: idea was that 3D printers can make whatever part you need.

Problem with the 10k$ container is who has the skill to run it? Unclog nozzles etc.

2. Innovative Contracting

Date: 2022-10-28
Time: 11:00
Place: -
Facilitator: David Lang
Notetaker: Alison Parker (alison.parker@ wilsoncenter.org)

Participants: Greg, Jenny, Josh, Greg, Dorn, Constantin, Harold, Moritz (Approximate number of participants: 10)

Discussion notes

Three ideas (philanthropic tools)
Advance Market Commitments (AMCs)
    Michael Kramer
    e.g. vaccines
    scibetter.org/amc
Equipment Supply Shocks (made up term)
    Opposite idea - pre-buy a bunch of tools and distribute it to community
    eg a Mac in every classroom in California
    Neil Gershenfeld FabLabs - pre-buy 5 fablabs
    Not sure what the tool will be good for yet but put it out there
    Manu Prakash - distribute foldscopes
    Underwater drones - buffer of supply, then donate
    David wrote an essay on this scibetter.com/supply
    GOSH could be a facilitator
Patent Buyouts
    Lot of interesting IP locked behind corporate walls
    Buy and release patents
    No real life examples?
    IP at the margins - not critical like Coca Cola's recipe
    Contract Sofar to finish development of a standard
    Initial patent for seatbelts
    Tesla
    Pull things into the commons
    Concern - don't want it factored in by companies
    Josh - Two factors here, should be decoupled: actual buyout of IP + investment in the workaround, documentation etc (investments in open ecosystems)
    Why standardization efforts fail (essay) - no

commercial adoption. Incentivizing this might be a jumpstart
    Patents require documentation, but not enough - big difference between documentation for internal teams vs documentation for open use (Greg notes: worst possible documentation for patents, not something we want)

Mologic - interesting combination of a couple of these, show how these can combine in interesting ways
    Diagnostic company, pregnancy tests, diagnostics for low income countries
    Originally independent, bought by big manufacturers then bought themselves back out, bought by Open society foundation and Gates Foundation, bought the patents and the team and supported local manufacturers. Senegalese governments + foundations are subscription members, de-risks
    Still figuring out what it will be longer term

Foundations and others more open to these ideas, interesting time to propose
Once you prove them, easier to scale up

Huge investment for HIV diagnostics, distributed all over Africa, should have paid dividends for coid but it was proprietary - there is a need for a case study of how the open piece of it can benefit long term

Developing this language is really important

Another - Foundation for Food and Ag requires a match
Could bring a tool, could bring it as a match, converting historical work into something you can currently leverage

Jenny - who would be the expert on contractual terms for open interoperable projects - we need a contract lawyer, are there innovative contract lawyers?

Dorn - Dasa Greenwood with Civics.com
Machine readable contracts, parcelable and traceable.

Philip Sheldrick - peer to peer foundation, question the whole patent structure, Bergman Center
Clinic at Duke University doing really interesting stuff on contracting

3. Community Management

Date: 2022-10-28
Time: 11:00
Place: Outside
Facilitator/Notetaker: Bri (brianna@openhardware.science)
Participants: Alexandra Covor, Linda Aidoo, Goldjian, Laura Olalde, Ryan George
Stoica Mihnea, Madalina Banica

Discussion notes

This was an exploratory session focused on the role of intrapersonal and interpersonal relationships as community managers. To do this, we used tarot cards to guide us through a process of self-reflection. Each participant pulled a card from the deck and was given 5 minutes to themselves to reflect on their card, what imagery stands out to them, and how it relates to their positionality within communities. While doing this they were asked to write notes to themselves that they can keep.

After spending 5 minutes individually self-reflecting, we paired up to share our reflections with one another (10-15 minutes) and afterwards spent the remaining time coming together as a large group and sharing our reflections.

Links
https://twitter.com/GOSHCommunity/status/1586034027454078978\

4. Distributed manufacturing 1

Date: 2022-10-28
Time: 11:00
Place: Coati room
Facilitator: Constantin
Notetaker: Constantin

Participants: Greg Austic, Andrew Lamb, Ryan George, Josh Greenberg, Obanda Johanssen
Number of participants: 6

Discussion notes

The global distribution network is falling apart and rather than try to fix it we are thinking of some sort of recipes to achieve local sustenance when it comes to creating products locally.

Right now based on the materials needed to build something there is a rule of thumb if you can produce it locally: things that use two or three materials like soap or buckets are relatively simple to create in any country, and things with more than four are already a bit more demanding for example basic devices containing a single PCB, some basic electronic components, screws and an enclosure, 10 types or more materials are complex and demanding and you need the effort of multiple combined countries.

A follow-up of this discussion will be done on Sunday to decide what a good testpilot would be.

5. Standards

Date: 2022-10-28
Time: 11.12 am
Place: Tucan room
Social media links and hashtags:
Facilitator: Nico
Notetakers: Nico and Pierre

Participants: Nico, Katie, Pierre, Andrew

Nico Notes

Post It prompts
Connecting OSH and FOSS efforts, specially to support common metadata practices.
Broad metadata about projects?
Adoption of standards – what is needed to make this happen?

Hardware standards at least for common problems. Integrating OSH for platform-level standards in science.
What does "platform" mean in this context?
Methods of standardising open hardware designs.
About content: BOM, Design files, ...
About how to design: no black boxes, modularity, reusability, repairability.
About how to implement: electronics, mechanics, whatever!
How does open hardware gain credibility for use in academia? Eg. There is no standard for testing or calibration for DIY hardware.
Being the "far superior" product.
What does "for DIY hardware" mean? free?
Do we need testing devices?

Facilitation ideas
Come up with a standard game we can play.

List of common problems and solutions.
Example: "EMI noise countermeasures and related standards".
Micropipettes?
Map each device to a standard.
Make a list of first implementation steps towards standardisation (isolation, not routing traces on top of each other in PCBs). Standard practices to build stuff. Make a booklet on critical things to watch out for. This is very related to design decisions.
Make a list of testing tools (e.g. ventmon).
Standardise interfaces between OSH devices.
Format
Options:

Exploratory
Get work done: prepare a fanzine of common problems we know and how we fixed them. Towards the booklet.
Previous posts
Standards and open science hardware - any experiences with designing to conform to standards? 1
Standards in Open Science Hardware 1
UNESCO launches a global consultation to develop a standard-setting instrument on Open Science
DIN standard: Contribute to the development of an international open source hardware standard
An opportunity to create an inclusive dialogue on OSH standards [help needed] 1

Pierre's notes (pasted below):
https://md.opensourceecology.de/WwAZ2vAWT92wtp_r0PtExQ?both

Katie
* She is interested on standards for metadata
* Calibration for environmental sensing

Pierre
Design principles for bioinstrumentation: https://

www.nature.com/articles/s41598-019-48815-9

Andrew
There are three kinds of standards
Open-Know-How Case:
Hired a company specialised on writing standards and they did the following steps:

* Interviews
* Came up with a draft on Git
* Face-to-face meetings
* Analysis and Discussion

Several platforms have adopted Open-KnowHow: Appropedia, Thingiverse, etc.

Future projects: Interoperability

Two kind of standards:

* quality standards (e.g. high quality or low quality)
* general standards (e.g. general technical spec)

At community level:

* People who follow standards from previous published designs.
* People who set their own "standards" for specific applications.
* People who make a benchmarking with commercial equipment.

Performance criteria

GOSH should create its own standards

Links: https://forum.openhardware.science/t/standards-unconference-session-at-gosh-2022/4347

https://www.nature.com/articles/s41598-019-48815-9

Sessions Day 4 - Saturday Oct. 29

Block: 6 - 9:30 am

1. Medical Logistics & Compliance Barriers

Date: 2022-10-29
Time: 09:30
Place: Toucan Room
Facilitator / Notetaker: Amanda Matthes (amanda.matthes@gmail.com)

Participants: Amanda Matthes, amanda.matthes@gmail.com, Rachel Aronoff, Hackuarium, rachel@hackuarium.ch, Jason Whitson, Jaedos@Gmail.com (personal), Jason.K.Whitson@gmail.com ("Professional"), Martin @martinszy martinsz@gmail.com

Introduction Round

Rachel
- Works at Hackuarium, community lab with a P1 space in Switzerland
- Has built diagnostics tools including a COVID-19 molecular detection tool (https://docs.google.com/document/d/1e7EVftwHFX5ZjHGcaJ4lAfUBdSX9qVK_ZBvRaFv-Olc/edit?usp=sharing)
- Trying to get clinical validation
- Amanda
- Personal health enthusiast
- Interested in making it easier for individuals to access healthcare quickly

Jason
- Spent 10 years as a medical assistant in the US
- Also experience as a nurse
- Experienced how difficult it can be for patients on the receiving end of the healthcare system

Martin
- Experienced how different medical systems in Argentina and Mexico
- Works in open data/anti corruption
- Calculated that massive amounts of money have been wasted on medical resources

Discussion notes

- Rachel: JOGL Fitz tries to help open source projects navigate health care regulations (https://app.jogl.io/space/joglfitz)
- Martin: How do we prevent patent trolls? We need patent reforms.
- Jason: The FDA has an enormous backlog. Going through official channels takes many years.
- Martin: Argentina passed a law that automatically approve medications that don't get processed after a certain amount of time has passed. (https://www.pharmabiz.net/anmat-plazos-by-macri/ and https://www.cafabo.org.ar/main/noticias-ver/alertan-sobre-los-riesgos-de-los-cambios-introducidos-en-anmat-para-la-aprobacion-de-nuevos-medicamentos/)
- Jason: Things labelled as supplements can circumvent medication regulations which has resulted in some dangerous medications becoming widely available in the past.
- Amanda: It's important that regulations exist for medical hardware that could be dangerous. But there are also many cases where making hardware widely available quickly has lots of benefit with very little risk (like diagnostics for common conditions)
- Jason: The biohacking community operates in this space of "do now, ask for forgiveness later"
- Martin: Different countries and communities place different amounts of value on human life. This partially explains why the quality of healthcare is so different in different places.

Mexican procurement law weirdness...
SaDiCo English
SaDiCo Spanish PDF

Regulatory Compliance Requirements for an Open Source Electronic Image Trial Management System – PMC (nih.gov)

RADVAC initiative

2. Illegal

Date: Saturday
Time: 9:30 am
Place: Outside
Facilitator / Notetaker: Juul

Participants: juul - marc@juul.io, Mihnea - mihnea.stoica27@gmail.com, Andy - andy@dinalab.net

Discussion notes

Sci-hub, libgen z-library

Hosting in Romania? Cheap internet
https://www.digi.ro/

* Can we make local copies of these? Legality of archiving?
* Some journals are leaving sections out of their PDF journals to keep them out of sci-hub. E.g. Nature articles with no Methods section.

biomedical piracy

* Four thieves vinegar collective?

reverse engineering and cracking

* Where is it more or less legal

* Can we do clean room reverse engineering as a community?
* Can we make sniffing of communication between computer and lab hardware easier?
** So we can make our own open source software to replace the proprietary software
** Idea: Maybe an embedded device that is plug and play that can log and share traces?
* Legality of cracking. Is it legal in some countries
* Jailbreaking is illegal for most devices in the U.S. but not in the EU
** Distribution of jailbreaking tools also illegal
** Can we get more DMCA exemptions for e.g. scientific devices?

