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Making Sense

H2020 CAPS Project

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STATEMENT OF ORIGINALITY

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INTRODUCTION

Making Sense is already showing us how urban participatory sensing may become a more established pathway for citizens and communities to produce and interpret data themselves from air quality outdoor and indoor, odour nuisance to noise and water pollution. And our current DIY/DIT developments of low-cost and open source sensing technologies are increasingly helping the support and enablement of such citizen and community-led interventions in environmental monitoring.

We always envision more nevertheless, with citizens and their communities playing the leading role in creating, designing, building and implementing transdisciplinary bottom-up technical and social innovation strategies in all stages of the project and in their own houses, streets, neighbourhoods, cities, regions, or even countries.

Allowing these citizens to reflect on the required steps to appropriately develop this process, and above all supporting them while they pass from the thinking to the acting stages, has a series of benefits. If selected by and decided upon by those who have an actual stake in the matter, we strongly believe that data will become more relevant and reach higher impact levels as it is appropriated by those who need it.

Supported by relevant open technical and social tools for their own contexts, citizens and their communities can take ownership and responsibility for the data collected and analysed, increase their own chances of staying engaged throughout and after the process, and hopefully find new channels for their own empowerment at multiple levels, from environmental and economic, to social, cultural and political dimensions.

Remembering Ivan Illich in his seminal work Tools for Conviviality (1973), *"the crisis can be solved only if we learn to invert the present deep structure of tools; if we give people tools that guarantee their right to work with high, independent efficiency (...) People need new tools to work with rather than tools that "work" for them. They need technology to make the most of the energy and imagination each has."* [1]

[1] Illich, I. (1973). Tools for Conviviality. Glasgow: William Collins Sons & Co. p.23.

From our standpoint as enablers, curators or organizers of participatory sensing pilots in 3 different cities, Amsterdam (Netherlands), Barcelona (Spain) and Prishtina (Kosovo), one of the main questions is indeed how to build robust conditions for a successful participatory approach here that can at least help inverting this still present centralized structure of tools. But most of all, we also need to understand what do we mean by success within each of these pilot, and what is truly required to assess it beyond traditional quantifiable check lists that can become counterintuitive in this context.

We are thus facing simultaneous opportunities and obstacles in putting into practice a bottom-up participatory approach. A crucial challenge here is for citizens and communities to define what they want to achieve in the end, and choose an adaptable path taking into account the environmental, economic, social, cultural and political circumstances that will always change with time. And we recognize this is a course of action and reflection that will probably stay open for a long time after the end of Making Sense itself.

But we also believe we need to tackle it right now by establishing from the very beginning an approach based on transdisciplinary processes driven both vertically, by integrating all possible citizens' interests and actions, that is, closely embedding immediate practical issues and needs, and horizontally, by promoting a collaboratively designed and strongly balanced framework which is able to draw from any form of suitable disciplinary or lay knowledge, that is, from social to technical disciplines, from citizen science to vernacular know-how.

The ultimate goal of empowering citizens and communities to make social change in their local contexts will only be achieved if this is done from first to last days within such open and highly engaging and encompassing frameworks.

We can always repeat to the exhaustion that a bottom-up and participatory approach in the context of projects such as Making Sense needs to start from the real needs of citizens and communities who are trying to understand concrete problems, such as air and noise pollution, and what they can do to improve it. But if we are not aware of the necessary or most likely pathways to design and achieve it, meaningful words will never be turned into meaningful and sustained actions.

This is first about getting to a diagnosis of a problem or issue (the “what” or “why”) that should always be done by citizens and their communities, independently of the level of expertise offered by those of us supporting them within such discovery phases. But then, we should always be aware that a set of other questions will surely arise with it.

For example, who are these citizens and communities (the “who”)? Are they in place or engaged, for instance in neighborhood associations or environmental groups, or are they mainly unorganized lay citizens in need of first day resources and structured mobilization and action strategies? Do we need to promote their organization through specific processes? Or do we fully refuse any prescriptive models in favor of self-autonomous ways of citizen participation?

Specific problems in the context of Making Sense can be translated into questions and answers through the use of DIY/DIT and low-cost open source sensing technologies (“for what” and “how”). But we should also be conscious of the emergence of several other sensible points of discussion.

Which challenges emanate from the openness and adaptability of low-cost technologies? How can they influence the whole process, pertaining to issues such as data quality or calibration? And how should we factor technical glitches, higher level of required skills and time, or overall accessibility to citizens and communities?

As a crucial point also to be considered, urban participatory sensing needs to encourage open and inclusive relationships between citizens, communities, NGOs, public administrations, business and industry players, and several other actors in a given territory or context (“with whom?”). And once more, additional questions will find their way into the mix.

How to position participatory sensing communities in larger scientific and technological ecosystems? How to engage already established institutional actors in processes that sometimes conflict with their own goals? How to make the best of possible connections with those who are already engaging with similar issues? Or yet how to position citizen and community outputs within debates already being led by some of these actors?

All this requires a plan for intervention or implementation with a shared set of milestones and goals that could fit the largest possible number of contexts and experiences inside and outside of Making Sense if we want to maximize our efforts.

This type of plans may never be assumed as fit-for-all model, but it should set a course for action based on environmental data collection, analysis and interpretation, with the goal of supporting a variety of practical activities and events, from campaigns, bootcamps, hackathons to training sessions or interventions in public spaces. Moreover, it should also set

such course for action in a way that it is conceptually informed by theoretical and empirical evidence pointed at the sustainability in time and resources of all activities and outputs envisioned and developed within Making Sense.

During and after its execution and depending on the objectives established in the beginning, Making Sense can strive for increased awareness and empowerment in the local context, actual policy change, or outreach with wider publics not in traditional, formal and scientific formats but with more participatory and creative methods.

Such a complex, dynamic and multifaceted process at the heart of a bottom-up and participatory approach calls for the use of a flexible framework able to employ several methods of design for social and technical issues, while being highly adapted to each one of the involved contexts and communities as mentioned earlier.

First, this builds on previous experiences of participatory sensing and community led environmental monitoring initiatives, by the Making Sense partners and other relevant citizens and communities throughout the world, directly addressing the best practices but also the main challenges faced so far, as captured in precedent Making Sense endeavors (D6.2 + D4.1). Second, it also derives from a follow-up on the mapping of such best practices and challenges with informal conversations and contacts with the coordinators of the pilots, and when possible, community participants, together with particular moments of qualitative observational research in some of the pilot contexts, and access to produced materials of previous and ongoing activities in the pilot cities.

But as this framework was never meant to be a mere conceptual or prescriptive exercise concerning best approaches for citizen and community engagement, we decided to take it also into a different development level, with a hands-on and practical framework co-created between all Making Sense partners, those in charge of pilots (Waag Society, IAAC and PEN), and those in charge of providing support to the pilots themselves (Dundee University and JRC).

We shaped and organised a co-design and generative tools workshop with partners and key players from the Making Sense communities with this in mind, where the main outputs could be used “on the ground” with a sort of collective ownership by those who would benefit the most from them.

What is included in this deliverable is an enriched textual and visual summary of this co-design and generative tools workshop, its methods and main exercises, together with a perspective on how its main outputs can take us into the flexible and encompassing participatory framework we have been referring to. The structure of this document is the following:

Section 1. Co-Creation and Participation in Community Engagement describes the main purposes, key activities and outcomes of the co-design and generative tools workshop.

Section 2. Open Shared Framework to Build and Sustain Communities describes the framework that emerged in the final session of the workshop, while also drawing from presentations and exchanges that took place throughout the two days.

Section 3. Proposing a Minimally Viable Open Manifesto for Making Sense puts forward a set of principles or guidelines as recommendations for conducting a participatory approach within community engagement contexts for collective environmental monitoring.

1

CO-CREATION AND PARTICIPATION IN COMMUNITY ENGAGEMENT

Background

As means to co-create the shared and open participatory approaches we aim for within Making Sense, a co-design and generative tools training workshop was held on June 7 and 8, 2016 at the European Commission with partners and key players from the Making Sense Project. The workshop was co-designed and organized by the Joint Research Centre (JRC), together with key external experts in this field, Liz Sanders, from Ohio State University (OSU) and MercèGraell from University Politècnica de Catalunya (UPC) who also played the roles of co-facilitators throughout all of the workshop.

A co-creation platform and wide set of co-design generative tools were chosen and put to use within this workshop to build and enact simultaneously a framework for Making Sense, as a transdisciplinary approach that actively attempts to involve all stakeholders (e.g., experts, citizens, policy makers, etc.) in any design process, therefore helping to ensure that the results meet their needs and are ultimately actionable.

This was our decision to better address the initial questions stated in the Making Sense proposal of improving the conceptual and methodological framework of the project, by

complementing in-field evaluation and research on the strategies being deployed by each partner, with suggestions for innovative methods and best practices of community engagement that should permeate all relevant Making Sense processes and components.

We went **from the first two mapping and exploratory steps already mentioned in the Introduction, into a new setting where all partners shared their recent efforts and activities in the scope of the project. And then we employed multiple co-design and generative tools to create and visualize a common participatory framework for community engagement**, moving ahead not only in their own contexts, but also in the Making Sense consortium a whole.

Aiming at such a broad perspective and especially when discussing a common game plan for Making Sense, however **we always acknowledged the specific characteristics and needs of each context, trying never to erase the specificities that make them unique, and also never to create an artificial pre-packaged solution for all pilots to adopt and implement.**

It is never enough to remind how crucial choices like this need to carefully consider every project needs to always keep its participatory framework as open as possible to modularly integrate and play with methods and tools which might work better in a given context. Flexibility is a key for our goals, guided by general principles of creativity and collaboration that place citizens and communities as the main deciders and co-creators of the process. Such co-creation or in-depth engagement of citizens and communities varies on the local conditions in the contexts, such as resources, environmental awareness, political priorities, or any unintended circumstances that may arise.

In attendance at the workshop were members from all the partner of the Making Sense project, as well as other stakeholders involved in the pilots and members of related projects:

- Waag Society (WAAG) from the Netherlands
- Institute for Advanced Architecture of Catalonia (IAAC) From Spain
- Peer Educators Network (PEN) and Science for Change from Kosovo
- Dundee University (DUNDEE) from The United Kingdom
- Joint Research Center (JRC) from Belgium
- hackAIR | Collective Awareness for Air Quality (another CAPS project)
- Laboratory of Geo-Information Science and Remote Sensing, Wageningen University from the Netherlands (collaborating with Waag Society)
- citizens/participants in the Amsterdam first pilot from the Netherlands, Urban AirQ, including the leader of the TreeWifi project (collaborating with Waag Society)

The stated objectives of the workshop were:

- To develop a shared understanding of and appreciation for each other's work and methods in participatory and community based activities,

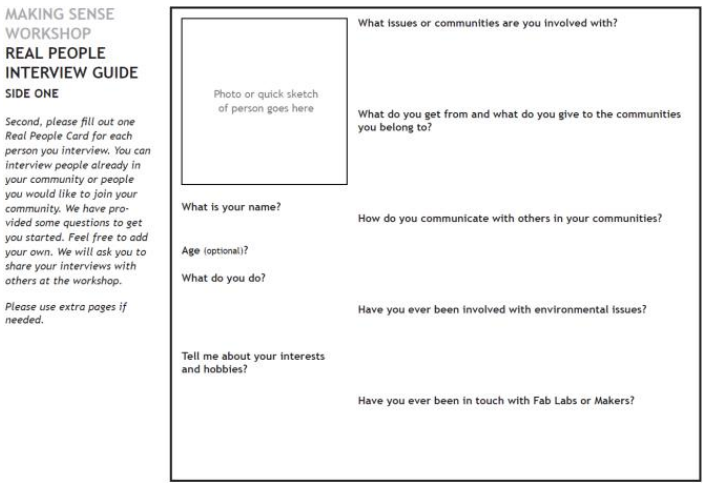
- To learn about and to gain hands-on experiences with co-designing and generative design research tools while engaging in project-related activities;
- And to apply these co-designing methods and tools to establish and visualize a common ground that could be expressed as an actionable framework for participation and citizen engagement.

The key activities that took place during the workshop included:

- Presentations about progress and future plans from each of the consortium partners,
- Presentations on Co-designing and Generative Tools with an applied case study example,
- Hands-on immersion in conducting co-design sessions with generative tools,
- Visualization of experience timelines for each of the pilot cities, and
- The collective creation of an actionable framework for participation and citizen engagement.

Homework

The workshop participants were assigned homework to complete before the workshop itself. Each participant was asked to conduct one or two interviews with current and/or future community stakeholders in the respective pilots or similar previous contexts. A pre-defined template was prepared (Fig. 1) as a common guide to present the information, in an easy-to-use format standing between a "persona card" and a semi-structured interview guide. This assignment was essential to ensure that the co-designing activities in the workshop could be used to produce results that directly came from the contexts of the pilots and therefore are relevant and actionable.



MAKING SENSE WORKSHOP
REAL PEOPLE INTERVIEW GUIDE
SIDE ONE

Second, please fill out one Real People Card for each person you interview. You can interview people already in your community or people you would like to join your community. We have provided some questions to get you started. Feel free to add your own. We will ask you to share your interviews with others at the workshop.

Please use extra pages if needed.

Photo or quick sketch of person goes here

What is your name?

Age (optional)?

What do you do?

Tell me about your interests and hobbies?