* Tools
** Ghidra for static analysis (made by NSA)

Censorship / collaboration barriers

* How can we keep collaborating on open projects through access and trade barriers
** E.g. how can we sure we don't exclude folks behind firewalls / tradewalls
** Getting people funding is problematic (and sometimes illegal)
* Censorship and financial/trade barriers:
** E.g. Russia, Ukraine, Iran, Myanmar, China

3. Electronics design Workshop - Mario Seeed

Date: 2022-10-29
Time: 9:30
Place: Ñeque
Facilitator: Mario De Los Santos (madlsh3517@gmail.com])

Participants:

Notes
Designing electronics and good manufacturing practices for makers.
The workshop talked about Eagle Autodesk, an open source platform to design circuits. The workshop had 5 participants that interacted with the software.

Specific points:
- Smart farm monitoring.
- Open source project.
- SeeedStudio develop open-hardware with design availables in the website
- Documentation on electronics.
- How to clear your designs to be understandable for more people
- Clear schematic dividing the main parts of the design.
- Use of commands on the software can make the design easier.
- PCB quote on industrial environments for makers.

4. Feedback session: Unconference Retrospective

Date: 2022-10-29
Time: 9:30
Place: Outside
Facilitator & Notetaker: Maria Frangos
Participants: Shannon Dosemagen, Greg Austic, Nat Irwin, (and later) – Karl, Niko

Discussion notes

Things we should continue doing...
- Hosting social events
- Scheduling time for workshops (but more)
- Connecting culture with ecology
- Providing good food that accommodates individual food tolerance and preference
- Onboarding new community members
- Supporting those who couldn't otherwise attend through sponsored / subsidised attendance and travel
- Focusing on diversity of participants
- Creating programming for locally-focused initiatives and prioritisation
- Planning activities to connect as many , as quickly as possible (pre- and during first day of gathering
- Translating talks / hiring translating buddies
- Prioritising regionally diverse gatherings
- Facilitating whole group unconference planning activity to enable participatory topic selection
- Providing training for how-to facilitate (but on Day 1 / earlier in the day)

Stakeholder/ organiser perspective:
- Strong "system" sessions, e.g. policy, funding
- GOSH History, Day 1

Things we should start doing...

Participant perspective :
- Being more intentional about the spaces we provide / different rooms for different vibes - e.g. don't place the rest area next to the beverage and snack area
- Planning more workshops
- Standard communications channel (half the group was on WhatsApp
- Make better use of forum
- We can create an Element integration for the forum (or use Signal)
- Redesigning workshop sign up form so that participants know what "workshop" means
- Proposing ways that session work can continue between global events
- Bringing back pre- and post-residencies for global gatherings
- Providing better participant bios - e.g. "talk to me about..."
- Doing a call for presentations / workshop proposals ahead of time on the forum
- Creating a team to put together unconference proceedings
- Creating a call for posters
- Making sessions longer - 90 minutes
- Encouraging participants to capture actions for each session

Stakeholder perspective:
- Finalising agenda weeks in advance
- Holding a logistics meeting for organising team so we are on the same page about who does what and when
- Focusing on the future
- Creating plan for outreach (ESRI, UN)
- Hosting the public demo in more public, or at least in a more publically accessible space
- Using our natural talents more effectively - Match people's talents to tasks e.g.:
- Social Media & Outreach
- Communication
- Whole Group Facilitation
- Holding roadmap session earlier, perhaps as a pre-cursor to unconference planning session
- Reconsidering how Working Group for Global Gathering is seated
- Engaging academic / research community (consider a different format)
- Creating a conference paper track
- "Commissions" for long-term, persistent topics

Things we should stop doing...

Stakeholder / organiser perspective
- Disregarding what was done before / reinventing the wheel
- Changing the agenda on the fly

Dedicated groups:
- Social
- Logistics
- Programming

Block: 7 - 11:00 am

1. Private Investment and Incubators

Date: 2022-10-29
Time: 11:00
Place: Coati room
Facilitator / Notetaker: Constantin
Participants: Andrew Lamb, Ryan George, Jenny Molloy
Number of participants: 4

Discussion Summary

When raising private investment for Open Source Hardware we encounter a series of challenges that are a bit different from closed source products: understanding the private investor of the Open Source movement and vision, the way how you can provide a Return of Investment if the point is not entirely humanitarian to name a few.

It's important to understand the product fits with the investor and if necessary to compromise in the middle somehow to make it happen. A good idea is to pitch the product, not the action.

In our collective opinion, there is no open science hardware incubator at the moment although hardware accelerators or incubators exist, they are focused intensively on the protection of the tech stack and return on investment in terms of sales and the protection of the product in terms of competitivity thus making them not a good fit for Open Science hardware.

Such incubators would need both technical and entrepreneurial support from people with experience in these areas in the context of Open Science Hardware.

We foresee two focus points: Design to Product and Product to Scale.

Innovation funds need to be invested both in producing and distributing Open Science hardware locally and remotely if possible.

An interesting skill needed to be developed in this type of incubator would be how to pitch OscH to investors.

GOSH would be a good candidate to kickstart such an Incubator.

---

2. Distributed Manufacturing - Next Steps

Date: 2022-10-29
Time: 11:00
Place: Coati
Facilitator: Constantin
Notetaker: Obanda
Participants: Andrew, Greg, Nat, Ryan,Amanda
Number of participants: 7

Notes:

- What success looks like for distributed manufacturing
- Mapping the level of hardware: hard-medium-easy
- easy: soap, buckets: single material, local, no electronics: #groups who can make - high: Case studies - Richard and Julian: search + quality mark would make sense ------>(protolabs, geomake)
- medium: gps logger, stem kits: single pcb, no calibration, lowish skills, <4 materials, <10m assembly time: #groups who can make - some: Case studies: Amanda: Contractual agreement between many parties would make sense e.g uber eats --->(groupgets, seed, kespal, konopo, kitspace)
- hard: open flexure microscope, reflectometer: >30 mins assembly time, calibration required, higher skill, more parts, custom parts, single source components: #groups who can make -few: A co-operative would make sense -------> (coop)

- Open distribution system where there is a big collective people forwarding things globally

- Issues with shipping:
- Customs
- Supply chain
- Text support
- Point of sale services
- competition
- Skillset and knowledge to solve the technical challenges are required.
- So we look at the manufacturing framework
- Contractual agreement
- Process:
- Developers <> the cooperative <> Support <> Manufacturers <> Market
- Supply chain tool support
- Discovery tool to help one find what they need and what they don't.
- The MVP includes the core activities of the COOP, and the legal system, and the products.
- onboarding

- catalogue/website
- point of sale
- distribution process is legal
- manufacturing training/system
- Quality mark/QC/QA
- Really good marketing/sales
- Cool Name

---

3. Mapping OSH - Lit Review

Date: 2022-10-29
Time: 11:00
Facilitator & Notetaker: Nico
Participants Mapping: Darin, George, Moritz, Honey Badger, Juul,Andy (briefly :P).

Discussion notes
UC session: OH literature review, projects directories and searchability
This session split into a project "Mapping" session and a "OH literature review" session.

Intros:

-- Darin & Nico: same stuff, we have a lot of "modular" high level dependencies, and want to reuse stuff and not make everything from scratch.
-- George: go to GitHub/GitLab for specific software. It is frustrating to not know if there is some free project.
-- Moritz: personal growth.
-- Honey badger: loves hardware.
-- Juul:
Related forum posts:

Webpage that lists all GOSH projects – #12 by Kaspar
Objectives:

OH search engines and repositories.
List projects: needs, work in progress, finished projects.
Proposals:

-- George: Get someone to crawl all websites, and make a list.
We need tags.
-- Honey badger: Get an identifier for projects.
-- Juul: make a mediawiki, host it on MIRAHEZE perhaps.
Search engines
Broad spectrum:

GitLab/GitHub
YouTube
Reddit forums
Reddit subs
Instructables
Thingiverse/Printables/Yegg/...

Make forums
fieldready.org
kitspace.org
Closer to OH (no particular order):

OpenNeuroscience: open-neuroscience.com
Open Hardware Observatory (OHO): oho.wiki
Just One Giant Lab (JOGL): app.jogl.io/search/projects
Open Hardware Repository (OHR): ohwr.org 1
WikiData projects category/node.
Juli's query: github.com/thessaly/GOSHMap
Shortlink: https://w.wiki/5ttR
Appropedia: appropedia.org/Category:Projects
OpenKnowHow (OKH): search.openknowhow.org
Kaspar's "GOSH projects" community members website: projects.openhardware.science 1
GOSH forum has few projects, and doesn't have a nice enough layout to crawl it.
Hackaday / hackaday.io (blog/information, project)
WikiFactory (HackADay alternative): wikifactory.com/community/projects
OSWHA certification program list: certification.oshwa.org/list.html
OpenHardwareMakers list: openhardware.space/projects
WildLabs.Net (field science)
Hackster.io: hackster.io
WikiFab, Piblitz
Tindie (Etsy for hardware)
Is there a yelp for hardware? A "meta" search engine for hardware. Crowd-source stuff like reviews.
Closer to wetlab OH:

Mailing lists:
DIYbio
OpenWetWare: openwetware.org
Big mediawiki where many labs document their protocols.
Would be great to have something like this for OH.
Hackteria (blog/information): hackteria.org/category/projects/
Metadata standards
What information must we include about a project in a repository.

OpenKnowHow: internetofproduction.org/open-know-how
Great stuff.
Forum: community.internetofproduction.org
The standard supports "SUB PARTS" but does not

define the dependencies "functionally" (not yet, 2022) or interfaces, to support modularity. Would be nice.
Open hardware literature review.
People: Jenny, Shannon, Katie, Luis Felipe.

Objective: gather papers on open hardware and around open hardware.

Notes: next post! Thanks Katie.

Other related stuff
allspice.io "A git platform for hardware"
Why not use git? High entry barrier.

---

4. Make place for mistakes

Date: 2023-11-29
Time: 11:00
Place: Outside dining venue
Notetaker: ?
Facilitator: Goldjian
Participants: Guillermina Actis,Fernando Daguanno,

Linda Aidoo, Marcela Basch
(and another girl, her pic is here https://twitter.com/GOSHCommunity/status/1586394697261613059)

Vulnerabilities, failures, impairments shared as a way to open processes

---

5. GOSH Community Building

Date: 2023-11-29
Time: 11:00
Place: Outside dining venue
Facilitator and Notetaker: Fernando Daguanno, @alquimetricos

Participants: Karl Kaddu, Environment for Development, Gina Leite, Wildlife Conservation Society, Guillermina Actis, Centro de Investigaciones para la Transformación, Linda Aidoo, Kumasi Hive (5 people)

Notes:

Timeline: A brief recall on GOSH 2017-2022 events

GOSH Santiago 2017
TecnoX 2018
Africa OSH Ghana 2018
2019 GOSH Shenzhen
Africa OSH Tanzania 2019
CIACIAR - RICAP - ReGOSH 2021
ReGOSH Mendoza 2022
GOSH Panama 2022
GOSH Camerún 2022
Audience ecosystem: What do GOSH current and potential members clusters look like?
-NGO
-Academia

-Networks
-Highschools
-Government
-Supragovernment institutions
-Individuals

Assessment

-The SH ecosystem is diverse and complex
-To expand and improve the reach of the OH community we need to transmit OSH value proposal in a brief and effective way through by-audience-tailored messages

Solution proposed

-(a collection of) OSH Elevator pitch(s)
-We need an internal tool/procedure to train the GOSH community members to become effective and diverse spokesperson/ambassadors/representatives of the OSH
-Some call them "Message toolbox"
-It may look like a Double-entry table with "audience cluster" in one column and "benefits" in the second one.

Summary: "To develop a brief handbook that we can use to train and help ourselves to communicate what OSH is to different types of audiences. A toolbox to become better OSH ambassadors and infiltrate other events and communities."

6. ACTIVISM IN OScH

Date: 2022-10-29
Time: 11:00 hs
Place: mesa
Facilitator: Isaac
Notetaker: Lara Jatar

Participants: Byron, Isaac, Tamara, Lara

Discussion notes

Notamos que quienes participamos somos de Latinoamérica, nos preguntamos si tiene algo que ver o algo que nos reúna.

Comenzamos dibujando lo que significa/representa o lo que nos gustaría abordar en relación con el activismo del OScH. Algunas cuestiones que surgieron:

- espacios naturales: respeto
- recuperación de industrias: espacios donde participan grupos que han sido discriminados/segregados.
- cooperativas comunitarias que puedan hacer uso de herramientas
- desarrollo social cooperativo
- desigualdad de
- quien hace el hardware, qué grupo, cómo se conforma
- Visibilizar brechas de la desigualdad de acceso.
- la herramienta libre puede utilizarse para visibilizar los privilegios.

Preguntas que surgen:
- ¿Cómo definimos la calidad de los productos?

Conclusiones:
- hardware abierto ayuda a visibilizar problemáticas: sociales, ambientales!!!
- problema social: contar las voces, quienes hablan, cuanto. Hacer ruido.
- mayor participación de comunidades locales de donde se realizan los encuentros.
- a veces nos debemos incomodar o debemos incomodar.

Links:
https://ejatlas.org/?translate=Es

---

7. Peer review publishing

Date: 2022-10-29
Time: 11:00
Place: Tucan Room
Facilitator: Rachel
Notetaker: Pablo

Participants: Pablo, Valeria, Diego

Discussion notes

Participants introduction:
-- Pablo develops OSH for teaching and agroecology. Most of the developments are documented on gitlab. Not published in a paper because of lack of time and cost.
-- Diego studies bio-engineering. He has some projects documented (not very well) on github, but most are not.
-- Valeria is writing his thesis, and has no documented projects.

Suggestions:
Choose the journal
Read the author guidelines
The reviewer is always right
Negotiate price with the journal
Take a look at the open source compliance
You can put your data in a repo as well
Share pre-prints

Diego asks how to collaborate with other labs. Rachel says most of the time it depends on random chances.
If you finally publish, be careful with spam inviting you to events to talk about your work.

Links
Journals:
[HardwareX](https://www.hardware-x.com/)

8. Communication

Date: 2022-10-29
Time: 11:15
Place: outside
Facilitator: Alison   Parker   (alison.parker@ wilsoncenter.org)
Notetaker:

Participants: Alison, Marcela

Notes
Collection of post-its – what are our needs?
- OScH 101: for new people. Find their potential
- Definition of "ubiquitous"
- How to continue promoting GOSH to reach an even wider community
- Building bridges (e.g. between academia and the grand public)
- OSH in simple language

- Find a common simple language (words) to speak about OScH
- Comms: how to get some attention in this attention economy
- New metaphors

Storytelling session in Shenzhen - collection of slogans
The description of GOSH is not about hardware - it's about making things differently

the collaborative economy
collaborative economies
decentralised
commons

How is it different? different from the mainstream, capitalism, private property
what are we trying to dispute, push against

Appendices:
Participants and affiliation

1. **Alexandra Covor - Zalmotek | Romania**
Maker and embedded engineer with an eye for details, 2022 Ada Lovelace Fellow (https://2022.oshwa.org/fellowship/), active member of the OSH community, passionate about mixing aesthetics and functionality when building electronics. I have developed hardware prototypes for various industries as part of the Zalmotek team, previously working as a STEAM educator, and I am also currently part of the Harkopen team (https://harkopen.com/). My favourite projects to work on are wearables and anything involving colourful LEDs, tiny microcontrollers, Edge ML, and PCB design. I also doodle at PikaComics, a comic that aims to teach electronics in a fun way.

2. **Alison Parker - The Wilson Center | United States**
I (Alison Parker, PhD) am Director of Open Science and Acting Deputy Director with the Science and Technology Innovation Program (STIP) at the Woodrow Wilson International Center for Scholars. With STIP, I evaluate and amplify new approaches to science and technology, including low cost and open source hardware and citizen science. Previously, I served on the Board of Directors for the Citizen Science Association, including as Chair in 2019-2020, and worked on open innovation, citizen science, and low cost sensors as a fellow hosted by the U.S. Environmental Protection Agency. At the Wilson Center, I am leading the THING Tank project, which tackles how the things of science are accelerating and broadening science. We're working to bring disciplines and communities together to address common challenges and opportunities in low-cost and open hardware, in the context of open science. Our work is explicitly policy focused; we seek to understand the perspectives and interests of U.S. federal audiences; increase alignment between grassroots, academic, and government actors; address common barriers; and strengthen public policy communities' recognition and support of open hardware.

3. **Amanda Matthes - University of Oxford | United Kingdom**
I am a PhD candidate at the University of Oxford with the AIMS CDT. I have an undergraduate degree in physics from the University of Heidelberg, where I wrote my thesis on superscalar out-of-order processors. I am currently working on SnapperGPS, a small, low-cost, low-power GNSS location tracking system, specifically developed for wildlife tracking.

4. **Ana Julia De Lucia | Panamá**
An enthusiastic and dedicated Project Manager Professional with over 7 years' experience in the project manager role and overall professional experience of 10 years as financial professional within the Corporate Industry. PMP Certified by the PMI. Extremely organised with the ability to work both independently of own initiative or as part of a successful team, demonstrating the motivation and strategic planning abilities required to meet demanding deadlines while maintaining the highest of standards. Languages: Bilingual in English and Spanish; Basic proficiency in Italian.

5. **Andres Colmenares - Open Climate | Spain**
Andres (he/him) is the Coordinator of the Open Climate collective at OEDP. He is a Latin American strategist and creative foresight consultant based in Barcelona. His work is guided by the encouragement and practice of critical hope and collective imagination, and a firm belief in the transformational power of collaborative learning. For over a decade, he has been using futures as design tools to help organisations make better decisions in fields such as media, tech, public policy, education and culture, while creating networks and conferences to open conversations about the socio-ecological impacts of digital technologies and their role in addressing the environmental emergency. Andres is also co-founder of the creative research lab IAM, co-director of the Billion Seconds Institute and leads a new Master in Design for Responsible Artificial Intelligence systems at ELISAVA.

6. **Andrew David Lamb - Internet of Production Alliance | United Kingdom**
I am a Shuttleworth Fellow who has focused on 'Massive Small Manufacturing'. I am the Global Innovation Lead at humanitarian relief organisation Field Ready, which locally / digitally manufactures aid supplies in disaster responses and shares its designs as open hardware. I chair the Internet of Production Alliance, which is a group of organisations that are interested in collaboratively creating open

standards to support distributed manufacturing in the future. The alliance has published the Open Know-How and Open Know-Where data standards and is working on others, with close engagement from many GOSH members. I am also on the board of Helpful Engineering, which has supported open hardware in response to COVID-19, and the Appropedia Foundation, which runs the Appropedia wiki.

7. Andrew Quitmeyer - Digital Naturalism Laboratories | Panamá

Dr. Andrew Quitmeyer is a hacker-adventurer studying interactions between wild animals and computational devices. He left his job as a professor at the National University of Singapore to start his own field-station makerspace in Gamboa, Panama. At Digital Naturalism Laboratories (the Institute for Interactive Jungle Crafts) he blends biological fieldwork and technological crafting with a community of local and international scientists, artists, engineers, and animal rehabilitators.

8. Bill Hatcher - International School of Panama | Panamá

Bill Hatcher currently serves as the Innovation Coordinator for the International School of Panama. His duties include leading K-12 STEM programming, including ISP's Innovation and Entrepreneurship Certificate, coordination of ISP's library/media centres, and management of EdTech resources. He is in 15th year of education with experience in the USA and Panama as a special educator, maths teacher and STEM educator.

9. Bri Johns - Gathering for Open Science Hardware | Australia

My name is Bri and I am the community coordinator for GOSH. As community coordinator, I work with a global community of artists, researchers, activists, hackers, and hardware developers dedicated to making open science hardware ubiquitous by 2025. I am also interested in intersections between science, art, and storytelling, with 2+ years of experience podcasting and over a year of experience performing as a drag artist. I have also spent years involved in North Carolina State University's citizen science community, coordinating both the Citizen Science Club at NC State and Citizen Science Campus.

10. Brígida De Gracia Taylor | Panamá

I am a native of the Ngäbe Buglé Comarca, Nedrini Region, Corregimiento of Hato Culantro. I have the Title of Primary Education Teacher. I finished my degree in Geography and History at the University of Panama. In 2012, I obtained the titles of Teaching in Diversified Secondary Education and in Higher Teaching. I am currently a Research Technician at the Smithsonian Tropical Research Institute, focused on the study of Paleocology, specifically marine environments.

11. Byron Tarabata - Universidad San Francisco de Quito, Instituto de Micro y nanoelectronica| Ecuador

Byron Tarabata was born in 1988 in Quito Ecuador, 2014 received his electronic engineering degree from Universidad Politecnica Salesiana, in 2020 and received a master's in electronic engineering (microelectronic design) from Universitat Politecnica de Catalunya. Currently, researcher and lecturer at Universidad San Francisco de Quito. My research topics are low-power electronics for IoT applications, mixed-signal system design, open tools for microchip design. My personal interests are climbing, mountaineering, science disclosure, photography, and nature conservation.

12. Carolina Borrero - Cine ANIMAL| Panamá

Realizadora audiovisual, parte del colectivo ANIMAL, con base en la Ciudad de Panamá. Estudió Dirección Cinematográfica en la Universidad del Cine de Buenos Aires, tiene una amplia trayectoria en cortometrajes entre los cuales destacan, el capítulo "1913" de la película "Historias del Canal" (2014) y el documental "Los Cuentos del Bosque" (2019), y ha colaborado en diferentes roles para producciones cinematográficas y comerciales. Además fue curadora de la exhibición audiovisual "Imaginando la Ciudad: retrospectiva del Cine Panameño" y es profesora de Cine y Video para niños, niñas y adolescentes. Actualmente, dirige su primer largometraje documental "La Selva Llama".

13. Christoph Körtl - Self-employed| Germany

I studied sociology in Germany. After my bachelors I taught myself how to code and worked at a start up in Germany. After 2 years of working there, I decided to become self-employed. I am currently a digital nomad.

14. Clinton Martin - Independent | Panamá

Originally from Texas I have been living and teaching computer science & design tech in Shenzhen, Casablanca, and now Ciudad Panama over the last 7 years. I am volunteering with the STRI Bat Lab for the capstone component a Masters in STEM Education program I am completing with the University of Iowa. Way back, I worked for an internet hosting startup called Rackspace that worked heavily with open technology: we had expertise in Linux,

Apache, MySQL, led the creation of OpenStack and collaborated with the Open Compute project. I am interested in teaching, sustainable design & architecture, restorative agriculture, fabrication & micromanufacturing, physical computing, diving, sailing, and birding.

15.   Constantin Craciun - Zalmotek| Romania
Entrepreneur for over 10 years (co founded an IoT startup, a STEM education company that delivered courses to over 3000 children, and Zalmotek.com, an OSH prototyping company. Passionate about biohacking and transhumanism, I experimented with an NFC implanted in my hand and many other personal projects.