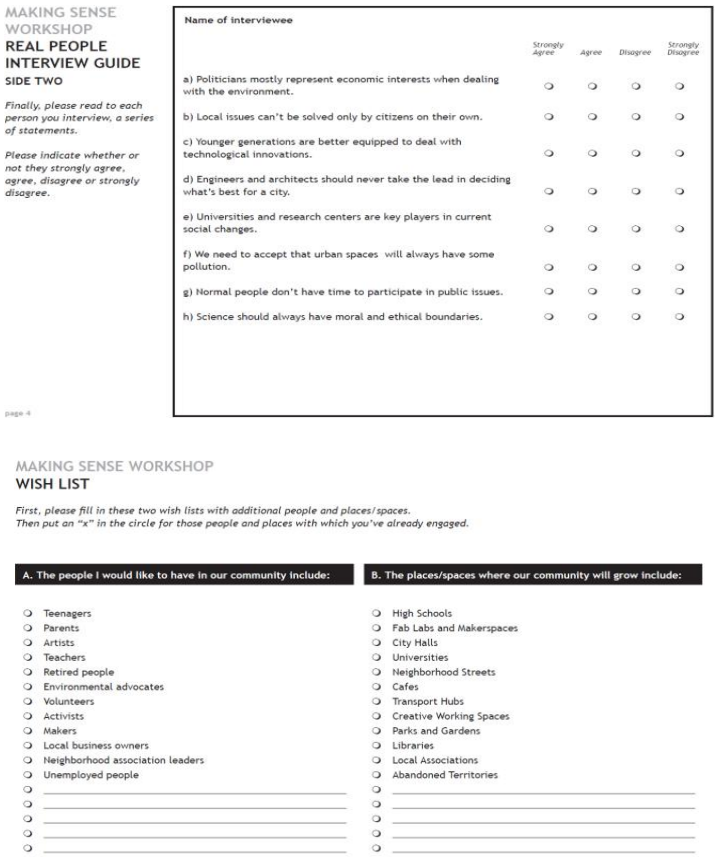
What issues or communities are you involved with?

What do you get from and what do you give to the communities you belong to?

How do you communicate with others in your communities?

Have you ever been involved with environmental issues?

Have you ever been in touch with Fab Labs or Makers?



MAKING SENSE WORKSHOP
REAL PEOPLE INTERVIEW GUIDE
SIDE TWO

Finally, please read to each person you interview, a series of statements.

Please indicate whether or not they strongly agree, agree, disagree or strongly disagree.

Name of interviewee

	Strongly Agree	Agree	Disagree	Strongly Disagree
a) Politicians mostly represent economic interests when dealing with the environment.	❍	❍	❍	❍
b) Local issues can't be solved only by citizens on their own.	❍	❍	❍	❍
c) Younger generations are better equipped to deal with technological innovations.	❍	❍	❍	❍
d) Engineers and architects should never take the lead in deciding what's best for a city.	❍	❍	❍	❍
e) Universities and research centers are key players in current social changes.	❍	❍	❍	❍
f) We need to accept that urban spaces will always have some pollution.	❍	❍	❍	❍
g) Normal people don't have time to participate in public issues.	❍	❍	❍	❍
h) Science should always have moral and ethical boundaries.	❍	❍	❍	❍

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MAKING SENSE WORKSHOP
WISH LIST

First, please fill in these two wish lists with additional people and places/spaces.
Then put an "x" in the circle for those people and places with which you've already engaged.

A. The people I would like to have in our community include:	B. The places/spaces where our community will grow include:
❍ Teenagers	❍ High Schools
❍ Parents	❍ Fab Labs and Makerspaces
❍ Artists	❍ City Halls
❍ Teachers	❍ Universities
❍ Retired people	❍ Neighborhood Streets
❍ Environmental advocates	❍ Cafes
❍ Volunteers	❍ Transport Hubs
❍ Activists	❍ Creative Working Spaces
❍ Makers	❍ Parks and Gardens
❍ Local business owners	❍ Libraries
❍ Neighborhood association leaders	❍ Local Associations
❍ Unemployed people	❍ Abandoned Territories
❍ _____	❍ _____
❍ _____	❍ _____
❍ _____	❍ _____
❍ _____	❍ _____
❍ _____	❍ _____

Fig. 1: Homework given to consortium partners' prior to the workshop

Presentations from each of the consortium partners

The Making Sense Workshop began with presentations by representatives for each of the pilot cities. The aim of these presentations was to get everyone quickly up to speed on what has been going on, to make explicit what the goals were for each of the pilot cities, and to review best practices and lessons learned so far (see presentations in Annex I).

One member from each pilot city came prepared to present their city's progress to date in a presentation addressing the following topics:

- What is the purpose of your work and its expected impact?
- Where are you in the process?
- What is working well and what is not working so well?
- What plans do you have for immediate next steps?
- What do you hope to get out of this workshop?

After the presentations, the facilitators asked the participants to identify and to note on cards any surprises and/or insights that had occurred during the presentations (Fig. 2). Notable among the surprises and insights were:

- Diversity is a most important strength of this group that incorporates experienced partners with a lot of relevant, yet different, experiences.
- Building a common framework for such a diverse group poses challenges.
- Efficiency in social activism, considering the energy amongst volunteers in Prishtina is remarkable!
- Barcelona is starting from a ground zero from the needs of the people and existing issues, now building an open map of Barcelona communities, networks and civic associations, and already and connecting across this map.

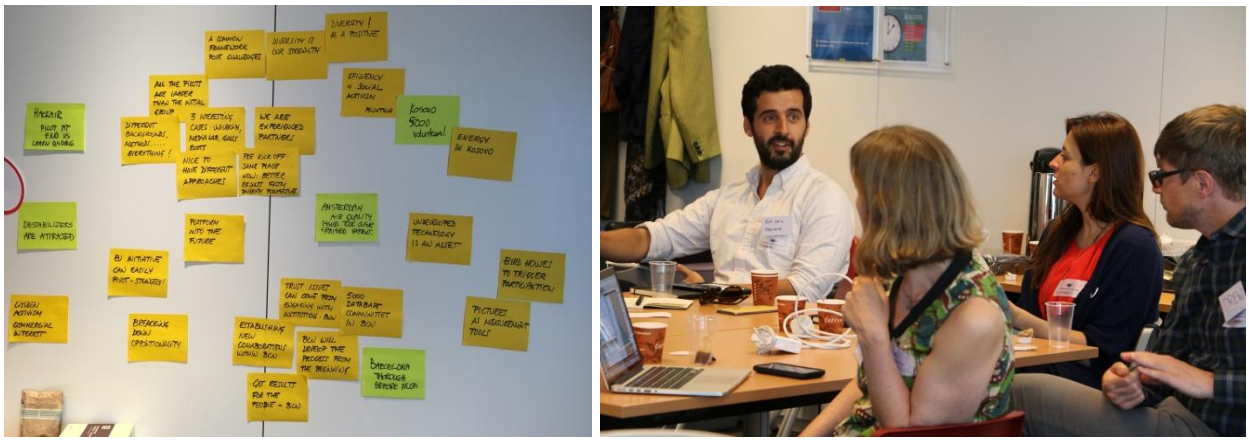


Fig. 2: Key insights from the consortium partners' presentations

Presentations from the facilitators I: A presentation on Co-designing and Generative Tools

Liz Sanders presented Co-designing and Generative Tools (see presentation in Annex II). It introduced the workshop participants to the theory and practice of co-designing, and the topics covered included a definition of co-designing, the positioning of co-designing in the overall design and development process, and a theoretical perspective on individual creativity and collective creativity. An introduction to the Participatory Prototyping Cycle (PPC) and the use of generative tools for making, telling and enacting was also presented. Many examples of the Participatory Prototyping Cycle in action were shared, including projects in industry as well as academic research projects that could offer useful inputs for Making Sense, from front-end exploration and innovation in the design of consumer products and services, the built environment, healthcare spaces and systems, and industrial technological products and systems.

The PPC is a framework for action in design that has emerged over 35 years of practical experience by Liz Sanders while working with teams and communities in the front end of the design and development process2. Its framework invites relevant stakeholders into the design process and supplies them with tools, methods and activities that they can use without having education or experience as designers. The PPC combines making, telling and enacting and uses each activity to fuel the next. By putting making together with telling and enacting, people who are not skilled in making can be empowered to externalise their visualization process. The PPC is especially effective when it is used to frame co-designing activities for teams that are made up of stakeholders from different backgrounds.

The unique advantage of the PPC model is its emphasis on the cyclical and iterative relationship between making, telling and enacting (Fig. 3). You can enter the PPC at any point, i.e., by making things, or telling stories about the future or enacting future experiences. And from each entry point, you can move in any direction. The PPC opens a myriad of possibilities for participation by all the relevant stakeholders in the early front end of design projects.

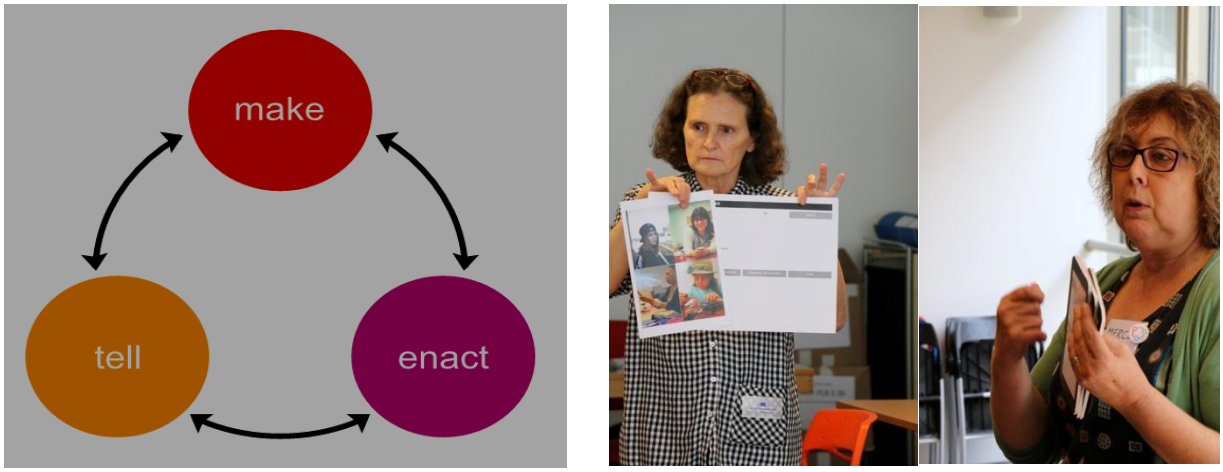


Fig. 3: Iterative model of making, telling and enacting, explained by both Liz Sanders and Mercè Graell.

In making, we use our hands to embody ideas in the form of physical artefacts. Telling is a verbal description about future scenarios of use. We might tell a story about the future or describe a future artefact. Enacting or pretending refers to the use of the body in the environment to express ideas about past, present or future experience.

The primary advantage of the making/telling/enacting model is that it provides for alternative forms of expression for all the stakeholders in the design process. Some people will respond best to stories, some to the enactments and others to the props and models. By utilising all

[2] The PPC was introduced in: Sanders, E.B.-N. and Stappers P.J. (2012). *Convivial Toolbox: Generative Tools for the Front End of Design*. Amsterdam: BIS Publishers.

three in an iterative cycle, everyone who has a stake in the experience domain can contribute to the conceptualisation process and find a means of externalising their visualisations. Liz Sanders' approach is thus characterized by a participatory mindset that values people as co-creators in the design process and is oriented to concrete action. In this sense it stands in contrast with critical design approaches, such as speculative design3 and design fiction, more oriented by an expert mindset in which design researchers are designing for the people, not with the people.

In the Making Sense workshop a set of methods and tools were put to use using the making/telling/enacting model. In making, the workshop emphasized hands-on experiences with both 2D and 3D materials for making. A large variety of materials were made available for the participants to use for planning co-design activities and toolkits in the workshop and also potentially in the pilots. A sample of some of the making materials is shown below (Fig. 4).

[3] Dunne, A., Raby, F. (2013). *Speculative Everything: Design, Fiction and Social Dreaming*. Massachusetts: The MIT Press.

Fig 4: Sample of the 3D and 2D generative tools used in the Workshop

In enacting, the participants were encouraged to explore it as a collaborative co-design method. Velcro-modelling materials and other props were made available for their use. The telling methods were used throughout the workshop as the participants shared their homework content, explained what they have made using the 2D and 3D materials as well as reflect on the enactments.

Hands-on immersion in conducting co-design sessions with generative tools

Next we discussed the stakeholders who showed up in the homework as well as the stakeholders who emerged in the presentations by the consortium partners. The stakeholders, who might be participants/citizens playing a role in the Making Sense project, included:

Politician	University student
Activist	Chief Technology Officer of Amsterdam
Community champion	Representative of an organization
Concerned citizen	Tourist
Person with asthma	Other experts
Petrol company representative	Academic
Journalist	Doctor
Local business owner	Volunteer
Expert with a negative attitude	Child (aged 9 to 12)
Angry old woman	

Applying a making/telling/enacting model, the participants were then invited to use the wide range of 2D and 3D tools and materials, made available by the facilitators, to explore how best to set up a generative session to further develop one or more of these stakeholders (Fig. 5). Each team planned and prepared a half-hour generative design research session to execute on another team. Thus, each workshop participant had the opportunity to serve as a researcher on their own team and also as a participant for another team.

Fig. 5: Generative co-design session with 2D and 3D tools

After the co-design sessions, the 13 stakeholders who were further developed were summarized in the form of stakeholder posters that we put on the wall (Fig. 6) as a reminder of the diversity of people who might take part in the Making Sense Community in the future.

Fig. 6: Stakeholder posters developed

Presentations from the facilitators II: Presentation of an applied case study example

MercèGraell presented a case study called Co-Designing with Citizens: The IC3 Case (see presentation in Annex III). She shared the co-design process developed with the Catalonian Climate Institute (IC3) and sponsored by a big national bank. The challenge was to make a significant positive change in people's generally indifferent attitudes regarding climate change. Mercè described the different stages of the process—including methods, techniques and learnings - up to the conceptualization of many solutions.

As a summary, the case showed:

- How people's perceptions and attitudes regarding climate change were explored: how the many co-design activities helped to identify the barriers and leverage points for people to act.
- The co-design strategy: the co-design activities included contextual immersion techniques within samples of people with awareness, without awareness and others who denied climate change. They created projections of the future and collective reflections of future-present situations.

- Analysis and synthesis of co-design outputs.
- The creation of a conceptual model.
- The different actions and initiatives designed with a focus on participation, user content building and exploration.