16.   Darin Lobo | Singapore
I am by training a molecular biologist, I have in the past worked in the field of genomic medicine and epigenetic. I am interested in open healthcare devices and making medical information more open. I was a combat medic and an emergency medical technician in the singapore emergency ambulance service during my mandatory military service. I grew up in hackerspaces and makerspaces tinkering and building things hence later when I entered the world of academia and research labs I became frustrated with the amount of information that existed but was simply not accessible and hidden behind paywalls and red tape. I want to work on democratising biology through open science and the building of low-cost alternatives to traditional lab equipment. As well as making reagents accessible and finding consumer accessible alternatives. Most of my interests relate to making from welding to programming to pottery.

17.   Dario Taraborelli - Chan Zuckerberg Initiative | United States
Dario is an open knowledge advocate with a background in social computing based in San Francisco. As the Science Program Officer for Open Science at the Chan Zuckerberg Initiative, his goal is to build programs and technology to support open, reproducible, and accessible science. Prior to joining CZI, he served as the Director, Head of Research at the Wikimedia Foundation, the non-profit that operates Wikipedia and its sister projects.

18.   David Lang - Experiment Foundation | United States
David Lang is an entrepreneur and writer. He is the Executive Director of the Experiment Foundation and the host of the Science Better podcast. Prior to that, he co-founded Sofar Ocean Technologies, OpenROV, as well as Open Explorer, which was acquired by National Geographic. He is the author of Zero to Maker. His work has been covered by the New York Times, WIRED, and Outside Magazine. He is Senior TED Fellow and his TED talks on ocean technology and conservation have received millions of views.

19.   Denise Dalbosco Dell'Aglio - University of Bristol & Smithsonian Tropical Research Institute | Panamá
Since my undergraduate degree, I have been actively studying Heliconius butterfly ecology. I began my research experience during my undergraduate and master studies in Biology at UFRGS, Brazil. For my PhD, I moved to the University of Cambridge, UK, to study behavioural and sensory ecological interactions between Heliconius butterflies, their predators and host plants. I then was awarded with a Postdoctoral Research Fellowship at STRI, Panama, allowing me to conduct a project on behavioural differences between two species of Heliconius butterflies. In my last postdoctoral research, I studied oviposition preference through odour perception of Bruchid beetles on Vicia faba crops at INRAE, France. Now, as a Postdoc at University of Bristol in the EBAB lab, I will explore the role of the mushroom body in spatial and visual memory in Heliconius butterflies through behavioural experiments. I will investigate how visual landmarks influence "traplining" behaviour.

20.   Diego Muñoz - UTEC Universidad de Ingeniería y Tecnología, Aulas Creativas| Perú
aDiego Muñoz is a Bioengineering student at UTEC Universidad de Ingeniería y Tecnología in Lima, Perú (https://www.linkedin.com/in/diegomunozn/) He was trained as a University Innovation Fellow by Stanford d.school. As a Fellow, he focused his work on well-being and applied Design Thinking to life design programs. He got involved in IDDS International Development Design Summit , an initiative created by MIT D-Lab. In 2020, he co-found a STEAM educational project called Aulas Creativas that promotes creativity, innovation and biotechnology. He was selected among the 100 young leaders in Biotechnology in Latin America by Allbiotech. My interests focus on developing open hardware for basic education and experimental biotechnology learning.

21.   Dorcas Owinoh - Lakehub | Kenya
An innovative professional with experience in the innovation, policy making and technology ecosystem in Kenya and knowledgeable of the information, technology and innovation scene in Africa. I have spoken on technology, entrepreneurship and community building in Africa

in 10+ International Conferences. I have also worked with 10+ international organisations as partners; they included UNDP,USAID, HIVOs, Microsoft, Google, Facebook, Governments (Kenya, French) to mention a few. Developed and executed Lakehub developer, training, incubation and acceleration programmes for Kenyan entrepreneurs, Lakehub Fellows, and incubated startups.

22. Dorn Cox - OpenTEAM (Open Technology Ecosystem for Agricultural Management| United States

I am an agriculturalist and technologist with a focus on soil health, participatory science, global knowledge exchange and local production. I serve as research director and OpenTEAM project lead (Open Technology Ecosystem for Agricultural Management) at Wolfe's Neck Center for Agriculture & the Environment, a pioneer and leader in regenerative agriculture, a nonprofit research and education centre. As a co-founder of the FarmOS software platform, the GOAT (Gathering for Open Ag Tech) and Farm Hack community, I am passionate about sharing open source agricultural tools, ideas, information and inspiration to accelerate innovation and quantify environmental services from regenerative agriculture. In 2019 I was awarded the Food Shot Global Ground Breaker prize and have a PhD from the University of New Hampshire in Natural Resources and Earth Systems Science., which focused on a framework for open source agricultural research and development.

23. Elio Challita - Georgia Institute of Technology |United States

I am a Ph.D. student in bioengineering at Georgia Tech in Atlanta, Georgia, USA. My research interests lie at the intersection of biomechanics, microfluidics, and synthetic biology. As a bioengineer, I am fascinated by elegant biologic designs and am interested in applying some of these discoveries to develop bioinspired solutions for engineering problems. My interest in bioinspired research started during my undergraduate studies in Lebanon. During that time, I was involved in several projects related to developing hair-like smart material sensors inspired by inner-ear hair cells, an energy harvesting device inspired by efficient fish locomotion, and a collaboration with UNICEF to design drones that delivers urgent medical supplies to Syrian refugees in remote areas in Lebanon. These projects often suffered restrictions by the amount of available funding and accessible resources. These constraints forced our research team to come up with creative ways to develop low-cost yet reliable scientific tools such as a low-cost hot press, microscope, and electrophysiology circuits. More importantly, this experience bolstered my appreciation for the dissemination of what is often regarded as inaccessible high-level science to citizens and young students. Recently, I have worked with several undergraduate scientists at Georgia Tech; some of whom I have co-authored research articles or helped present their projects at international conferences. In addition, through the International Genetically Engineered Machine program at Lambert high-school in Georgia, I am fortunate to have mentored more than 10 high-school students in developing scientific frugal devices for molecular biology like a bead homogenizer and tracking microscope.

24. Ernesto Gomez - The Metropolitan School of Panama | Panamá

I am a microbiologist with a specialty in myrmecology with 12 years of research experience at the Smithsonian Tropical Research Institute, focusing his research on the public health system of the leaf-cutter ants. A former and founding member of the first Panamanian Synthetic Biology team at the iGEM (International Genetically Engineered Machines) competition held at the MIT for two consecutive years, and former Latin American Regional Officer of iGEM LATAM. Also an entrepreneur (Music Business), self-taught musician and professional metal vocalist. Now I am a science educator at an International School with its curriculum allowing me to do an outside of the box approach to teaching science. HANDS-ON in Science is my approach.

25. Fernando Daguanno - Alquimétricos | Argentina

Maker, educator, and artist, founder of Alquimétricos, an international community of educators, designers and communicators focused on developing and sharing OERs, STEAM, DIY educational toys and resources targeted at low-income communities.

26. Genesis Colmenares - Freelance| Panamá

Born in Venezuela, moved to Panamá 5 years ago, Model, Makeup Artist, psychology enthusiast.

27. George Albercook - The Make Good Collective and Our-Sci | United States

I grew up on a family farm. My father was a skilled tradesman, self-taught mechanic, machinist, and engineer. I was the first person in my family to go to college. I majored in chemistry with a minor in mathematics and graduated cum laude. I then earned a Ph.D. in analytical chemistry when I built an ultra-high resolution mass spectrometer to indirectly determine the mass of the neutrino

and potentially the fate of the universe. As a postdoctoral fellow and research faculty member at the Department of Atmospheric, Oceanic, and Space Science at the University of Michigan, I built instrumentation to measure trace levels of reactive nitrogen species to understand human impacts on the climate. Somewhat disillusioned with academia and 80-100 hr work weeks I left to spend 5 years as a part-time teacher and full-time parent. I was the primary parent of our infant son and later our daughter while my wife pursued her dream of medical school. When we transitioned roles again I wanted to enter the workforce on my own terms. I started a summer program for kids. I wanted to tackle the loss of curiosity that I had seen in students in higher education. For 20 years I have stoked the fire of curiosity and independent thinking in children to inoculate them to study not for the grade, but for the love of learning. I feel this is our only hope.

28. **Gina Leite - Wildlife Conservation Society |Brazil**

Gina Leite has a degree in Social Communication from Universidade Federal da Bahia (UFBA), completed her MBA in Project Management from Universidade Devry / Keller Graduate School of Management in 2015. She has been part of the WCS team since 2017 and is currently a program officer for Open Science and Amazon Waters and specialist for regional collaboration.

29. **Goldjian - Femhack | Canada**

Goldjian, artist, researcher and crip transfeminist hacker, based in Tiothiake, collionaly known as Montreal, Quebec, Canada. I have a PhD in sociology and communication, I'm a multidisciplinary artist. Co-founder of Femhack, I'm interested in spaces and stories of ruptures and restorations between human and their technologies, especially in creative and scientific contexts.

30. **Gourav Saha - BITS Pilani | India**

I am Gourav from BITS Pilani, India and I am double majoring in Biological Sciences and Electronics Engineering. Throughout my coursework, I have noticed analogies between gene circuits and actual circuits and it has been an incredible incentive for getting into STEM. I am interested in trying to solve local problems with local solutions. With hardware and biology, I believe a lot of issues in the world now would be artefacts of the past.

31. **Greg Austic - Our Sci LLC | United States**

I love building strong communities comprised of active and motivated individuals working from a place of person belief, not organisational need. I want diverse communities of professionals and non professionals to be the main driver and producer of research and scientific outputs in the coming century. Professionally I've cofounded a few open source startups like photosynq and our sci (current company), and helped organise grassroots movements like GOSH and GOAT. I'm currently most active in Our Sci where we build open source software like surveystack.io and soil stack for helping communities collect, process, manage and share information that is comparable, validatable, and high quality. We also build open source hardware like a 10 channel reflectometer and soil respiration sensor to the same ends. Finally, we directly support communities to run large scale research projects like the bionutrient food association's Bionutrient Institute. You can find links to all project documentation at our-sci on gitlab, and more about our sci at our-sci.net. I actively code in js mostly now, design software, design hardware, design and manage research projects, manage our sci with two partners, play with kids, watch cooking shows, love on my cat, garden in the summer and skate in the winter.

32. **Guillermina Actis - Centro de Investigaciones para la Transformación | Argentina**

I am a PhD student with a background in political science, public policy and science and technology studies. I worked as an advisor in governmental organisations implementing open access and open research data policy. With my Phd I am currently studying the potential of the link between citizen social science projects and initiatives and policy-making in sustainability issues. I have been part of open science communities (OpenCon, Red Iberoamericana de Ciencia Participativa) and organised several events (OpenCon Latinoamerica, Congreso Argentino de Ciencia Abierta y Ciencia Ciudadana). In addition I have also maintained my links to the S&T policy sphere in Argentina, in particular to promote Citizen Science (see https://www.argentina.gob.ar/noticias/ciencia-ciudadana-y-politicas-publicas-para-tratar-problemas-socioambientales for a recent workshop for exploring Citizen Science and policymaking in collaboration with the STI Ministry and the UNDP). For the past two years and a half I have been part of CoAct, a citizen social science project. The Buenos Aires action takes place in the Matanza-Riachuelo river basin addressing environmental justice issues. In collaboration with a non governmental organisation (FARN) we are working to co-design and develop an open digital

platform to gather citizen data and co-produce knowledge to promote transformative actions in this highly contaminated area. I have addressed issues of ethical and informed consent of participation, governance issues of the digital platform and the open data, coordinated and co-organised the strategies for the platform's co-design and implementation workshops with community organisations, and designed and conducted the research on policymakers perceptions to develop informed strategies for community organisations and groups to develop actions for transformation in environmental justice. To see more on CoAct global project: https://coactproject.eu/. For the Environmental Justice action see: https://farn.org.ar/proyecto/coact/

33. **Harold Tay - Stand Up Labs|Singapore**

I'm a mechanical engineer by training, in which capacity I have worked for the defence industry, but I have since branched out into software and electronics engineering to work in the field of underwater acoustics. At present I work for myself and I build passive acoustic monitoring equipment for wildlife conservationists and researchers. My present goal is to build a system to monitor and localise gunshot poaching and dynamite fishing incidents in near real time.

34. **Ian Cooke-Tapia - Cooked Illustrations**

Ian Cooke-Tapia is an illustrator, storyteller, cultural producer and science communicator from Panama. He has tried his hand at starting a coworking space, running a digital artist collective, kick-started a graffiti troupe that soon dissolved, and was editor of a short-lived international arts magazine. None of these ventures lasted long, but from them Ian learned a lot. Currently based in Wales, Ian spends his days working as a freelance cultural producer and the creative director of Cooked Illustrations, a visual communications agency specialising in science communication, outreach engagement, and bringing research of all types close to the people who would most benefit from having it. From his experience being close to researchers, Ian learned that science is not finished until it is communicated; yet current methods of science communication and outreach are suspect and need to be closely investigated. Ian's mission is to create better science engagement tools, methods and content that helps empower audiences, broad and specific, with the tools they need to make sense of the world. Ian has a deep network in the creative and cultural industries in Wales and to a lesser extent in Europe. His main interests involve the use of creative

production as a means to develop new funding models for research, and how stories embedded in place and lived experience can provide alternative ways to communicate complex ideas. Outside of the creative industries, Ian wishes he could run a farm. Interested in issues of sustainability, food sovereignty, designed solutions, and collective action. Ian is always open to collaboration with any individual, collective, organisation or researcher. Currently, Ian is working on a children's book with Lee and Low.

35.   Ippolit Markelov - BioArt research team of the Art & Science Center, ITMO University |Russia
a.   Artist, researcher, PhD in Biology, Chief researcher Head of the ""BioArtLab"" Art & Science Center of ITMO University. Ippolit focuses on problems of relations in interspecific communication and the transformation of the "living", using and developing neurobiological, bioengineered technological systems. Founder of Science Art group "18 Apples", the Chief Researcher of Posthuman Studies Lab and the visiting professor within the Art & Science Master's program (ITMO University). Selected exhibitions, festivals, art laboratories: Ars Electronica, SymbioticA, GOSH, Ural Industrial Biennale, MMOMA, Garage Museum.

36. **Isaac Núñez Quijada - iBio institute, TECNOx and ReGOSH |Chile**

I am an Engineer and PhD candidate in biotechnology at Pontificia Universidad Católica de Chile and iBio Institute. My research focuses on Synthetic Biology, DNA Assembly and Open Hardware-Software development. I am a passionate advocate for open & free technologies, exploring how they can boost innovation and development in a democratised way, empowering communities to solve their own problems. I am an activist in communities such as ReGOSH and TecnoX that promote the use of open technologies (I was an organiser of the 2018 TecnoX gathering and a current organiser of the 2023 ReGOSH meeting). I am constantly running national and international workshops to share, develop and apply open knowledge and tools because I am really interested in increasing access to cutting-edge technologies by researchers, schools, and developers to improve local communities' capabilities. As a hardware developer, I have worked in the creation of diverse OSH equipment such as a multi-fluorescence imaging low cost equipment called "FluoPi" (one of the PLoS OH channel editor's pick 2018, https://osf.io/dy6p2/), a DNA assembler machine, a bacterial OD device and a real-time LAMP equipment. I am currently working on the development of FluoPi

extensions to make optogenetics. About biological open resources, I have worked in the uLoop DNA assembly and ReClone protein expression toolkit collections. During the pandemic, we use these tools to develop a COVID open and low-cost test, and I am running lots of collaborations around these resources. Other interests: I am a Kung Fu instructor, Solar Punk lover and Vegan :)

37. Jason Whitson - SOAK (Oregon Burning Man Regional) |United States

I am a recently retired nurse who has always maintained a lot of hardware and electronics. I've always enjoyed tinkering and taking things apart and I've long enjoyed figuring out how things work. I blew up my first computer processor in the early 90s by mucking around with the jumper pins on a motherboard. From there it became a series of computer builds, car repairs and work, teaching myself how to solder and build LED arrays. I got building various designs and projects from things I found online and I've taken an interest in learning how to build art from hardware. I really love using electronics and hardware to add capabilities to things like fantastical lamps and furniture.

38. Jay Poh Wei Jie - Edible Makerspace |Singapore

My name is Jay and my background mainly in Biomedical Sciences. Specifically towards the field of research. I have always found science and technology fascinating growing up and I'm particularly interested in the molecular side of things. This leads to a little trivia about myself, where I was actually inspired by science through the geekiness of my comic book obsessions. Spider-man is and always will be my favourite superhero, and it was actually Peter's origin story that got me hooked into genetics and then science eventually. The idea of him being genetically altered through a radioactive spider bite(complete sci-fi bs by the way) was just so cool for an 8-year-old. Anyway, that's what got me into this whole scene and I've just been meandering my way about it ever since. Hoping to constantly broaden my horizons and further my networking. I should also mention that I've only recently gotten into the whole maker scene(about 2-3 years now) and I'm still pretty fresh around it, but really keen to learn as much as I can.

39. Jenny Molloy - University of Cambridge |United Kingdom

I am a Senior Research Associate in the Department of Chemical Engineering and Biotechnology at the University of Cambridge, where my research group builds technologies for an open, globally inclusive and equitable bioeconomy. In particular, we develop biomanufacturing tools and technologies that are sustainable by design and deployable in low-resource contexts. We also investigate the most effective ways that our research can make a positive impact in developing and emerging economies, particularly the effect of open source technologies. I founded the nonprofit Beneficial Bio to support local manufacturing of important reagents for research and diagnostics, such as the PCR enzymes, thus reducing supply chain dependencies, costs and delays. We now work with locally-owned businesses, nonprofits, academic institutions and the public sector in Cameroon, Ghana, Kenya, Ethiopia, Philippines, Chile and Argentina to establish reagent production hubs. Beyond Beneficial Bio, I have co-founded three other social enterprises and nonprofits making open source tools more accessible to researchers and building communities for open source tool developers. I am a long-term member and organiser in the GOSH community having organised the first three Global Gatherings and I am now on the board of Gathering for Open Science Hardware Inc and a PI on the grant from the Alfred P Sloan Foundation that is funding several community activities 2020-2022.

40. Johanssen Obanda - Jabulani Youths for Transformation |Kenya

Johanssen Obanda is a Social Innovator who works with AfricArXiv to build the organisation's scholarly community in Africa; and with Jabulani Youths for Transformation to co-create social enterprises with young people in order to solve economic and environmental challenges in Kisumu, Kenya. He also works with Pint of Science Kenya to organise annual science communication events in different cities in Kenya. After spending nearly five years working in communication and strategy development, Johanssen knows what truly drives conversations and actions that lead to positive social impact. It is how well you connect with people you are trying to help and communicate your understanding back to them. Interests: Social innovation, co-creation, entrepreneurship around open-hardware, sustainable scaling of open-hardware solutions.

41. Jorge Luis Medina Madrid - Universidad de Panamá |Panamá

Mi nombre es Jorge Medina, soy estudiante tesista en la Licenciatura en Biología con orientación en Biología animal. Actualmente formo parte como voluntario y asistente de investigación en el laboratorio de aves del Instituto Smithsonian de Investigaciones Tropicales desde ya hace más de

4 años ayudando a científicos en sus proyectos, Mi área de interés es la ornitología, pero como la mayoría que está en la carrera de zoología me gusta la biodiversidad en general, por lo cual trato de captar mediante fotografías o vídeo cada una de ella y dar a conocerlas en mis redes sociales, también realizó ilustraciones digitales referente a la biodiversidad de Panamá principalmente y promoverlas en redes sociales en otra cuenta alterna enfocada en ilustraciones.

42.   Joshua M. Greenberg - Alfred P. Sloan Foundation |United States

Joshua M. Greenberg is director of the Alfred P. Sloan Foundation's Digital Information Technology program. He is an active member of the broader digital library and digital humanities communities, serving on a number of advisory boards and program committees, and maintains active research and teaching interests in the history and sociology of information technology, the dynamics of public engagement with expert knowledge, and the methodological implications of new digital technologies for research. He has broad experience and understanding of the content and research needs of traditional scholarly communities as well as digitally-networked services and tools to support myriad forms of public engagement and participation.

43.   Josh Seltzer - Nexxt Intelligence |Panamá

I run an AI (NLP) tech company, and have been involved in various conservation and ecological research projects. In general I have a lot of experience with software and AI, and am keenly interested in hardware, particularly hardware solutions for various conservation and ecological challenges: for example, I am invested in working with ecological monitoring systems such as camera traps and passive acoustic monitors, and am equally interested in using AI and developing software to help analyse them.

44.   Juan P. Maestre - University of Texas at Austin|United States

I am an environmental scientist working on community based research projects (among others). My interests are on instruments that can help community based science. In our CBR projects, we are interested in water quality but also in indoor environmental quality. To this end, our research group has developed air quality sensors using open data resources. We also pursue representation of geospatial data to inform community members at broader scales. I am originally from Spain, but coming from the University of Texas at Austin, TX,

USA.

45.   Karl Kaddu - Environment for Development |Sweden

I am a seasoned science communication professional. I am passionate about science and technology innovations that seek to uplift the livelihoods of the underprivileged especially in the global south. I associate with open science and hardware due to the aspect of equity embedded thereof.

46.   Katie Hoeberling - Open Environmental Data Project |United States

I'm the Director of Policy Initiatives at the Open Environmental Data Project (OEDP), where I support government actors, communities, and researchers in redesigning and opening up environmental data systems to strengthen policy, accountability, and civic participation in science and governance. This position has brought together my background in open science and environmental policy in a really exciting way, giving me an opportunity to expand my motivation for open, from focusing largely on policing scientific practice (toward rigour and reproducibility) to enabling cooperation between scientists, communities, and policymakers. It has also helped ground my approach to open science by providing real connections between data and its use by communities and governments, in addition to scientists. I previously managed the Berkeley Initiative for Transparency in the Social Science (BITSS), leading programs on capacity building, infrastructure development, inclusion, and science policy. I organised open science trainings for early career researchers and coordinated the development of two platforms to crowdsource predictions and reproductions. I also organised a consensus-building workshop that resulted in policy recommendations for advancing equitable solutions to publication bias (https://www.pnas.org/doi/pdf/10.1073/pnas.2106178118). I've studied and worked on carbon accounting and offset programs, agricultural extension, cooperative farm innovation, food policy, and food labour at UC Davis, the US Forest Service, UCLA, and in Phnom Penh. In my spare time, you can find me working my garden, volunteering at a CSA in Alameda, hiking, reading a sci-fi or fantasy book (or fanfiction), cooking up a feast.

47.   Lara Jatar - CoSensores |Argentina

Soy Ingeniera Ambiental y actualmente me encuentro realizando un doctorado con una beca de CONICET. El tema en el que me estoy especializando es el estudio de la combinación

de diversas metodologías de potabilización para aportar en la búsqueda de soluciones ante la falta de acceso al agua en el Delta del Paraná, Mpio Tigre, Argentina. Junto con una cooperativa del sitio trabajamos en conjunto, generando también herramientas bajo la lógica del software libre para complementar al sistema de potabilización propuesto a escala comunitaria. Me resulta de gran interés la aplicación y la generación de herramientas y tecnologías junto con comunidades socioterritoriales.