Visualization of experience timelines for each of the pilot cities

Each pilot city team was then given the challenge to visualize their project plan in the form of a timeline that extended from the start of the project and went all the way to the end of the project and beyond (Fig. 7). Generative toolkits (2D and 3D tools) were made available for the workshop participants to use to express their plans. The following sections show the timelines for each city and provide notes that capture the essence of the presentations that were made for each of the timelines.

Fig. 7: Building the experience timelines for the pilot cities

Roadmap Amsterdam

Waag presented their three pilots (see the orange ovals) on their timeline (Fig.8):

1. The Urban Air Quality pilot that started two months ago.
2. The Smart Kids Lab that will start in October.
3. The third pilot is still an open question. Inspired by Barcelona, Amsterdam will do community and issue mapping before deciding what to commit to.

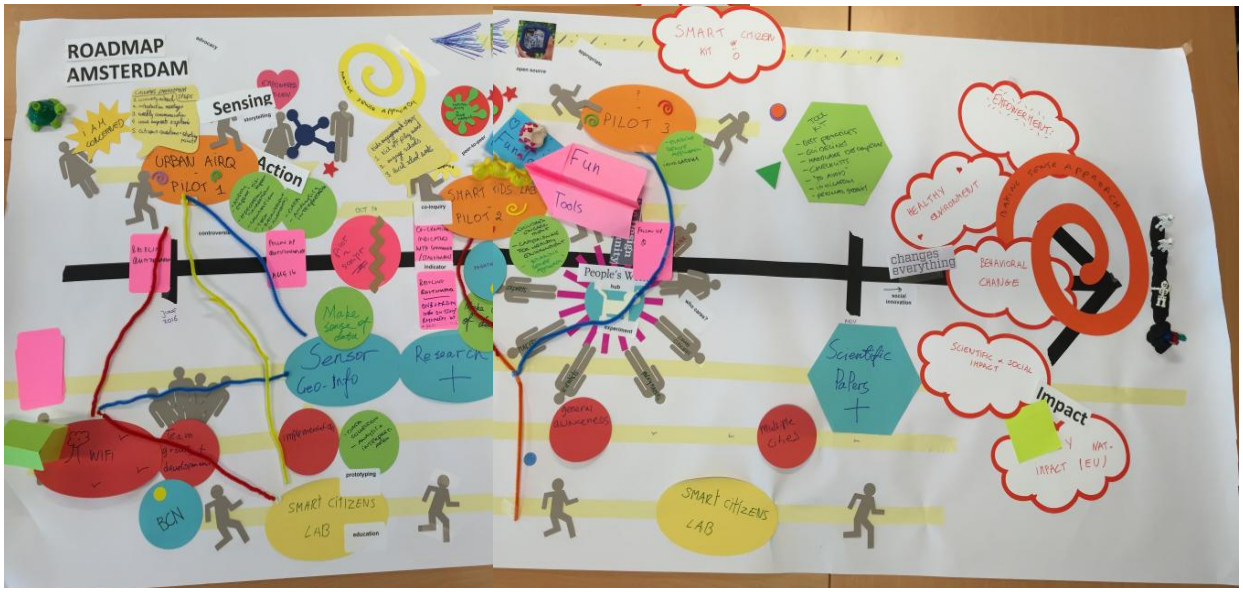


Fig. 8: Roadmap Amsterdam as co-designed by their participants

They also detailed three additional lines of activity (on the bottom half of the paper) connected to the pilots:

- Smart Citizens Lab that builds on cooperation with the City of Amsterdam (CTO), HvA, RIVM, SenseMakers, Alterra, AMS, Amsterdam Economic Board, Fablab Amsterdam and Waag's Open Wetlab, also internationally supported by Fablab Barcelona, Microgiants, FutureEverything and Dundee University.
- The TreeWifi project that uses the trees in Amsterdam to measure the air quality, and to motivate people to use public transportation and their bikes more often by rewarding them with free WiFi when the air quality improves in their street.
- The Sensor Geo-Information project as a case study deriving from the Smart Citizens Lab that is focusing on citizen sensing for improved urban environmental monitoring, in collaboration with Dutch universities and research centers.

a) The Urban Air Quality pilot has engaged 15 to 30 participants. But the outreach has been much larger since the story was featured on television. A lot of data has been collected and will be analysed and interpreted. Some of the learnings from this first pilot include:

- How to work with "angry citizens" and skeptical experts,
- How better to manage expectations from participants,
- How to deal with problems of technical calibration of the low-cost sensors.

b) The Smart Kids Lab will start in October. It kicks off at a planned event and the team in Amsterdam plans to engage about 100 to 200 kids in the 9 to 12 year old age group. In this pilot Waag hopes to draw key learnings on how to engage young people in environmental monitoring and to help them to become active campaigners. They want this young group to learn what it means to collect data about the environment, to visualize the data and to get a feeling of what it is to sense their environment. They hope that this pilot will turn into a campaign about bad or poor air quality.

A part of Waag's participatory approach is to engage with other experts such as makers, scientists and other organizations. They plan to use advocacy to reach many more people than those directly involved in the pilots. In their roadmap for the Making Sense project, Waag presented their main goals they would like to achieve: broadening the range of people actually doing environmental sensing, producing scientific impact on the topic of citizen sensing, promoting actual policy change, and delivering an output in the format of the "Making Sense Toolkit" that can reach wider publics.

The Making Sense Toolkit is an evolving and collaborative output of the project assembling the contributions from all partners and has been a key output from the project from its early draft versions, and has been changing in form and contents as the projects is developed in all 3 pilot cities. It currently stands as a knowledge and resource online and offline environment for participatory sensing with DIY, low-cost and open source technologies, but future learnings are prone to offer a few structural changes. From the beginning its overarching goals are to foster community appropriation of existing sensing technology infrastructures, encourage data sensemaking processes, embed technical and methodological skills and foster learning among participants and across communities.

Waag envisioned the Making Sense toolkit containing the following items:

- Documentation and tutorials for use of low-cost sensing technologies,
- Software platform with resources,
- Best practices in both online and offline format (what works and what doesn't),
- Collection of personal stories from pilots,
- Also available as a PDF (i.e., downloadable and printable for free).

Roadmap Prishtina

The partners from Prishtina, the Peers Educators Network (PEN) and Science for Change, are well-established in their local context as civic and social organizations aiming to promote active citizenship, especially focusing on a young population. In their activities in participatory sensing and citizen science, they have focused since 2014 on working with young people (also considering the high percentage of Kosovo's population being under the age of 25).

As part of their participatory approach, they give careful attention to training courses and activities to empower young people on the use of low-cost sensors, measurement techniques and campaigning for social change. These training events are co-produced with the young people. The Science for Change Festival in 22-23 April marked the starting point of the Making Sense project (Fig. 9).

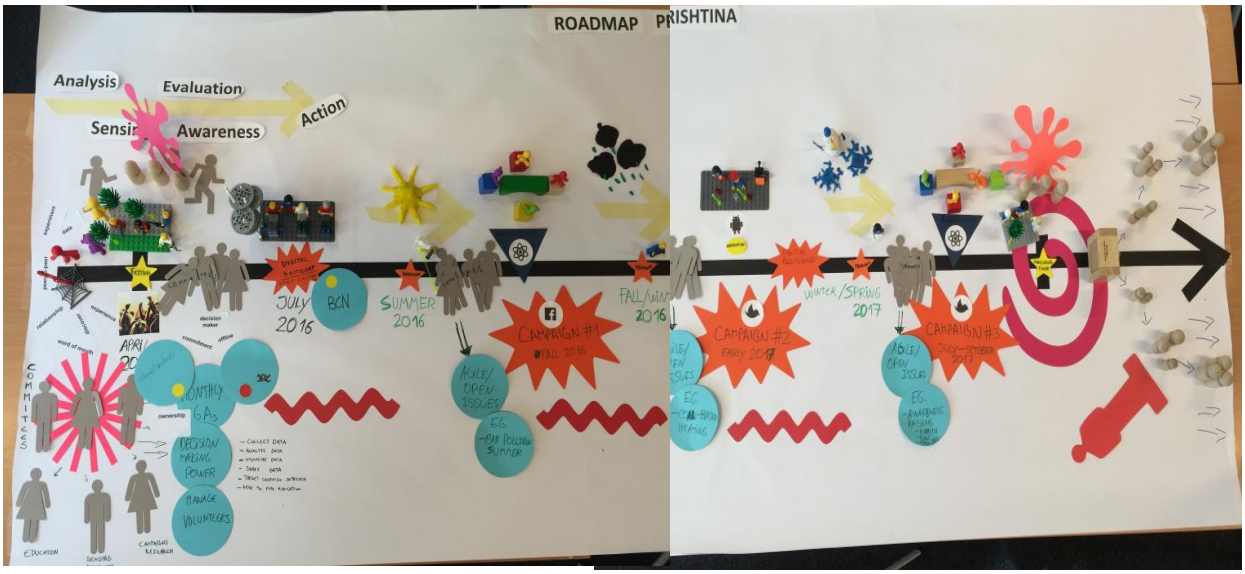


Fig. 9 Roadmap Prishtina as co-designed by their participants

Their bottom-up approach also focuses on empowering the youth/participants in the actual decision-making process governing the pilots on the ground. Participants are organized into three Committees in separate but still intertwined areas:

- Education
- Monitoring and research
- Campaigning

The Committees together with the team from the Making Sense project, meet in monthly assemblies (under a consensus/direct democracy model) to share successes and failures,

and decide next steps for the activities in the pilots. Each pilot follows the same rationale with main three components:

- Gathering environmental data,
- A get-away activity (taking place monthly), such as a hackathon,
- Campaigning

Each pilot will build on the results of previous pilots. Prishtina plans to look at the air pollution by season and to compare indoor and outdoor measurements. Before they start a pilot Prishtina conducts a Bootcamp with the young activists where together they discuss and make decisions about:

- What to measure,
- Where to conduct measurements,
- What tools to use,
- How to use the tools,
- What do the committees think of the tools

Prishtina's goals are to create a solid ground of young activists who will continue to do this measurement and to grow on the results of one another. The aims are for the volunteers to recruit more volunteers and to spread the movement out to a larger scale population. They also hope to use young people as a tactic to engage their parents.

Roadmap Barcelona

Barcelona worked for the first three months on the technical developments of the Smart Citizen Kit, API and platforms, and also in mapping the landscape of participatory sensing together with the JRC on the D6.2 + D4.1 deliverable "Mapping the Participatory Sensing and Community-Led Environmental Monitoring Initiatives". They are currently engaged in the final 1.5 version of the Smart Citizen Kit, and in issue and community mapping within Barcelona, which has helped them to identify the key issues for running the pilots (Fig. 10). The first pilot is very likely to focus on noise pollution. Barcelona's pilots will be iterative, with the results of the previous pilot informing the next.

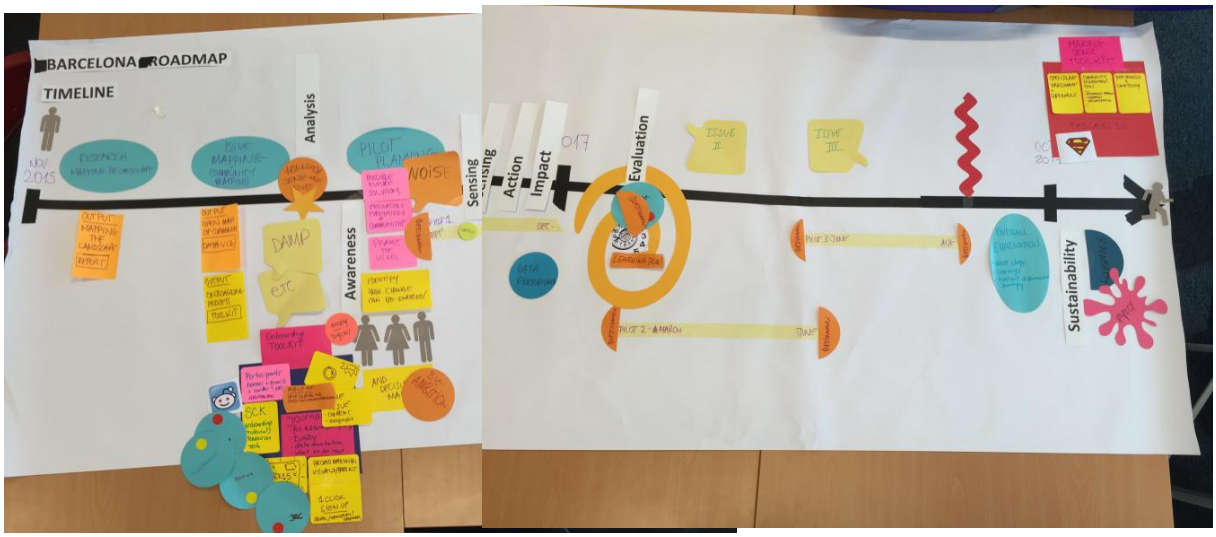


Fig. 10: Roadmap Barcelona as co-designed by their participants

Barcelona is working on the design development of the "Onboarding Toolkit", a welcoming package for Making Sense pilot participants, which will bring together valuable approaches from user research, community engagement and activism. The Onboarding Toolkit is considered important in light of previous experiences in Barcelona that many participants (even those with technical skills) are not able to set the Smart Citizen Kits up when they take them home.

As they expressed it in their roadmap (Fig.6), the goals for the Onboarding Toolkit are:

- To provide Smart Citizen Kit tutorials,
- To help participants connect with other participants,
- To raise overall awareness, and
- To embed skills in the community that are crucial for sustainability.

The Onboarding Toolkit will provide three types of information - contextual, technical and community - including succinct information about the pilots, their communities and goals, 3D files and technical help, and a conversational user interface that "real people" can install and use it to share insights with others.

A "Journaling" device was also proposed by Barcelona, in a type of ethnographic approach. The journal would allow the team to obtain "soft data" about people's experiences, using for instance digital collectable cameras, guidelines for note taking, etc. The annotations in the journal could help to interpret the hard data, i.e., journaling could be a way to make sense of the numerical data collected through the low-cost sensors used in the pilots. This was already

planned as a possible shared development with WP4 and WP5 partners, JRC and Dundee University.

The question of interpretation and visualizing data is crucial for Barcelona's team. They believe that it is important to speak to people in the language that they understand. So they will be exploring alternative ways of visualizing the data so that it makes sense to people and so that it can be a call to action. Options to be explored are for instance enabling tweet data to be sent directly to public authorities, or organizing "interventions" or "performances" to develop data as spectacle with a visible and concrete presence in public space or people's everyday life.

At the same time see as a challenge and opportunity in their local context, Barcelona acknowledges and seeks to cross-pollinate communities of practice with communities of interest. They will give careful attention to the tensions and interactions between these two main communities, one more technologically-savvy and involved throughout the project, and the other more likely to be involved in specific issues depending on the pilots.

Barcelona also shared their thoughts on the Making Sense Toolkit. They envisage it as containing:

- Technical resources
- Community engagement tools
- Campaigns
- Case studies of real people
- A full length documentary
- Strategies to engage the media

All cities feedback on the roadmaps

After the presentations of the experience timelines, participants were given the opportunity to "vote" on the best ideas across all three timelines by placing voting dots (Fig. 11 and 12). Each pilot city was given two votes since there was an unequal number of people representing each city. The other consortium partners who are running a pilot (Dundee University and JRC) each had one vote.

The most highly prioritized idea was the Onboarding Toolkit in Barcelona, previously presented as a structured assembly of technical and social knowledge. It was followed by a number of other ideas and best practices coming from all pilots:

- Committees made up of young people with decision-making powers (Prishtina),
- Community-based and event-based approach, engaging a network of people already on the ground and supporting them with relevant skills (e.g. Prishtina through bootcamps),

- Reaching out to and working with external stakeholders, such as local entrepreneurs that bring more knowledge and visibility to the project, like the TreeWifi project (Amsterdam),
- Engaging with young people, their parents and teachers, such as in the next pilot of Smart Kids Lab (Amsterdam),
- An interactive feedback cycle, as each pilot iterates during and after each activity, when it comes up with back-up plans when facing unplanned obstacles or when it identifies next challenges, all feeding into an evaluation and learning plan (Barcelona and Amsterdam),
- The use of campaigns as “real tests” and points of contact with wider publics within the pilots (Prishtina).

Fig. 11: Details on Onboarding Toolkit (Barcelona) and Committees (Prishtina)

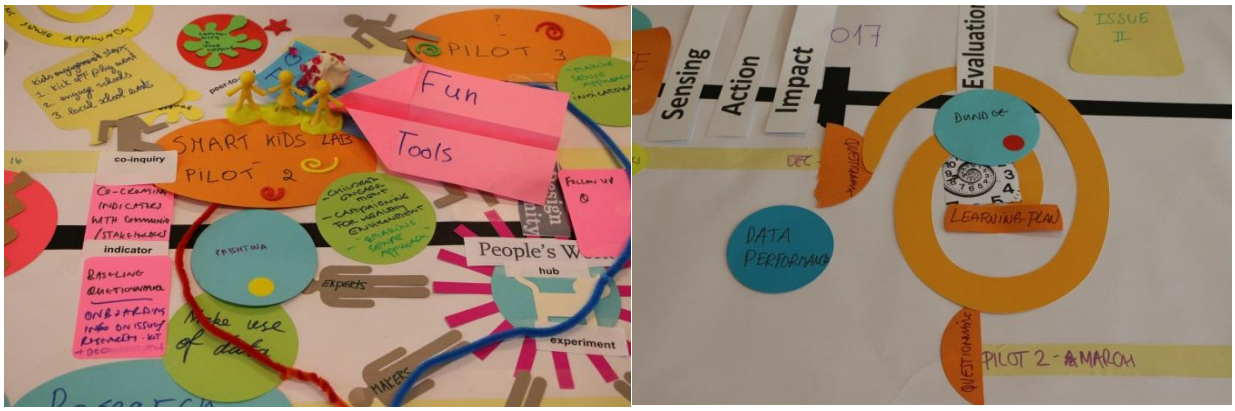


Fig. 12 Detail of Smart Kids Lab (Amsterdam) and evaluation phase (Barcelona)

The Making Sense Collective Roadmap

The collective creation of an actionable framework for citizen and community engagement took place over two steps. First the participants formed four mixed-city teams to explore and visualize the challenges and opportunities posed by the following four topics (Fig. 13). These four topics became apparent to the facilitators after the presentations were made by the pilot cities on the visualizations of their experience timelines:

1. Onboarding the citizens
2. Campaigns and community building
3. Collecting, analysing and visualizing both hard and soft data
4. Project documentation and the Making Sense Toolkit

Fig. 13: Mixed cities and partner teams exploring the topics into visualisations

The second step was for the teams to position their visualizations on a very large timeline so that all the contributions could be seen together. The Making Sense Collective Roadmap took shape over several long tables (Fig. 14) and the photo combination below shows the teams working on the front half (left) and the back half (right) of the roadmap/timeline.

Fig. 14: The collective roadmap developed by all participants

Onboarding the citizens

All participants joining this project need a painless, simple entry point into the project. But first they need to sign up. Events and networks are likely to be a major part of signing up. The Onboarding Toolkit is a resource that citizens can access to give them the tools, the information, the log-ins, and the pathways to participate in this project. Onboarding has three core dimensions and then an additional other: context, community, technical, and journaling that cuts across the first three dimensions.

A pyramidal model of participation (Fig. 15) provides the framework for onboarding. Onboarding needs to be staged and there will be phases by which people enter the project. The entry point is generic, and then other resources are made available as required. This is a design issue of “progressive disclosure”. The idea is to make all this information accessible so there is not withholding of information, but at the same time without overwhelming the participants, especially for nontechnical people. If we think of the life of the project overall, there are different entry points. For instance there's a point at which a campaign scales up. There's a point at which the campaign is being scoped. So, the Onboarding Toolkit needs to align with that. Each city will need to decide what will be offered first - on the top of the pyramid, what will be offered next and so on, within a modular pyramidal scheme for Onboarding.

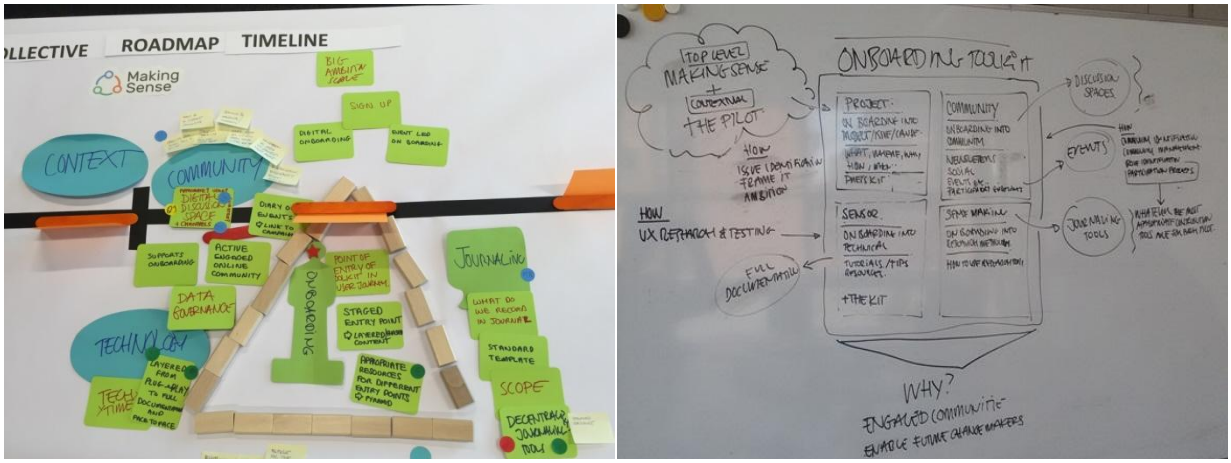


Fig. 15: Onboarding the citizens with a pyramidal model of participation and a possible prototype

To co-create the Onboarding Toolkit, the first phase is to define the underlying principles of the Making Sense project such as open design, participatory sensing, campaigning, etc., followed by a second phase at the start of a campaign or pilot where the material to be included is to be decided through collective authorship by the Making Sense teams and participants whenever possible. Looking more in-depth into the core dimensions or components of the Onboarding Toolkit:

a. Context: This includes the informational resources, infographics, short videos, and the background information about the pilots, their communities and goals that the citizens need.

b. Community: This refers to the added value of social platforms and social channels where citizens and communities can interact. Some questions to consider include:

- What are the appropriate spaces and channels?
- Is it something that people already use?
- And will it be curated?
- Are the partners to undertake this as an activity to curate, to facilitate and manage?
- Are the partners to run events online, etc.?

c. Technical: This refers to the technicalinformational resources that are gateways to the different technical tools the Making Sense will be using as well as resources needed to access the project and community. It is a layered approach in terms of the different requirements of the citizens and communities:

- Some people are going to want to plug and play.
- Other people are going to want full documentation so they can really get under the bonnet, and they're going to want face-to-face interactions.

*d. Journaling:*This refers to recording participants' experiences and observations and annotating data in a similar format. Some questions to consider include:

- What is it we're trying to record?
- What is the data we are trying to capture?
- How to ensure standardization across the data we collect?
- Is the journaling tool to be developed for the onboarding? Several options: onboarding can have very lightweight instructions on how use the journaling tool for the purpose of the pilot, or in the first pilots we can leave the journaling outside of the onboarding and test participants' willingness to do it in the next pilot.

Campaigns and community building

As a common statement from all partners, the communities are seen as the most important part of the whole Making Sense project. In each pilot, communities are the underlying basis of all activities and the main actors that are in fact "making sense" of the whole process. When engaging with communities, a number of challenges and opportunities were identified by the partners (see Fig. 16 below for a detail of challenges in red and opportunities in blue).

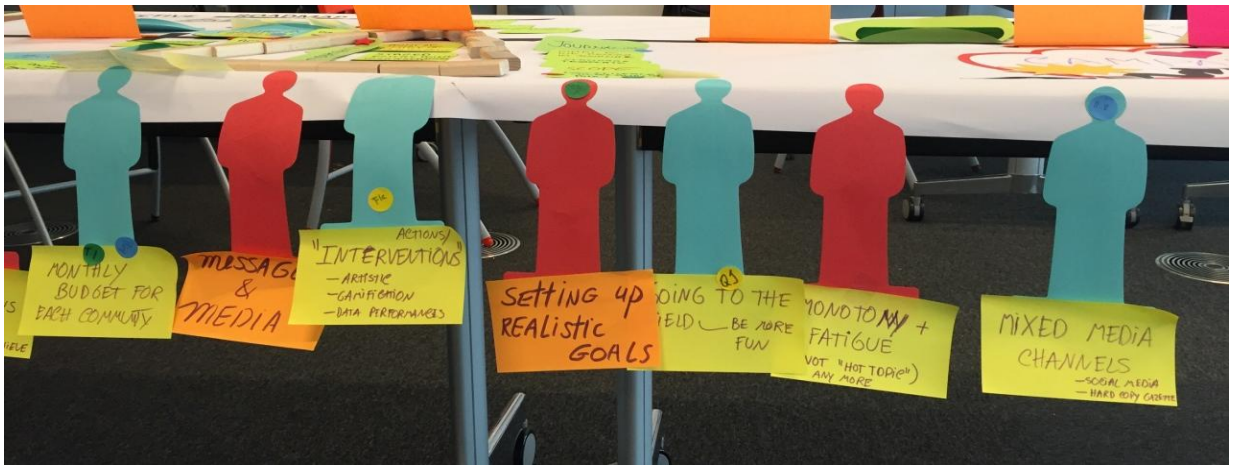


Fig. 16: Challenges and opportunities in campaigns and community building

When starting a campaign, a challenge is to *consider potential threats and legal complications*. Often an activity for measuring air quality can be a sensitive topic depending on the local context, for instance when the collected data can contradict or complement official data that is lacking or incomplete. Other situations can arise when measurements are taken in public spaces or nearby private sites without explicit authorisations or implicit

acceptance from the organizations or companies, or when such activities have the clear of promoting policy advocacy campaigns.

It is a very good practice that the *community is trained quite extensively* before the pilot starts. As experienced in Prishtina, when the pilot brings young people into campaign committees, they need to have the necessary skills to campaign and to mobilize wider publics. So, the team in Prishtina provides extensive training on different campaign tactics, user generated campaigns, or Google bombing campaigns, including how to create stories, how to do mobile broadcasting and mobile journalism, how to use different apps, how to improvise, how to do press releases for different scenarios, etc.

A challenge also experienced by the pilots is the *management of expectations*, voiced by Amsterdam regarding their first pilot. When participants are strongly engaged because the low-cost sensing technologies are promised to save the world or to help them promote or solve their problems, a lot of expectations are created. It is an issue that each pilot constantly should be aware of and constantly should think about the best timings when communicating with communities.

A good practice (from Prishtina) is to give the committees composed by the participants more responsibility or *more ownership of the topic.* In Prishtina's experience, whenever more responsibility is given to participants, the more they feel more attracted and engaged. A mechanism that works well is giving communities a small monthly budget (Fig. 17) which they can spend on the topic they are interested in and want to move it forward into a campaign.