48.   Laura Olalde - Unaffiliated. Artist, educator and independent researcher. |Argentina

I am an artist, educator and independent researcher and I am part of GOSH community since 2017, year in which I attended for the first time to a GOSH Gathering in Chile. Much of my artistic research has been framed since the last decade under the sciart co-production modality together with molecular biologists and social scientists, in an independent and self- managed way, which motivated my interest in building open hardware devices to facilitate access to our practices. For this reason I joined the GOSH community with great enthusiasm and embraced their vision of making scientific hardware ubiquitous by 2025 and facilitating the appropriation of open technologies to the community. Having assisted the GOSH community as a documentation team coordinator during the 2018 GOSH Gathering in Shenzhen, China, and most recently in Panama (2022), I am honoured to be an elected member since 2021 of the GOSH Community Council. I am part of the reGOSH Buenos Aires, Argentina node where I currently live and I am open to generate networks of collaborations on a regional and global scale.

49.   Lenin Rueda Torres - INS - PERU |Perú

I am Lenin Rueda Torres, a Peruvian researcher, medical technologist and MSc. in Environmental Sciences with a major in environmental health (NIH's Geo Health Hub fellow). Currently, I am Head of the clinical Laboratory of the National Center for Occupational Health and Environmental Protection for Health (Censopas in Spanish) which is a line organ of Peru's National Institute of Health. Additionally, I am a member of the Peruvian node at reGOSH, where we aim to solve some of Latin America's greatest challenges through open technologies and open science. Here, alongside a multidisciplinary team, I am developing devices for environmental monitoring of outdoor particulate matter which affects our country significantly.

50.   Linda Aidoo - Kumasi Hive |Ghana

I am an administrator and the space manager for Kumasi hive, a tech innovation hub in West Africa, Ghana. I am a high school graduate without a degree but I have a lot of skills and experience in administration, management, and organisational skills.

51.   Liz Barry - GOSH Community Council; Public Lab; The Computational Democracy Project |United States

Liz Barry cultivates the emergence of collective intelligence through the design of dreaming at scale. She is currently serving as Council Member on the first GOSH Community Council. She also serves on the founding board of The Computational Democracy Project, advises Extinction Rebellion's Future Democracy Hub, and is a nobody at g0v.tw. Some of her other co-founded ventures include: PublicLab.org, TreeKIT, and Talk To Me (NYC) — in each, thousands of people came together to succeed in beautiful and previously impossible missions.

52.   Luis Felipe R. Murillo - University of Notre Dame |United States

Luis Felipe R. Murillo is an assistant professor in Anthropology at the University of Notre Dame. His interests include Anthropology + Science and Technology research, Open Tech research and activism.

53.   Madalina Banica - Zalmotek |Romania

I am a project manager in various Blockchain based projects and I have a background in electrical engineering. I'm passionate about open-source hardware and the decentralisation of information.

54.   Marc Juul - Counter Culture Labs / sudo room / sudo mesh |United States

I have co-founded four (bio)hackers (Counter Culture Labs, sudo room, BiologiGaragen, Labitat) two of which I'm still co-organizing. I have degrees and experience in software and wetware with specialisations in decentralisation/p2p and synthetic biology / lab automation. A partial degree and some experience with electronics design/test/build. I see myself as a tool-builder and enjoy working at the intersection of software, hardware and wetware. My focus is on building open, decentralised and equitable alternatives to existing technologies and infrastructure. Recently I was approved for a small GOSH grant for a "spectrometer brain replacement"

55.   Marcela Basch - Independent |Argentina

I am a journalist and comms person interested in people, words, life, and how to make it more livable for everyone, in love with the open movement. Since 2013 I've been focused into collaborative and open ways to produce, consume, learn and live. I founded El plan C (elplanc.net), a website dedicated to collaborative and alternative economies, free and open culture. I co-organized and co-programmed Comunes (Commons), an annual international conference, with Goethe-Institut. I love connecting people and translating complex ideas into actionable propositions.

56. **Maria Frangos - Breathing Games | Canada**

I am an interaction designer engaged in both practice-based work and design research activities. I have 20 years professional experience and hold a Bachelor of Fine Arts in Design and a Master of Design in Industrial Design. Over the last several years, I've been working as a design consultant in a product design environment for the home energy sector. I'm also a core member of Breathing Games, a collaborative project promoting respiratory health and autonomy through collectively managed and freely available resources, such as open science instruments, free/libre games and knowledge

57. **Mario De Los Santos - SeeedStudio |México**

I am a project manager in various Blockchain based projects and I have a background in electrical engineering. I'm passionate about open-source hardware and the decentralisation of information.

58. **Martín Szyszlican - Sutty.nl, Red Argentina de Educación Abierta |México**

Free software developer, open data activist, raspberry pi and frame.work user. I'm a link between many activist communities in Mexico or Argentina

59**. Moritz Maxeiner - Free University Berlin |Germany**

Long-term FLOSS and recent OS(c)H enthusiast by conviction, computer science research assistant by profession (M.Sc.), I currently develop (open) tech for animal research, as well as study the nature of open hardware in the academic setting. I have extensive experience in writing domain-specific software, as well as some subordinate skills in information security and machine learning.

Outside of work I happen to enjoy playing Pen & Paper games, as well as designing rules, building worlds, and crafting narratives for them.

60. **Nat Irwin - OpenTEAM |United States**

I am the Tech Ecosystem Facilitator at the Open Technology Ecosystem for Agricultural Management (OpenTEAM), a research initiative based out of Wolfe's Neck Center for Agriculture and the Environment. I serve as a liaison between OpenTEAM's network of open source tech developers and on-farm tech users, and I'm working to implement systems of community governance around feature development. I believe that setting up the systems for interfacing between developers and farmers in the OpenTEAM ecosystem will help facilitate a collaborative and equitable shift toward sustainable agricultural methods.

61. **Nicolás Méndez - reGOSH and CONICET |Argentina**

I've always enjoyed opening things up, learning how they work, and to make other things that work. With that in mind, I then studied biotech in university, and then started a PhD in biology (which is ongoing). In the meantime I participated in TecnoX, an event similar to iGEM, held at Buenos Aires. Among many things, these experiences taught me that access to scientific equipment is a huge barrier, for both students and researchers. This sparked my interest in OScH.
b.   Later, I was thankful to participate in reGOSH 2019, at Porto Alegre, and slowly became more involved in the GOSH community. I am now interested in making basic lab equipment using free technology, to overcome local barriers for research and education.

62. **Nicole Meier Alegre |Panamá**

I've been fascinated by the tropics since I was little, travelling yearly from Switzerland to visit my relatives in Panama. I discovered my country's rich history, culture and biodiversity through my grandfather's passion for science and history, and through every adventure he took me to, into panga rides, visiting Embera communities, horseback riding in the rainforest, or visiting colonial sites. Today, this fascination is translated into my aim of addressing biodiversity loss, as well as socioeconomic inequalities facing climate change by using a multidisciplinary and community-based approach in research and conservation. I particularly recognize the importance of working with farmers and Indigenous communities who hold a traditional knowledge and relation to nature imbibed in their historical and cultural identity. In the past, I graduated from the University of Toronto with an Honours Bachelor of Science in Forest Conservation (2018) and worked in research and conservation-driven institutions such as Credit Valley Conservation, Mississauga. My research at

the Neotropical Ecology Laboratory aims to expand our knowledge on biodiversity and forest resilience mechanisms in the face of climate change. I aspire to use this knowledge to guide forward-thinking reforestation and conservation projects to consider the ongoing and predicted changing climatic conditions into their planning and use climate change resilient species.

63. **Niko Arranz |United States**

My name is Niko Arranz. I am a product and spatial designer working both physical and digital spaces. I am currently a designer at a holographic embellishment startup, but I have a background of building interactive experiences. In addition to my profession, I teach grade level students 3D printing and basic programming. A large source of my inspiration comes from biology, physics, and science fields. I frequently visit science and bio art events and volunteer at a public biolab in NYC called Genspace.

64. **Pablo Cremades - reGOSH|Argentina**

I'm currently a professor at Universidad Nacional de Cuyo. I'm in charge of the physics lab at the Faculty of Exact and Natural Sciences. As an old time user of free software, I started developing open hardware during my PhD to assess the lack of air quality data in Mendoza, and Argentina in general. Together with Nano Castro we developed the MACA (Monitor Abierto de Calidad the Aire). Since 2015 I've been developing open hardware for teaching science because proprietary equipment not only are prohibitively expensive, but also limit the possibilities to design experiments other than those the developer originally conceived. Since 2018 I ama member of reGOSH, the Latam chapter of GOSH, and coordinator, together with Nano Castro, of Mendoza node. We're working with CEFIC-Tierra (CEFIC is a space for education and research on agroecology and food sovereignty), Ayllú Cooperative, and other organisations to build an agroecology laboratory. Finally, we are organising the annual reGOSH residence and GOSH regional event in Mendoza to be held in September 2022, for which we've been granted GOSH's 2022 Regional Events Fundings! I'm also participating in the Open Hardware Makers program with a soil respiration chamber project.

65. **Paola Larrauri-Aguilar |Chile**

Ph.D. student in Biological and Medical Engineering. Major in Molecular Biology. STEM education and mentoring advocate. Science Communication and outreach enthusiast. Worked as a research assistant in molecular, cellular, and immunology research projects. Worked as a Commercial advisor and brand speaker in Molecular Biology - Research and Diagnostics area, and as Technology Transfer and linkage Manager in academia. Involved in initiatives for STEM Education such as Serendipity: Mentorship in Science, and Clubes de Ciencia Peru. The technical and interpersonal skills I've developed up to date due to my experience in Research laboratories, customer linkage and service, education STEM initiatives, and scientific outreach allow me to work in Research and Development, Technology Transfer - Management of Science and Innovation, and Science Communication. Currently affiliated to the Laboratorio de Tecnología Libre, held by Fernan Federici at the IBM-UC. My thesis aims to work on the monitoring of infectious agents in the environment through low-cost, open-source, and field-usable sensors (lyophilized and stable components at room temperature). The development of this open and modular platform will allow the development of cell-free sensors for the early detection of molecules associated with infectious agents of interest in the region, such as Cryptosporidium, also enhancing local technological autonomy, and contributing to the technological sovereignty of the region.

66. **Pen-Yuan Hsing – Gathering for Open Science Hardware |United Kingdom**

I have a PhD in biology, am originally from Taiwan but have also lived in the US and UK. My 10+ years of ecological research began with field studies from tree frogs in the rainforests of Costa Rica to visiting oil-spill-impacted corals on the bottom of the Gulf of Mexico in a submarine, and during this time I developed a passion for open science (e.g. publishing a Guide to Reproducible Code in science), open source hardware/software (as a researcher in the Open!Next project), and community/citizen science. I've contributed to the GOSH Roadmap, helped organise related events in 2020, and my first contribution in the GOSH forum dates back to 2017. Now I am a GOSH Community Council member for 2021-2023, and also advises UNESCO and NASA on implementing open science best practices.

67. **Pierre Guillermo Padilla Huamantinco - Pontificia Universidad Católica de Chile |Chile**

Currently, I'm a second-year Ph.D. student in Biological and Medical Engineering at UC (Chile). I have a degree in Electronic Engineering and a Master's degree in Biomedical Informatics for Global Health. I've been participating in Open Science communities since 2014. Then joined the GOSH community in 2017 (Santiago, Chile). I am one of the six elected members of the GOSH Community

Council. My main contributions and collaborations with the global community have been: A DIY-BIO guide for setting up biohacking spaces (available in four languages) and the proposal of reGOSH (the Latin American GOSH venue). My main interests are open-source hardware, microfluidics, and the human microbiome.

68.   **Rachel Aronoff - Hackuarium |Switzerland**
A biologist with broad international experience in basic research, in particular molecular microbiology, Rachel, a Swiss/American researcher based near Lausanne, has significant academic experience, including genetics, imaging, viral vectors and transgenic animals (from worms to mice). In the public service domain, as founder of AGiR! Action for Genomic integrity through Research!, she acts to provide information about and promote projects investigating various aspects of dynamic 'genomic integrity' for public health. The idea is to help create greater awareness of common risks and directly investigate ways to easily protect genomic integrity. Rachel discovered open science practices at Hackuarium in about 2015, and pursues AGiR! projects to open-source classic tests for DNA damage detection and more in this community lab, where she has been the association president since 2018. At the original Hackuarium (in Renens, CH), Rachel worked with the start-up, SwissDeCode, providing crucial experience for development of Corona Detective during the pandemic. Since the lab's move to Ecublens, in February 2019, she has devoted herself to making it a sustainable venture. From amazing participatory research to bioart, with hopes still for AGiR! to really get known and for it all to actually make a difference, lifelong learning and helping others are Rachel's passions. On the personal side, Rachel loves music and reading, and plays on the local volleyball team ('detente' women's league). She has two grown daughters, 20 and 22 years old; and she and her partner love hiking, theatre and concerts, and dream about more surfing and paragliding.

69.   **Rajas Poorna - Georgia Institute of Technology |United States**
Hi, my name is Rajas, and I am a frugal OSH developer from India. I am presently doing a PhD in Bioengineering at Georgia Tech, USA and hold a BS/MS in Physics with a minor in Biology from the Indian Institute of Science. All my projects have been in frugal (very low cost and complexity) instrumentation. These include: 1. Two 80$ open-source devices (100x cheaper than commercial alternatives) to automate tedious and error-prone manual microbial "growth curves" that measure

how fast microbes grow (http://2017.igem.org/Team:IISc-Bangalore/Hardware) 2. Lowering the cost of and speeding up a Diffuse Optical Tomography (DOT) device. DOT is a 3D tissue mapping technique, like 3D ultrasound, but in colour. It can monitor tumours and blood flow in relatively "transparent" tissue like the breast and infant brain. I sped the machine's scan time up from ~40 minutes to 1 second (a ~2400x speedup) 3. A frugal ultrafast photonic PCR device: costs 7$ and can run a PCR DNA test, such as for COVID, in 7 minutes. Ordinary PCR devices take ~1 hour. My PhD work is on a frugal Raman spectrometer. If my design works, it could enable low-cost, reagent-free diagnostics of an incredible variety of diseases (Ralbovsky and Lednev 2020), including tuberculosis, malaria, cancer, asthma, diabetes, Alzheimer's etc. even in remote, low-resource environments. I am presently testing a new method for development and distribution of OSH that could greatly expand its reach. I am also working on a new technique for fast, easy, low-cost optics.

70.   **Reinaldo Xavier Pérez García - Universidad de Panamá |Panamá**
Mi nombre es Reinaldo Pérez, soy Licenciado en Biología con orientación en Biología animal. Mi área de interés es la herpetología, pero me interesa aprender de otras áreas siempre que sea posible. Actualmente me encuentro cursando un posgrado y maestría en docencia superior dentro de la Universidad de Panamá.

71.   **Ryan George - Spira Inc. |United States**
Ryan grew up in Orlando, Florida, and attended school at UCF. After graduation he worked odd jobs to fund a home lab to prototype devices for lab automation and microfluidics before winding up in Taiwan. After teaching science there for a few years he went back to the USA and continued home lab efforts before winding up in California, where he now works with Spira Inc to develop genetically engineered spirulina for sustainable biosynthetic products and precursors. He is excited about the future of open science and making tools more accessible to people around the world! When he isn't in the lab he enjoys the simple absurdities of life, good conversation with audaciously alive forced part time nature enthusiasts, and procrastinating writing assignments.

72.   **Saad Bhamla - Georgia Institute of Technology |United States**
Saad Bhamla is an assistant professor of biomolecular engineering at Georgia Tech. A self-proclaimed ""tinkerer,"" his lab is a trove of

discoveries and inventions that span biology, physics and engineering. His current projects include studying the hydrodynamics of insect urine, worm blob locomotion and ultra-low-cost devices for global health. His work has appeared in the New York Times, the Economist, CNN, Wired, NPR, the Wall Street Journal and more. Saad is a prolific inventor and his most notable inventions include a 20-cent paper centrifuge, a 23-cent electroporator, and the 96-cent hearing aid. Saad's work is recognised by numerous awards including a NIH R35 Outstanding Investigator Award, NSF CAREER Award, Innovation in MedTech Award, and INDEX: Design to Improve Life Award. Saad is also a National Geographic Explorer and a TED speaker.

73. **Shannon Dosemagen - Open Environmental Data Project |United States**

Shannon (she/her) is an environmental health advocate, community science champion and enthusiastic about the potential for open systems and technology to support the creation of a more just and equitable future. She has spent the last 20 years working with environment and public health groups to address declining freshwater resources, coastal land loss and building monitoring programs with communities living adjacent to industrial facilities. Shannon is a Shuttleworth Foundation Fellow with the Open Environmental Data Project, co-founder of Public Lab and Executive Director from 2010-20, an organiser of the Gathering for Open Science Hardware from 2015-2018 and a current GOSH, Inc. board member. She is on the board of Code for Science and Society and Journal of Open Hardware, and previous Chair of both the U.S. EPA National Advisory Council on Environmental Policy and Technology and the Citizen Science Association.

74. **Shannon Hicks - Stroud Water Research Center |United States**

I'm a research engineer with a background in Electrical Engineering, specialising in developing hardware for scientists. I've spent more than 20 years working with various universities, government agencies, and non-profit groups to support students and researchers by creating unique and low-cost equipment for collecting and analysing data. I'm the founder of EnviroDIY, which is an open community supporting development of low-cost hardware for environmental monitoring and supporting software and educational tools. I've always loved science, and my background in engineering allows me to help bridge the two worlds of science research and electronics design, and open source hardware allows me to do that even more effectively.

75. **Stoica Mihnea - Zalmotek|Romania**

Maker and Product manager at Zalmotek and Harkopen, with a wealth of experience in open-source hardware. Formerly trained as a biomedical engineer, I have worked on various projects, from Graphic Design, STEAM education, Industrial Automation, and designing medical devices. In my spare time, to get away from the screens, I enjoy doing leatherworking and reading about behavioural biology.

76. **Sylvia Garza - Smithsonian Tropical Research Institute | Panamá**

I was born and raised in Northern Mexico, and moved to the USA for my bachelor's where I studied Marine and Freshwater Biology at the University of Texas at Austin. For my master's, I moved to Germany and studied Biological Sciences at the University of Konstanz. During and between my studies, I have worked as a research assistant on multiple projects, all focused on animal behaviour, especially field-based projects. I've always been interested in learning about animals, therefore biology seemed like the right fit for a career. However, during my master's I realised I enjoyed learning and talking about other projects more than working on my own, and got interested in science outreach projects. I am currently doing an internship at the Smithsonian Tropical Research Institute in Panama, where I work for a lab that studies evolution and behavioural ecology of a diverse butterfly genus. My main role is to coordinate and establish permanent outreach spaces and programs that can be used by our incoming students interested in communicating their science to the general public. I also develop digital and printed outreach content that can be used by different audiences (teachers, students, lay audience, etc) to learn more about the importance of butterflies, biodiversity and scientific projects.

77. **Tamara Matute Torres - iBio institute, TECNOx and ReGOSH|Chile**

I am an Engineer and PhD candidate in biotechnology at Free Technologies Laboratory (PUC, Chile), developing molecular methods for invasive species detection in Tierra del Fuego. My research focuses on environmental monitoring, synthetic biology, DNA assembly and Open Hardware-Software development. I actively participate in TECNOx and ReGOSH communities (and particularly as an organiser in the Chilean events) to promote open technologies and an equitable culture around technology use and development. I am constantly running national and international workshops on DNA assembly and open technologies for different

communities (from schools to organisations and universities). I believe in the democratisation of knowledge and open hardware as a tool to empower citizens of developing countries. I am very interested in how to make science and technology open for and by all of society, particularly in Latin America. To this aim, it is essential that citizens are actively and responsibly involved with the development and impact of sciences. In that sense, I would like to contribute to this process, both in the development of open technologies and in the implementation and execution of these with the community. Particularly, in the area of biological engineering, we are engaged in the design of various DIY equipment for education and in-field biology, such as devices for DNA fabrication, environmental monitoring and diagnosis. During the pandemic I got involved with the ReClone community to develop the open enzyme expression toolkit together with an open-source and low-cost COVID LAMP test. Currently, I am running various collaborations around these resources.

78.   **Tiago Lubiana - University of São Paulo|Brazil**

I'm a PhD Candidate at the University of São Paulo working with a conceptual representation of cell types in Wikidata, the open knowledge graph of Wikimedia foundation. I'm into open science and open knowledge and taking pictures of little animals for iNaturalist.

79.   **Valeria Aguayo|Perú**

My name is Valeria Aguayo. I'm an industrial engineering student. Linkedin: https://www.linkedin.com/in/vaguayo/ . Since I was little I liked to play at being a teacher, to teach how to take care of the planet in a fun and creative way. When I entered university I participated in different extracurricular initiatives. An experience that changed me was being chosen to be a representative of my university in the international University Innovation Fellows program at Stanford University. Within the training I learned about innovation and entrepreneurship in higher education. That is why, together with my partner Diego Muñoz, we founded Aulas Creativas (https://www.instagram.com/aulas.creativas/) , where we seek to offer workshops to k12 students on innovation and science. We want students to have hands-on experiences and be able to build things. That is why we want to develop prototypes that involve Open Hardware that can be built in schools in Peru, especially in places far from the city that do not have access to laboratories and experiential scientific experiences.

80.   **Valerian Linus Sanga - Bongo Tech & Research Labs Limited, TanzaniaOSH|Tanzania**

Valerian L. Sanga, Eng, is the Co-Founder and CEO of BongoTech & Research Labs (formerly STICLab; The first Tanzanian Makerspace), Co-Founder & CEO of TanzaniaOSH (NGO), and a Steering Committee member of AfricaOSH. He is a Tech & innovation enthusiast, with over 6 years of experience and the designer of an open-source motor board controller (sangaboard) for OFM Microscopes. His interests lie within Distributed Recycling and Additive Manufacturing (DRAM), Open Source Appropriate Technology (OSAT), and Electronics Designing & Development.

81.   **Vicente Rodríguez - Freelance | Panamá**

Born in Venezuela and moved to Panama 6 years ago, Graphic designer, Tech savvy, and open software and Hardware lover. Worked as a translator with GOSH 2022.

GOSH Code of Conduct

The Gathering for Open Science Hardware (GOSH) is a diverse, global community working to enhance the sharing of open source scientific technologies. Specifically, this includes open source hardware (OSH) for scientific purposes which we refer to as open science hardware (OScH).