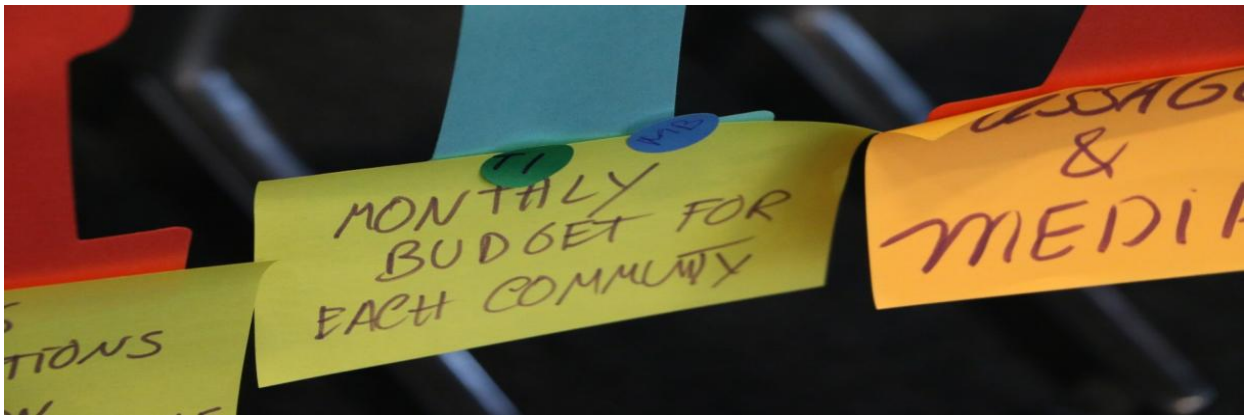


Fig. 17: Monthly budget for each community as an opportunity

A challenge is always to *get the message of a campaign into the right media.* Communicating about the pilots and the Making Sense project in *mixed media channels* is always more effective than just focusing on one. Prishtina's team is using a lot of social media combined

with a hard copy newsletter, which brings a lot of new energy and enthusiasm around communicating the issues.

A challenge for each city to consider depending on their local contexts is the interaction between the activist and technical dimensions of each campaign. It's a complicated challenge to *find the perfect mix* between the two, as campaigns can be perceived as too technical or too activist and in both situations interested parties might be alienated or scared away.

An opportunity to make a campaign stronger is what can be called *interventions* - in the sense of intervening in daily life of citizens and communities. It can be an artistic performance or an intervention in the street, where a campaign really stops being something that happens in an office to being out on the street and being visible. Gamification might work to attract more people to a campaign.

Also related to management of expectations, a campaign needs to *set up realistic goals* that can be tackled with the available technical and social tools. For example, starting an activity with a grand goal to stop climate change, is already setting considerable obstacles and unattainable goals. Setting a more realistic set of goals will also help in the positive evaluation by the community towards the campaign.

To *change the issue, change the approach or the topic, or change the target group* can avoid participants getting bored with the same issues in the same communities. In the partners' experience, fatigue around a certain topic is a real issue that should be taken into account, especially when each city is planning for three pilots in a short period of time.

Focus on the people who are well connected in the community when trying to build or engage people, is a common advice across the pilots. Finding and talking with the people strongly rooted in the community and turning them into community leaders or champions within the pilots, can make a difference in the success and impact of any activity.

A strategy for engagement could be to ask the participants for a *small financial contribution.*For example, instead of giving the sensors or the measuring toolkits away for free, the pilots could ask for a very limited amount of money, also to already filter out those people who will maybe just use a sensor once and then never again. Another lightweight strategy for engagement could be to *personalize the technology* given to participants in the course of the pilot.

Physical meetings are very important when engaging your community according to the experiences of the partners in their pilots. Online interactions are useful to save time and resources and to engage more people, but participants in the pilots want to feel part of something other than just being online.

Collecting, analysing and visualizing both hard and soft data

It is crucial to map the flow of data throughout the Making Sense project - both “hard data” and “soft data” -to be collected in an ongoing basis, per partner, per pilot and throughout the whole process (Fig. 18).

Hard data ranges from measurements coming from the low-cost sensors, to data coming from participants in the pilots, for example, number of participants in each activity, their age and socio-economic background, number of downloads of the Toolkit, etc. Soft data ranges from moments of qualitative observational research by the partners in some of the pilot contexts, to the experiences and stories registered in the journaling made by participants themselves.

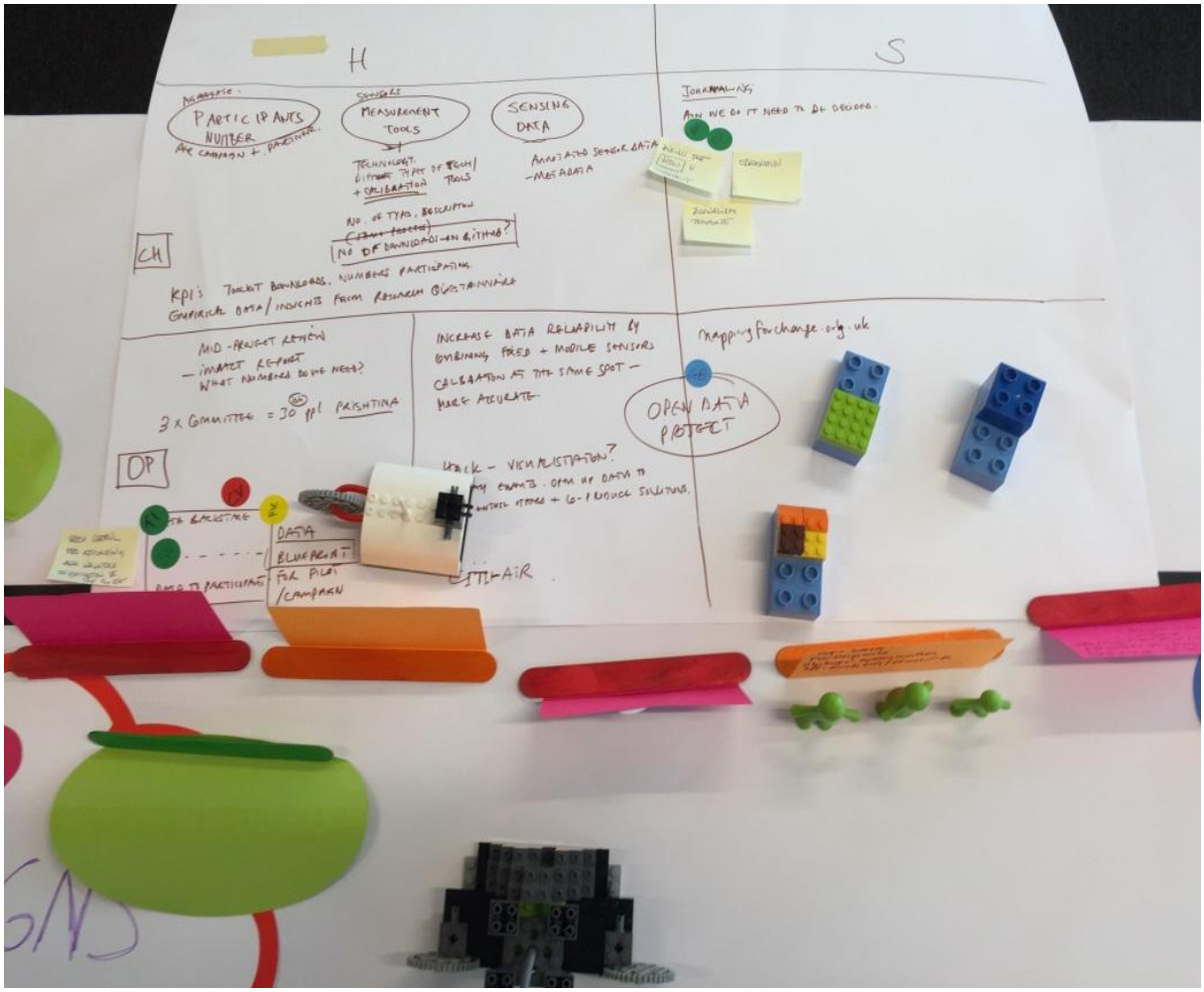


Fig. 18: Collecting, analysing and visualizing both hard and soft data expression

Dealing with hard and soft data individually or jointly poses its challenges and opportunities (Fig. 19). For example, there are challenges associated with the integration of the hard data if different types of sensors are used within one pilot intervention. Then there needs to be an understanding of how this data can be integrated to represent it in a way that makes sense, and also how this data is reported back to the others.

On top of this complexity just described there is another layer, i.e., sometimes soft data helps to understand hard data. For example, it will happen when participants use their journals to annotate data. This data, when it's added to geographical data, behaves as metadata of the hard data. So, the challenge is how to visualize this? How do you integrate it? On top of that, how do you visualize this when facing privacy concerns and the data needs to be anonymized?

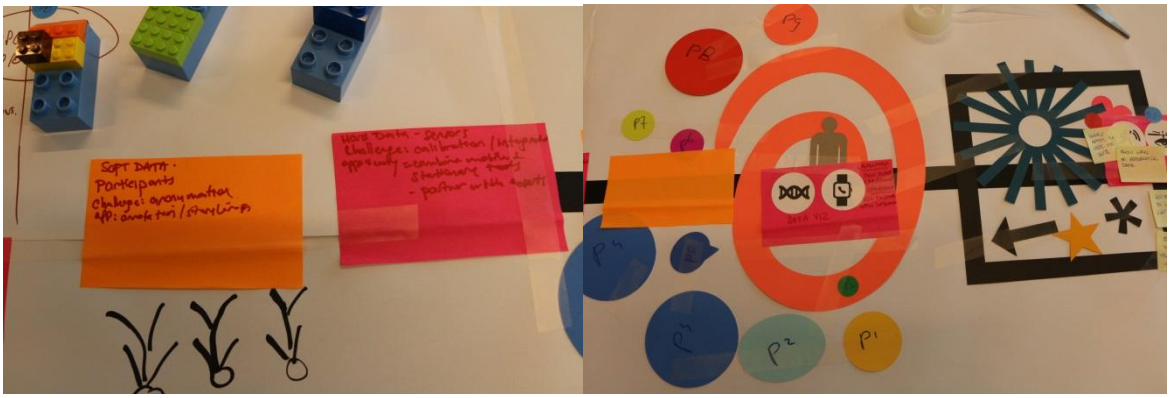


Fig. 19: Challenges in dealing with hard and soft data

There is an opportunity here to co-create a blueprint for the pilots, which serves as a reporting tool that allows all partners to report in real-time. It could allow the partners to report data per city and per pilot intervention throughout the whole process. And this template will present the categories of data that the Making Sense project expects to be reported in an ongoing basis.

But at the same time each pilot's going to be looking at a different type of data, noise for Barcelona, air quality, and others may be emerging. So, a one size fits all approach may not be possible on how to visualize data for the particular participants.

Other questions in need of answers: who's responsible for this and how far the Making Sense project can commit to it? What resources are available within the project to actually do that? One solution may be to sponsor or participate in small hack events and workshops and open some of the data that's being produced during a pilot, in order to have a hack to create a few prototype visualizations during the process of a pilot.

The opportunity about opening up the data and co-creating forms of data visualization, will be specific to each pilot because the data will be represented in different ways. The guiding principles is if data is opened up, other people will be brought onboard, such as in the case of social innovators who are co-producing situated and community data displays. Such social innovators can collaborate with the Making Sense and help to visualize the data. And in doing so, they are not only going to extend the outreach of the project and shed light on new ways to represent the data, but also demonstrate the usefulness of the data that the Making Sense participants collected.

Another aspect to consider is collaboration with other platforms, for example, Map for Change throughout the UK, or other communities that are doing similar projects. And it would be interesting for the Making Sense project to start identifying how to partner up in this. Still there needs to be a discussion with the participants about the challenges associated with the privacy and the ethical issues behind sharing the data.

Project Documentation and the Making Sense Toolkit

Towards the end of the Collective Roadmap, one of the main previewed outcomes is the evolving Making Sense Toolkit (Fig. 20), tentatively called *Start Making Sense.*

Fig. 20: Expression of the Making Sense Toolkit

Regarding its potential audience, the Toolkit would be useful for community organizers, smart citizens, other NGOs, activists and social innovators. The format of the Toolkit should be accessible to everyone. There might be a second version that is for an academic audience.

Three types of information should be included in the Toolkit:

- tools and resources that explain step by step how you should set up your pilot,
- case studies, guidelines, and resources, and
- testimonials to make it more tangible and fun.

A number of challenges and the opportunities of writing it emerge. A curator and storyteller need to be appointed in order to guide everything well and to avoid the danger of lack of input (Fig. 21). In each pilot the storyteller collects some stories which will go into the Toolkit, and updates the stories in the end. The curator collects all the stories and does some language checking, does the layout, etc. Reporting in itself it is quite effortful. For this, good reporting templates are needed so that it is easy for all partners to fill them in and know what to collect. An option to explore is to organize a book sprint to come up with final outline of the Toolkit, write draft documents and advance in the editing of the collected information.

Fig. 21: Detail of a storyteller citizen, within the discussion of the Making Sense Toolkit

In terms of distribution and dissemination of the Toolkit, PR will be important. It can also be presented as an eye-catcher at major events such as festivals and artistic interventions. If more citizens can be engaged, it could have a learning effect. The Making Sense project is well connected to international networks through which the outreach and impact can be maximized.

The idea of a Making Sense Academy also emerged, as an ideal place to disseminate the Making Sense approach and to reach out to other NGOs and cities who would like to learn more about it. Designers and hackers are also privileged groups to collaborate with (as mentioned in the previous topic of collecting, analysing and visualizing hard and soft data).

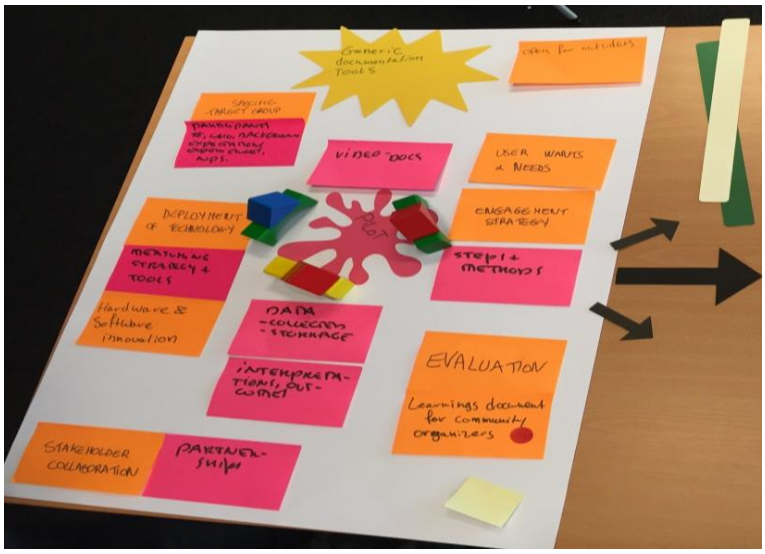


Fig. 22: The Making Sense documentation parameters

As a general blueprint to collect information (Fig. 22) that will be fed into the Toolkit, the following parameters should be defined every time a pilot is set up:

- a specific target group, their expectations and their experiences,
- technology: the hardware and the software,
- involved stakeholders and the partnerships that come out of it,
- the data collection,
- the data interpretation,
- the data visualization,
- and evaluation and learning.

2

OPEN SHARED FRAMEWORK TO BUILD AND SUSTAIN COMMUNITIES

A tentative hands-on and practical framework for the Making Sense project is now set up as the basis of a bottom-up and participatory approach. It is undoubtedly at the same time a common and a flexible framework that is able to be considered in its general lines and to be adapted according to the specific characteristics and needs of each context. Furthermore, it is the key result of a co-creation process between all Making Sense partners, starting from previous experiences of participatory sensing and community led environmental monitoring initiatives, incorporating constantly the ongoing activities and pilots as they develop from the perspective of the team and when possible lay participants, and developing the main points of the framework in a co-design and generative tools workshop with partners and key players from the Making Sense communities.

The following diagram shows the shared framework for building and sustaining communities on a timeline that extends throughout the course of the Making Sense project that ends in November 2017. The framework consists of the following components:

- Identification of a communities, issues, needs
- Generating awareness,
- Onboarding Toolkit for the communities,
- The data sense-making process,
- Community development that is shown as the large blue bubbles that grow over time,
- Events that connect the citizens to Making Sense as well as to each other,
- The Making Sense Toolkit, and the impact and outputs of Making Sense.

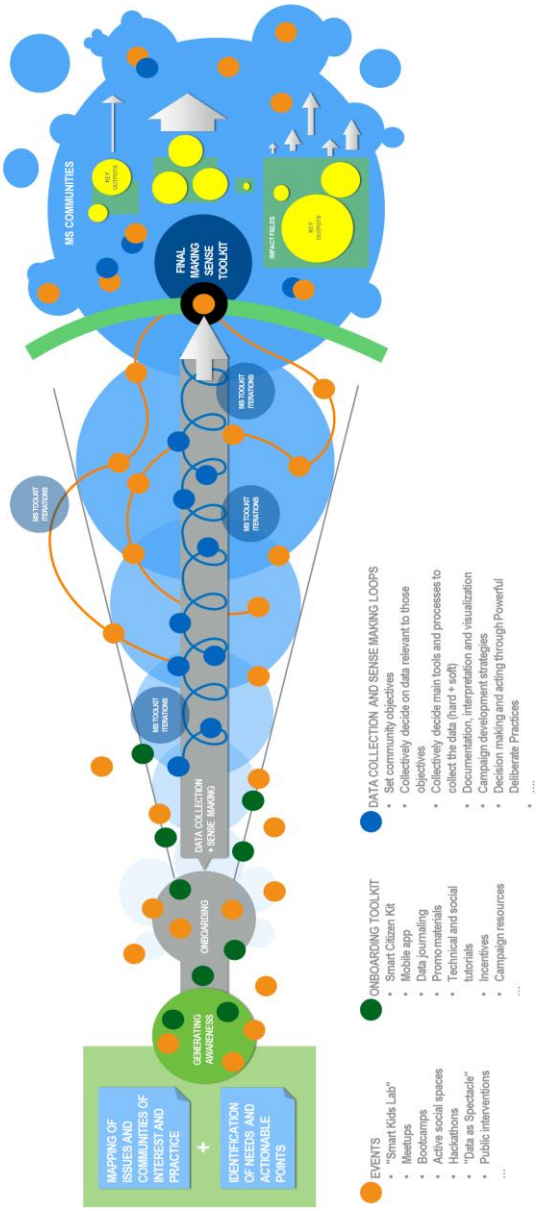


Fig. 23: Timeline for building and sustaining communities in Making Sense

It was agreed among participants that at the beginning it is crucial to **identify a community with needs** instead of placing technology inside a community that might not have any need to measure what the technology is intending to measure. To collect data that matters, participants should be highly motivated to solve a problem or a related set of problems (such as pollution, noise from mass tourism, or humidity and saltpetre from neighbourhoods close to the ocean, among other environmental concerns).

Once a community is recognized, some **events or campaigns to generate awareness must be developed** to create a larger number of participating citizens. Later on, as data is proving relevant to those communities, different types of events to generate awareness can be developed—from seminars or workshops targeted at the media to engagement with other communities of interest such as hackers and makers.

The **Onboarding Toolkit** at the front end of the process is a welcoming package for Making Sense pilot participants. It is a resource that citizens can access to give them the tools, the information, the log-ins, and the pathways to participate in this project. The entry point is generic, and then other resources are made available as required, following a modular pyramidal model of "progressive disclosure". It is organized along four dimensions:

- Context: background information on the Making Sense project, its pilots and communities, infographics, short videos, and other informational resources that the citizens may need to access up front.
- Community: social spaces and platforms where participants can interact, share insights and support each other.
- Technical: software and hardware information as gateways to available low-cost and open source technologies that are layered to meet the needs of different people.
- Journaling: annotating and recording observations, experiences and stories from or by participants themselves in a similar format, using for instance digital collectable cameras, guidelines for note taking, etc.

As a mix of technical and social knowledge, the Onboarding Toolkit can also contain:

- Smart Citizen Kit
- Mobile App
- Data journaling
- Promotional material
- Documentation
- Technical and social tutorials
- Incentives
- Campaign resources

The **data sense-making** track is shown as the gray zone that runs through the timeline as the central core. Data sense-making is an iterative process as is indicated by the loops. Loops can start at any of the following stages or activities:

- Set community objectives
- Collectively decide on data relevant to those objectives
- Collectively decide on how to collect hard and soft data
- Documentation, interpretation and visualization
- Campaign development strategies

- Decision making and acting through Powerful Deliberate Practices

A funnel of **community engagement, development and maturation** is represented with initial light blue bubbles, corresponding to early communities of interest and practice, that progressively grow into bigger and bigger bubbles, with time and engagement in the data sense-making track, and ultimately mature into final Making Sense communities, with possible spinoffs also depicted. This shows that the outreach goes further as different events are connected, campaigns are placed, and more and more citizens are engaged.

The orange dots are **events** that connect the citizens to Making Sense as well as to each other. Events can be performed at any stage of the data sense-making process and also can be connected with the campaigns. They can include setting up specific "labs" such as the Smart Kids Lab (Amsterdam) or the Making Sense Lab (Barcelona), bootcamps, active social physical social spaces, artistic interventions or performances, external hackathons, etc.

The **impact of Making Sense** will be felt in the future in several fields, identified as green boxes at the end, and through multiple key outputs, shown as yellow bubbles. In this context, not only Making Sense communities, but also other future ones will use the Making Sense Toolkit to build and sustain themselves using the common framework that starts with identifying a community with needs.

The **Making Sense Toolkit** should be written in plain and accessible language, and made available as a PDF (i.e., downloadable and printable for free). As its potential audience, the Toolkit would be useful for community organizers, smart citizens, other NGOs, activists and social innovators. The Making Sense Toolkit at the delivery end of the process is envisaged to contain the following modular elements (online and offline):

- A pilot methodology: a step by step guide containing tools and resources that explain how to set up a pilot
- Best practices (what works and what doesn't) for community engagement
- Technical resources, documentation and tutorials for use of low-cost sensing technologies
- Testimonials and personal stories from the pilots to make it more tangible and fun
- Description of the pilots as case studies
- A full length documentary
- Guidelines and strategies for campaigning and engaging the media

As a final insight, the participants agreed to discuss a set of common templates to document and follow up with the pilots: a pilot blueprint with an evaluation categories to share learnings and a database to track hard and soft data; journaling; the general evaluation template containing the reporting and data collected, and a template for each pilot set of methods.

3

PROPOSING A MINIMALLY VIABLE OPEN MANIFESTO FOR MAKING SENSE

Focus first on the needs and concerns of the local citizens and their communities.

The collected data must matter to them or they will not be motivated to continue their participation. The pilots should be driven by human needs, not by the technology that is available. Making sense refers to what makes sense to the citizen participants. What makes sense to them is information/data that is understandable, relevant, useful, timely and actionable. Manage expectations of the citizens and communities you're engaging and set up realistic goals.

Facilitate the transition of citizens from being “passive downloaders of data to active uploaders of action.”

Do not overload citizens and their communities with content at the start. Practice progressive disclosure while always remembering transparency. Invite them in with the basic information they need to get started and then give them more as they become involved. Citizens and communities need to be supported as they grow along the sensing towards action trajectories. Not everyone needs to be fully involved in all stages of a crowdsensing initiative and this is fine.

Don't push technology just because you can, but still prototype fast and early.

Even when technology pushes are effective on initial stages of a project, if they don't get linked to communities of interest and support structures, they will most likely dim out and fail with time. These are not commercial ventures and we don't need to spread our products at all costs. But we also don't need to wait until all the data has been collected to start testing our technical and social solutions and toolkits in ordinary contexts.

Standardize tools for documentation, data collection and reporting as soon as possible, but also explore and iterate alternative ways to visualize and use this data.

First, embrace a mindset of minimum viability in product and process. Then understand that a shared tool that is used in real time and that works across all contexts will help to ensure that insights are shared along the process of community building and sustaining. This will also help to integrate both hard (sensor) and soft (human) data, to better interpret, visualize, enrich and disambiguate the captured information. On top of this, explore all possible ways to visualize and employ all collected data. Its usefulness is the key point. If what we get out of sensing is not readable and usable by those who will benefit more from it, we need to rethink and iterate more the sense making part of the participatory sensing as a whole. Technical to social translation is often needed by design and this not a bad thing if done within inclusive, collaborative, and iterative frameworks.

Build ownership and trust with communities.

Put in place new and alternative ways of sustaining engagement of citizens. Provide tools that citizens can adapt, hack and alter according to their own needs and resources. Give involved citizens decision-making powers in several steps along the process, whether through specific forms of internal organization and governance, whether just by creating robust participatory channels. Assigning small budgets to be run by communities themselves can enhance a sense of responsibility.

Always consider social, cultural, economic and political asymmetries.

Don't assume that all or most citizens can engage in an equal standing in any technical or social activity. Take into account existing biases that hinder diversity for instance of gender, education, ethnicity, income or geographical origin. Moreover, localand contextual circumstances matter and can turn into serious constraints to participatory sensing.

Explore all social spaces and possible media channels for community engagement.

Online forms of engagement are efficient but face-to-face meetings are best. People like to be with other people. Some examples include: a) meet-ups; b) committees of the participating citizens that serve as decision-making teams; c) bootcamps with training on campaign tactics to lower the barrier to entry; or d) interventions in the streets. Use mixed media channels such as hard copy newsletter in combination with social media channels. Consider the audience. Should the message be technical or issue-based or both?

Celebrate the diversity between your partners and testbed contexts.

The three Making Sense pilot cities are characterized by incredibly diverse circumstances, issues and communities. This situation poses challenges for documentation but provides tremendous opportunities for the final deliverable. The final Making Sense Toolkit will benefit greatly from the diversity in lessons learned through multiple pilots across the cities.

Expand and enrich the project teams over time, considering possible forks and spin-offs.

Seek connections with like-minded organizations and individuals. Consider adding to the team and integrating technical experts as well as experts in communication, innovation, community and sense making such as: external innovators; storytellers; curators of information; influencers; hackers; designers; local champions; and others.

Build new governance models.

Open and inclusive relationships between citizens, communities, NGOs, public administrations, companies and others, are to be encouraged and supported. Consensus is not the only model. There needs to be mutual acknowledgement of competing and/or divergent ideas of common good. Go for 'sharing of power' where all involved allow the outcomes to be unpredictable and with consequences.

■ ■ ■

ANNEX I

Making Sense

Pilot 1
Amsterdam

waag society

waag society

Pilot 1: Urban AirQ

Local **community** involved in measuring **air quality** to find answers on questions **they** have.

Partners in air quality sensing

GGD Amsterdam

ALTERRA WAGENINGEN UR

LONG FONDS

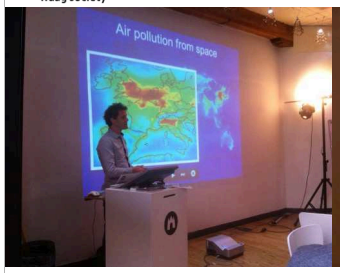
Koninklijk Nederlands Meteorologisch Instituut
Ministerie van Infrastructuur en Milieu

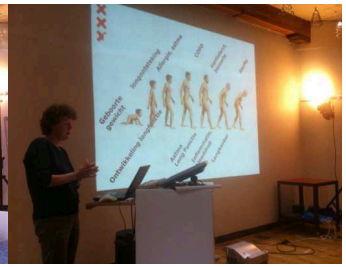
ECN
Your energy. Our passion.

Community engagement

Community leaders
Neighborhood groups
Using neighborhood network
Door-to-door

waag society





waag society

DE BROEDPLAATS

Burgers meten zelf de kwaliteit van hun woonomgeving.

door KELLI VAN DER WAALS en AN-SOFIE KESTELEYN

en SMART CITIZENS LAB VAN WAAG SOCIETY en FRANK KRESIN

Rond de Wibautstraat en de Weesperzijde is het NO2-happen geblazen.