We strive to make open science hardware open to everybody, regardless of scholarly or professional background, gender identity and expression, sexual orientation, ability, physical appearance, body size, race, age, economic background, country of origin or employment, religious affiliation, and other differences. Because we come from different backgrounds, it is important to be intentional about providing respectful, equitable spaces — both online and in person — for our community to come together and engage in constructive, respectful discourse. As our manifesto states: GOSH is used for peaceful purposes and causes no harm.

GOSH is equitable. Equity is different from equality; equality is about treating everyone exactly the same, while equity recognizes that everyone does not start from the same position and so treating everyone the same may leave them in the same uneven positions they began in. For this reason, we are intentional about actively reducing the inequitable barriers that stand between science and those who create, use, and learn from it. This document is written with this principle in mind.

This code of conduct applies to all GOSH spaces, both online and in person.

While we operate under the assumption that all people involved with GOSH subscribe to the GOSH Manifesto and the values laid out above, we take Code of Conduct violations very seriously. Therefore, individuals who violate this Code may affect their ability to participate in GOSH, ranging from temporarily being placed into online moderation to, as a last resort, expulsion from the community or in-person events. If you have any questions about our commitment to this framework and/or if you are unsure about any aspects of it, please email code@openhardware.science and we will provide clarification.

How To Report A Problem

In Person — Safety Officer or GOSH Organisers: If you are at a GOSH event with a designated Safety Officer, feel free to approach them or an organiser. The people to contact for GOSH Gathering 2022 in Panama are: Nat Irwin, Brianna Johns, Karl Kaddu, and Pen-Yuan Hsing.

Via email — GOSH Organisers: If you experience or witness something, you can also email the organisers at code@openhardware.science Emails to this address will be read by the same safety officers above for GOSH Gathering 2022.

Once you have reported something, we will strive to contact you privately within the same day or in the first hour of the event's start the following morning

How It Works

This Code is an effort to maintain a respectful space for everyone and to discuss what might happen if that space is compromised. Please see the guidelines below for expected community behaviour at GOSH 2022 in Panama, which we expect to apply in the future.

We listen.

We begin interactions by acknowledging that we are part of a community with complementary goals. When something has happened and someone is uncomfortable, our first choice is to work through it through discussion. We listen to each other.
- For active listening, we ask questions first, instead of making statements.
- We give people time and space to respond.
- We appropriately adjust our behaviour when asked to.
- We know that repeating hurtful behaviour after it has been addressed is disrespectful.
- We avoid this ourselves and help others identify when they are doing it.

We practice consent.

At in-person gatherings, everyone's physical space must be respected at all times. For example, there are many ways people greet each other. Before physically touching someone else, ask how they would like to be greeted. .
- Ask first.
- We respect everyone else's right to walk away at any time for any or no explicit reason.
- If you see or experience a violation of consent on a GOSH platform or at a GOSH event, please contact the GOSH organisers in person or on code@openhardware.science .

Note that many forms of harassment do not look like physical or verbal abuse, but still fall into this category. Non-consent can include exhibiting sexual images in public spaces, deliberate intimidation, stalking, following, photography or recording without permission, sustained disruption of talks or conversations, inappropriate or unwelcome physical contact, and unwelcome sexual attention.

Examples of in-person community behaviour

Do	Don't
Ask permission to take pictures of and post about others on social media (see Media Consent, below).	Do not upload photos, tag or mention others online without their consent.
Speak your own narrative, from your own unique experiences and culture.	Do not imitate the cultural expressions of groups you are not a member of, or dismiss people's experiences as illegitimate or merely personal.
Use accessible language to talk about your area of expertise. Be aware and mindful if others in the group seem confused, slow down; stop and ask for input.	Do not present information in a way / language that no one else in the room can understand, with no attempt to include others in the discussion. Accessible language is part of the GOSH manifesto.
Give everyone a chance to talk.	Do not repeatedly disrupt a discussion.
Stop, listen and ask for clarification if someone perceives your behaviour or presentation as violating the Code of Conduct.	Do not ignore or argue others' request to stop potentially harmful behaviour, even if it was an accident or you don't mean it as it is being interpreted.
Use words that accurately describe the situation rather than culturally or socially loaded terms.	Do not use disability and mental/emotional health terminology to describe a situation metaphorically, even if it seems normal to use it.
Ask someone before you touch them, even when joking or greeting, unless the other person has given verbal consent. Hugs, cheek kisses, and handshakes are normal greetings in some cultures, but not in all cultures.	Do not initiate or simulate physical contact without consent, even if it seems normal.
Disengage and find another activity if someone did not invite you and is not engaging with you.	Do not violate personal space by continuing your physical presence into private spaces without consent.
Use an even tone, rate, and volume of voice when disagreeing. Note that differences will be common, and some will be irreconcilable in a diverse movement.	Do not verbally or physically abuse, harass, yell at, or intimidate any attendee, speaker, volunteer, or exhibitor.
Use the pronouns people have specified for themselves.	Do not purposely misgender someone (ie, refusing to use their correct gender pronouns) after they have told you their correct pronouns.
Step up and comment when you see violations occur by emailing code@openhardware.science or reporting to the designated person(s) at in-person events	Do not expect that people who are subject to Code of Conduct violations are comfortable or able to address or report them themselves.
Respond to the point and content of what others are saying, e.g. "I think instead of x, we could do y".	Do not respond to others in a way that makes things personal, e.g. "You are wrong about x".

Additional guidelines for online community behaviour

In addition to the guidelines above, online modes of interaction involve large numbers of people without the helpful presence of visual cues. Because of this, respectful and self-aware online conduct is especially important and challenging. In addition to the Code, which remains in play in online spaces, our community has created specific guidelines for online interactions. If someone violates these guidelines, someone from the Moderators group will place them into moderation by changing that person's posting permission on the relevant list or forum, on the website, or both. Our triple notification standard for moderation means a point person from the Moderators group will 1) email the person directly with a brief explanation of what was violated, 2) send a summary email to the rest of the moderators group, 3) if it happened on a public space (vs a website), notify the community that one of our members has been placed into moderation with a brief explanation of what is not tolerated. Moderators will strive to take these actions in a transparent and documented manner and treat these issues as an opportunity for all to learn how to be more upstanding and help hold a respectful culture.

If you wish to begin the process of getting out of moderation, respond to the email sent to you from code@openhardware.science.

Do	Don't
Stay on topic to make long threads easier to follow.	Do not send unnecessary one-line responses that effectively "spam" hundreds of people and lower the overall content quality of a conversation. (expressions of appreciation and encouragement could be done, for example, via the "heart" emoticon or emoji in response to forum posts)
Start a new thread to help others follow along. Important if your response starts to significantly diverge from the original topic.	Do not respond with off-topic information, making it hard for the large group of readers to follow along.
Write short and literal subject lines to help the readers of the list manage the volume of communication.	Humour and euphemisms in subject lines are easily misunderstood, although enthusiasm is welcome!
Mind your tone. We are not having this conversation in person, so it is all the more important to maintain a tone of respect.	Do not write in an aggressive, disrespectful or mocking tone. Note: writing in all caps is regarded as shouting.

As an example, below is how participation guidelines are introduced at the beginning of GOSH online community events such as Community Calls:

Guidelines on Respect:
Overall, respect all participants in all ways at all times.

In particular:
Respect the time limits: when we allocate a specific number of minutes for dialogue, please be mindful of our need to move forward on the agenda.
Focus on listening and honourhonor whoever is speaking.
In particular, don't interrupt others while they are speaking

Please don't make noises or gestures of disrespect such as rolling your eyes.

Guidelines on Inclusion:
Language: speak slowly and clearly for those who have English as a second language, and always make sure to avoid jargon and acronyms, using vocabulary everyone can understand
A reminder as well that the GOSH code of conduct applies to both in-person and virtual spaces.

Another useful resource is the Anti-Oppression Resource & Training Alliance (AORTA) meeting facilitation guidelines: http://dev.aorta.coop/wp-content/uploads/2017/06/AO-Facilitation-Resource-Sheet.pdf

Media Consent

- There will be a media release form for all attendees to sign at GOSH 2022 in Panama. This gives the GOSH organisersorganizers permission for the official photographer/videographer to include you in event photos and videos. If you do not wish to be photographed or sign the release, you are responsible for informing the official photographer, such as, but not limited to, raising your hand in the moment to alert them to move you out of frame. We are happy to accommodate you.

- If you are taking a photograph, let people in the room know.

- If you do not want to be in photos/videos taken by participants other than the official photographer, please communicate this to them. Though we cannot be responsible for enforcing this among attendees.

- Always check with parents about posting anything with minors (such as those less than 18 years old), and never post the name of a minor in conjunction with their photograph.

Consequences

- Anyone requested to stop behaviour that violates the Code of Conduct is expected to comply immediately, even if they disagree with the request.

- The GOSH organisers may take any action deemed necessary and appropriate, including immediate removal from the meeting without warning.

- The organizers reserve the right to prohibit attendance at any future meeting.

By attending GOSH events and participating in any GOSH on/offline spaces, you are agreeing to this code of conduct.

This Code of Conduct was created collaboratively and drew from other Code of Conducts, including those by Public Lab, International Marine Conservation Congress 2016, and TransH4CK.

GOSH 2022 Media and Online coverage

Publications citing GOSH

-        Arancio, J., Basch, M., Dosemagen, S., Molloy, J., & Johns, B. (2021). GOSH Community Events Framework. Zenodo. https://doi.org/10.5281/zenodo.6278222

-        Arancio, J., & Molloy, J. (2021). Open Hardware is ready to help Technology Transfer Offices (TTOs) maximise the impact of academic research. Zenodo. https://doi.org/10.5281/zenodo.5094999

-        Arancio, J. (2021). Open Hardware: A key for accelerating science and technology towards the U.N. Sustainable Development Goals (SDGs). Zenodo. https://doi.org/10.5281/zenodo.5415527

-        Weinberg, M., Molloy, J., Bowman, R., Dosemagen, S., Irwin, N., Johns, B. and Stirling, J. (2021). Distributed Manufacturing of Open Hardware: A Report of the Open Hardware Distribution & Documentation Working Group. NY: Engelberg Center on Innovation Law & Policy.

-        Antoniou, R., Bonvoisin, J., Hsing, P., Dekoninck, E., & Defazio, D. (2022). Defining success in open source hardware development projects: A survey of practitioners. Design Science, 8, E8. doi:10.1017/dsj.2021.30

-        Chandler, M. Novak, A., Parker, A., Schuett, A., Long, A., Bowser, A. (2022) Rethinking Data Quality: Considerations for Low-Cost (and Open Source) Science Tools. Wilson Center.

-        Arancio, J. and Dosemagen, S. (2022). Bringing Open Source to the Global Lab Bench. Issues in Science and Technology. 38(2) 18–20.

Online Content
-        Journal of Open Hardware Blog: Sustaining community cohesion and enthusiasm with a cadence of "sparks" and social activities
-        Seeed Studio Blog: GOSH 2022 in Panama: Seeed Organized AIoT2Wild and Custom Electronic Design Workshops Using SenseCAP K1100 Kit!
-        QC/QA interviews with GOSH participants
-        Hackster.io Blog: Seeed Meets GOSH 22: The Path of the Open Hardware Community
-        IO Rodeo Blog: Spotlight on GOSH
-        Visual Notes from the Gathering for Open Science Hardware 2022

Social Media
-        Website: https://gathering2022.openhardware.science/
-        Twitter hashtag: #GOSH2022 and Community Account: @GOSHCommunity
-        Instagram hashtag: #GOSH2022 and Community Account: @gosh_community
-        GOSH Community Flickr
-        GOSH 2022 Forum

Local Media Coverage
-        Ciudad del Saber Newsletter
-        CineANIMAL video