Future

Smart Kids Lab
Multiple area sensing (air, noise, water)

Communication structure

Partner meetings
Participant meetings
Public meetings
Weekly Newsletter
Personal contact
Direct mailing

ether 106.8 kabel 103.3 amsterdamfm.nl

Nieuws » Kunst&Cultuur » Onderwijs&Wetenschap » Muziek020 » Programma's Contac

11 MEI 2016
DOOR ROSALIE BELDER

Luchtkwaliteit Amsterdam: Waag Society biedt burgers empowerment

Op de Nieuwmarkt zit de Waag Society gehuisvest. Het is een instituut waar kunst, wetenschap en technologische ontwikkeling samen komen. Een onderdeel van de Society is het 'Amsterdam Smart Citizens Lab'. Het Citizen Lab start in juni een pilot naar de luchtvervuiling in Amsterdam. Aan de telefoon is Gijs Boerwinkel van de Waag Society.

00:00 00:00

Tags: Amsterdam Smart Citizens Lab, Waag Society

Results so far

Enthusiasm with participants
Attention for project (in the media)
Great input from experts (positive & negative)
Learnings on project design

Challenges

Technology
Local partners
Managing expectations
Activists & Air

Making Sense

PEN
PEER EDUCATORS NETWORK
RRJETI I EDUKATORËVE BASHKMOSHATARË

PRISHTINA PILOT

Purpose of Work

- Youth Empowerment and Capacity Building to Support Pressing Environmental Issues
- Peer to Peer Experiential Environmental Education
- Bottom-up Citizen Science Research and Activism
- Review and Testing of Innovative Air Quality Measurement Tools
- Development of Mobilization Campaigns
- Raising Awareness on Air Quality Issues and Citizen Science Movement
- Change attitude of Citizen, Media, and Institutions towards Air Quality Issues

Expected Impact

- Enabling young people and citizens to understand, reflect, learn and take actions on environmental and air quality-related issues
- An involved youth in using air quality measuring tools, gathering data, developing participatory led campaigns, and visualizing data
- Calibrate, test and review air quality measuring tools; identify upsides and downsides of tools, review and share feedback on using specific tools for better adjustment to citizen needs
- Greater citizen involvement after participatory lead campaigns

Current Process

- Successful completion of Topical Barcamp (Environment Festival); Engagement of new members
- Mobilization of Committees, and Volunteers
- Drafting an Air Pollution Measurement Strategy
- Selection and Calibration of Measurement Tools for the First Measurement Session
- Utilize Relevant Institutions to Support the Project

Upsides of the Project (until now)

- Air Quality Issues are a "Hot" Topic Currently and Citizen are Interested
- Youth are very Interested to Participate as Volunteers in the Project
- Lack of Air Quality Measurements and Data in Kosovo Provide Positive Conditions for any Type of Air Quality Data Collection
- Multiple Locations and Variating Conditions to Test Measurement Tools Efficiently
- Support from US Embassy in Calibrating Equipment for PM Measurements

Downsides of the Project (until now)

- Data Visualization and Mapping System
- State Institutions Hesitate to Acknowledge Citizen Measurements
- Committees and Volunteers don't always provide Consistent Involvement in the Project
- Delay of the new models of Smart Citizen Kits
- Lack of a unified form of interpreting data

Immediate Next Steps

- Purchase of Measurement Tools and Calibration
- Air Quality Measurements
- Non-Formal Environmental Workshops in Elementary Schools
- Recruitment of new Activists
- Identifying Efficient ways to Share and Display the Data Collected from Measurements

Workshop Expectations

- Practical Experience of Co-design process
- Case Studies
- Adoption of the Learning Materials for the Pilot Project
- Share Experiences and Insights with other Partners in Forming Similar Strategies for Project Implementation

THANK YOU !!

Facebook: MakingSenseEU
Local Website: www.citizenscienceks.org
Website: www.making-sense.eu
Tweet: #MakingSense

Making Sense

Advances and experiment in participatory sensing

THE PILOTS

WHERE WE'RE AT

Mara Balestrini + Gui Seiz

7.06.2016

MAPPING ISSUES

From discourse in the media to communities of interest

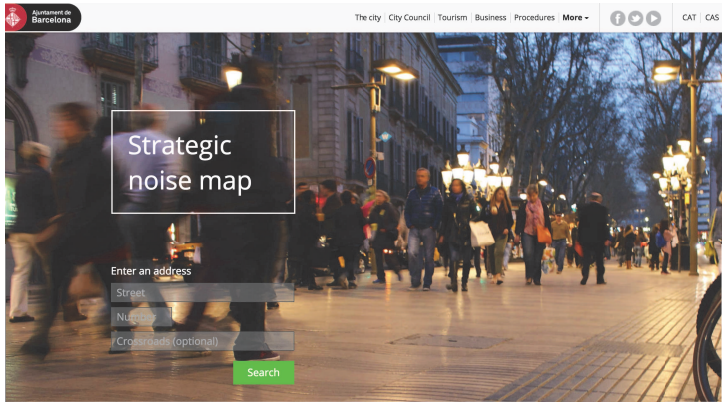
ORGANISATIONS IN BARCELONA

Communities of neighbours, Casal de barri, neighbours associations/assemblies, social movements, cooperatives, NGOs, City Council

COMMUNITIES' THEMES

Environmental, social, infrastructure, services, cultural, educational, economical, health, political

NOISE POLLUTION



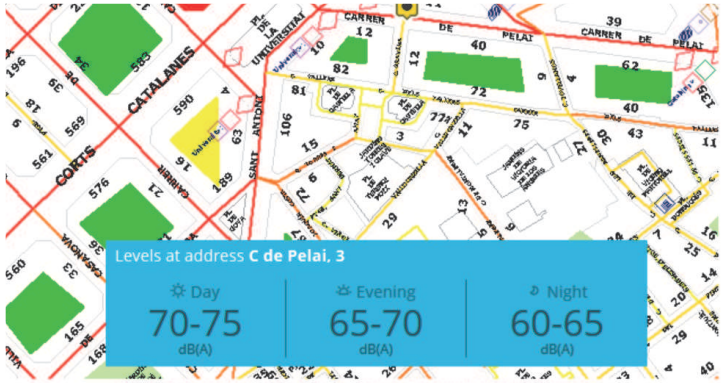
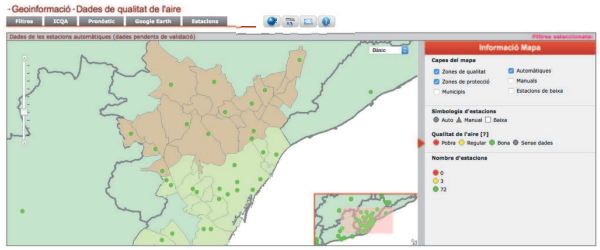


Figure 3: Screenshot of the Strategic Noise Map showing Placa Universitat

AIR QUALITY

Making Sense

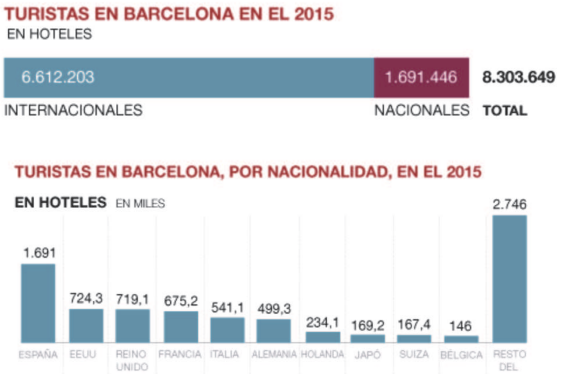
Making Sense



Making Sense

MASS TOURISM

Making Sense



Making Sense

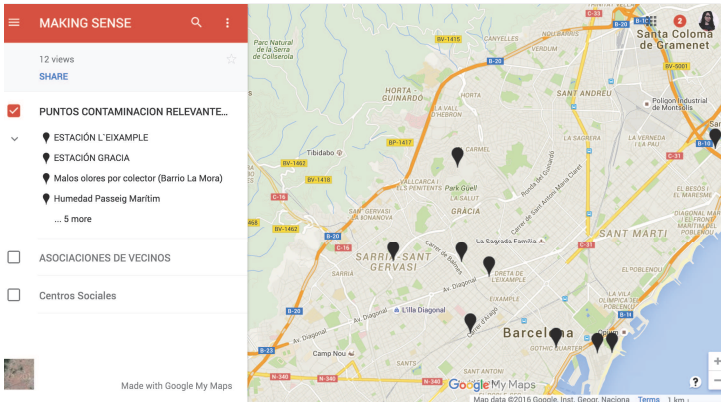
ELECTROMAGNETIC POLLUTION

Making Sense

HUMIDITY AND SALTPETRE

Making Sense

Making Sense



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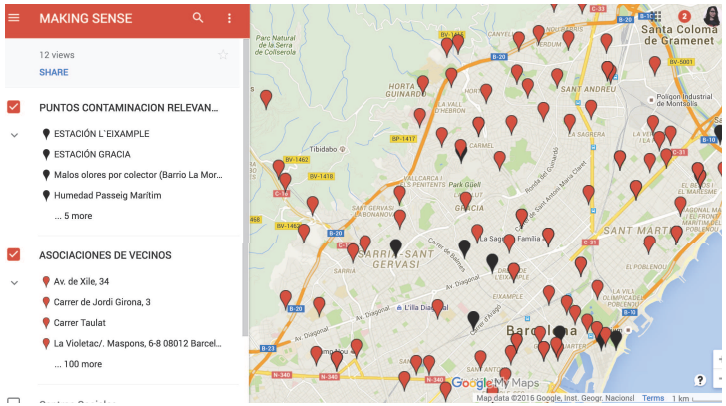
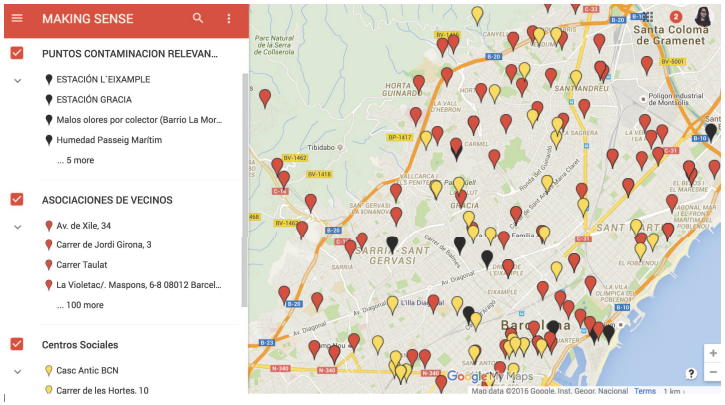
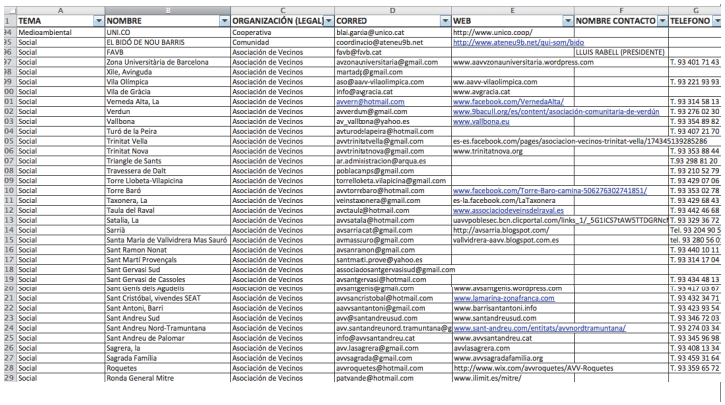


Making Sense



Making Sense



	TEMA	NOMBRE	ORGANIZACIÓN (LEGAL	CORREO	WEB	NOMBRE CONTACTO	TELEFONO
1	Medioambiental	UNI.CO	Cooperativa	blai.garcia@unico.cat	http://www.unico.coop/		
35	Social	EL BIDÓ DE NOU BARRIS	Comunidad	coordinacio@ateneu9b.net	http://www.ateneu9b.net/qui-som/bido		
36	Social	FAVB	Asociación de Vecinos	favb@favb.cat		LLUIS RABELL (PRESIDENTE)	
37	Social	Zona Universitària de Barcelona	Asociación de Vecinos	avzonauniversitaria@gmail.com	www.aavvzonauniversitaria.wordpress.com		T. 93 401 71 43
38	Social	Xile, Avinguda	Asociación de Vecinos	martadg@gmail.com			
39	Social	Vila Olímpica	Asociación de Vecinos	aso@aavv-vilaolimpica.com	www.aavv-vilaolimpica.com		T. 93 221 93 93
00	Social	Vila de Gràcia	Asociación de Vecinos	info@avgracia.cat	www.avgracia.cat		
01	Social	Verneda Alta, La	Asociación de Vecinos	avern@hotmail.com	www.facebook.com/VernedaAlta/		T. 93 314 58 13
02	Social	Verdun	Asociación de Vecinos	averdun@gmail.com	www.9bacull.org/es/content/asociación-comunitaria-de-verdún		T. 93 276 02 30
03	Social	Vallbona	Asociación de Vecinos	av_vallbona@yahoo.es	www.vallbona.eu		T. 93 354 89 82
04	Social	Turó de la Peira	Asociación de Vecinos	avturodelapeira@hotmail.com			T. 93 407 21 70
05	Social	Trinitat Vella	Asociación de Vecinos	avtrinitatvella@gmail.com	es-es.facebook.com/pages/asociacion-vecinos-trinitat-vella/174345139285286		
06	Social	Trinitat Nova	Asociación de Vecinos	avtrinitatnova@gmail.com	www.trinitatnova.org		T. 93 353 88 44
07	Social	Triangle de Sants	Asociación de Vecinos	ar.administracion@arquia.es			T.93 298 81 20
08	Social	Travessera de Dalt	Asociación de Vecinos	poblacanps@gmail.com			T. 93 210 52 79
09	Social	Torre Llobeta-Vilapicina	Asociación de Vecinos	torrelloketa.vilapicina@gmail.com			T. 93 429 07 06
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13	Social	Satalia, La	Asociación de Vecinos	avsatala@hotmail.com	uavvpoblesec.bcn.clicportal.com/links_1/_5G1IC57hAW5TTDGRNc		T. 93 329 36 72
14	Social	Sarrià	Asociación de Vecinos	avsarria@gmail.com	http://avsarria.blogspot.com/		Tel. 93 204 90 5
15	Social	Santa Maria de Vallvidrera Mas Sauró	Asociación de Vecinos	avmassauro@gmail.com	vallvidrera-aavv.blogspot.com.es		tel. 93 280 56 0
16	Social	Sant Ramon Nonat	Asociación de Vecinos	avsanranon@gmail.com			T. 93 440 10 11
17	Social	Sant Martí Provençals	Asociación de Vecinos	santmati.prove@yahoo.es			T. 93 314 17 04
18	Social	Sant Gervasi Sud	Asociación de Vecinos	associadosantgervasisud@gmail.com			
19	Social	Sant Gervasi de Cassoles	Asociación de Vecinos	avsantgervasi@hotmail.com			T. 93 434 48 13
20	Social	Sant Gents dels Agudells	Asociación de Vecinos	avsantgenis@gmail.com	www.avsantgenis.wordpress.com		T. 93 417 03 67
21	Social	Sant Cristòbal, vivendes SEAT	Asociación de Vecinos	avsancristobal@hotmail.com	www.lamarina-zonafranca.com		T. 93 432 34 71
22	Social	Sant Antoni, Barri	Asociación de Vecinos	aavvsantantoni@gmail.com	www.barrisantantoni.info		T. 93 423 93 54
23	Social	Sant Andreu Sud	Asociación de Vecinos	avv@santandreusud.com	www.santandreusud.com		T. 93 346 72 03
24	Social	Sant Andreu Nord-Tramuntana	Asociación de Vecinos	avv.santandreunord.tramuntana@g	www.sant-andreu.com/entitats/avvnordtramuntana/		T. 93 274 03 34
25	Social	Sant Andreu de Palomar	Asociación de Vecinos	info@avvsantandreu.cat	www.avvsantandreu.cat		T. 93 345 96 98
26	Social	Sagrera, la	Asociación de Vecinos	avv.lasagrera@gmail.com	avvlasagrera.com		T. 93 408 13 34
27	Social	Sagrada Família	Asociación de Vecinos	avvsagrada@gmail.com	www.avvsagradafamilia.org		T. 93 459 31 64
28	Social	Roquetes	Asociación de Vecinos	avvroquetes@hotmail.com	http://www.wix.com/avvroquetes/AVV-Roquetes		T. 93 359 65 72
29	Social	Ronda General Mitre	Asociación de Vecinos	patvande@hotmail.com	www.ilimit.es/mitre/		

Making Sense

NEXT STEPS

Workshop to frame “sense-able” issues

NEXT STEPS

Engage with communities

LAUNCH

Making Sense Lab

hackAIR
Open technology platform

Collect, access and improve air quality information in Europe

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 688363

"Despite continuous improvements in recent decades, air pollution is still affecting the general health of Europeans, reducing their quality of life and life expectancy."

Hans Bruyninckx, Executive Director European Environment Agency, EEA

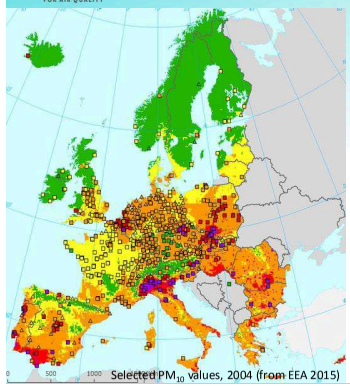
Photo: Lundrim Alliu / World Bank

Increasing citizens' engagement on air quality

- Air pollution is the single environmental issue Europeans worry about the most (56%)[1]
- Nearly six out of ten Europeans do not feel informed about air quality issues in their country (59%)[2]

[1] Eurobarometer, Attitudes of European citizens towards the environment, (2014)
[2] Eurobarometer, Attitudes of Europeans towards air quality, (2013)

We need better information



Selected PM_{10} values, 2004 (from EEA 2015)

To provide useful estimates of air quality, we need to:

- Fill gaps in areas where distances between sites may be large;
- Improve access to data across many sources;
- Provide up to date air quality information.

Time to be proactive

Individually: protecting our health & the environment

Collectively: triggering policy change & encouraging behavioral change towards a cleaner air

Photo: Austin Ban, Unsplash

6 partners, 5 European countries

We are taking up the challenge to launch the hackAIR project!

hackAIR is all about awareness and behavioral change: taking care of our health and of the earth.

Joining the movement to improve air quality data in Europe

DRAXIS · NILU · CERTH · BUND · Vrije Universiteit Brussel · ONSUBJECT

hackAIR partners

DRAXIS, Greece
Project management and platform integration

BUND, Germany
Pilot test in Germany and network of interest

NILU, Norway
Data fusion model and pilot test in Norway

VUB, Belgium
Co-creation and engagement strategies

CERTH, Greece
Data discovery and integration

ON:SUBJECT, Netherlands
Dissemination and exploitation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 688363

Making the problem visible

"The biggest strength of hackAIR is making air quality visible. You can be informed and contribute to this yourself." Arne Fellermann, BUND

Its uniqueness:

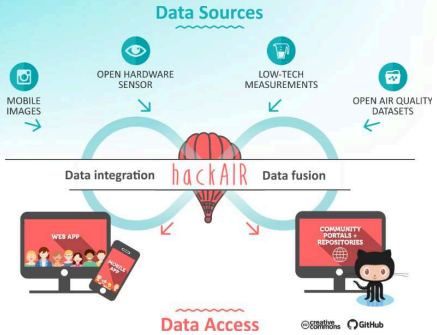
- Openness (open source);
- Pictures as measurement tool;
- Easy to use hardware hack solutions

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 688363

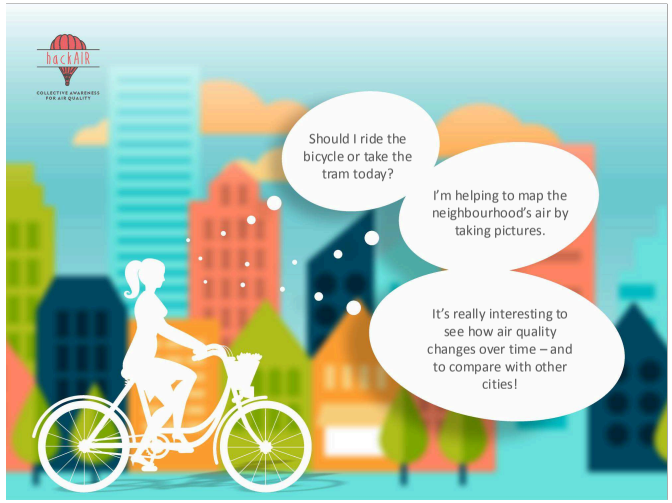
hackAIR in a nutshell

Access to:

- Open source code;
- Real-time information on the current status of air quality;
- A community of like-minded users;
- Personalised recommendations.



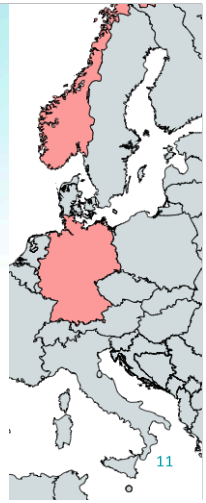
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 688363



hackAIR pilots

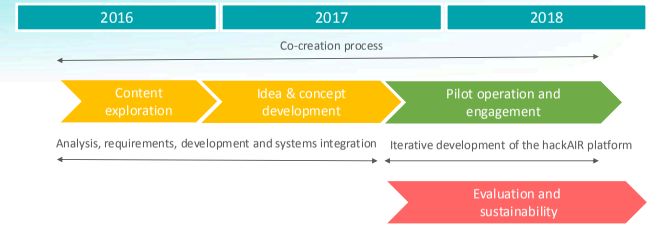
Starting in September 2016 in two countries:

- **Germany**: Focus on environmental activists
- **Norway**: Focus on health interest groups



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 688363

hackAIR timeline



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 688363

Join a growing movement to improve air quality data

Thank you!

[Presenter's contact details]

Project coordinator: Dr. Machi Simeonidou, msimeonidou@draxis.gr
Media contact: Wiebke Herding, wiebke@onsubject.eu

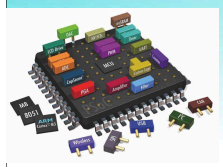
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 688363

Data sources: Mobile images

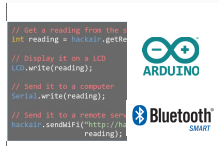
- From Instagram or as a direct upload in the hackAIR app
- Pictures need:
  - Geolocation data
  - Sufficient visibility of clear sky
- hackAIR's algorithm then estimates particle matter content based on the colour of the sky using aerosol optical depth

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 688363

Data sources: Open hardware sensors



- Tutorials and manuals for a DIY-sensor kit from low-cost hardware, including:
  - Arduino libraries for quick and easy deployment
  - Stand-alone hackAIR sensor system based on PSoC® with Bluetooth Low Energy transceiver
- Optical air quality sensors to measure PM_{10}
- Estimated system cost: ca. 40-90€



ARDUINO

Bluetooth SMART

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 688363

Data sources: Low-tech measurements

- Simple setup: Aquarium pump + food container + paper filter
- Upload smartphone photo of the resulting colorized paper and a reference filter
- hackAIR estimates air pollution based on relative difference of filter colors

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 688363

Data sources: Open air quality datasets and data integration

hackAIR integrates publicly available data sources from air quality monitoring stations and participatory sensing initiatives to provide an approximate picture of the current air quality in a given location.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 688363

Towards engagement & behaviour change

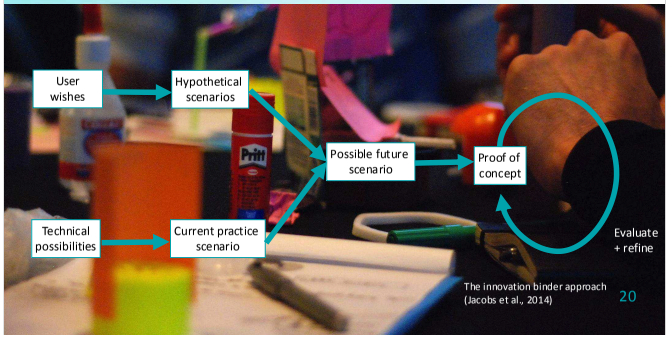
hackAIR helps citizens to move from awareness to behaviour change on air quality:

- Members of the hackAIR community collaborate to gather and make sense of air quality data;
- The platform supports citizens with:
  1. Steps to reduce individual air pollution, and
  2. Steps to protect oneself against air pollution;
- The data can also be used to impact policy making towards air quality improvements.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 688363

Co-creation of hackAIR

Together with users, developers and stakeholders in Norway, Germany, Greece



The innovation binder approach (Jacobs et al., 2014)

ANNEX II

Co-designing and generative tools

Making Sense

June 7 and 8, 2016

Design is an inquiry into the future situation of use.

Henrik Gedenryd (1998) *How Designers Work: Making Sense of Authentic Cognitive Activity*, PhD Thesis, Lund University.

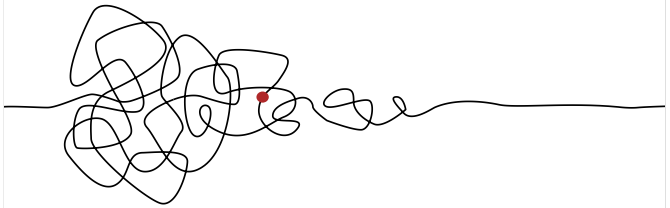
Co-designing is the collaborative exploration of future situations of use.

Who is involved in co-designing?

Today we can see co-designing being practiced..

- within communities
- inside companies and organizations
- between companies and their business partners
- between companies and the people they serve

When is it taking place?



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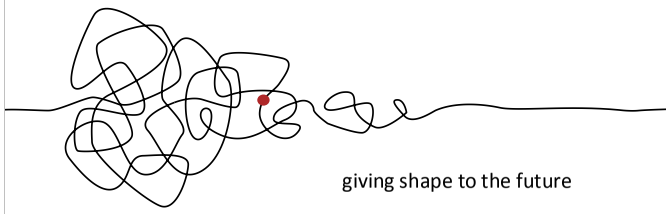
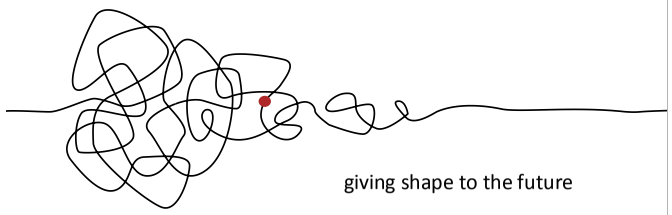


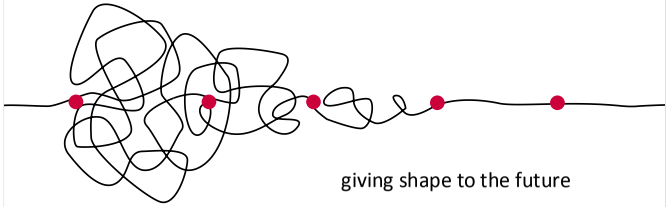
When is it taking place?

making sense of the future



When is it taking place?

making sense of the future

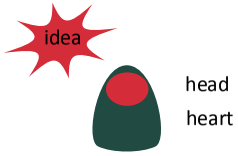


Individual creativity

Ideas are the basic building blocks of creativity.

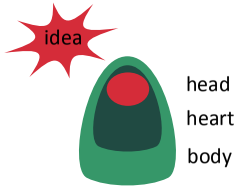
"Every creative act involves bisociation, a process that brings together and combines previously unrelated ideas." Koestler, 1964

Individual creativity



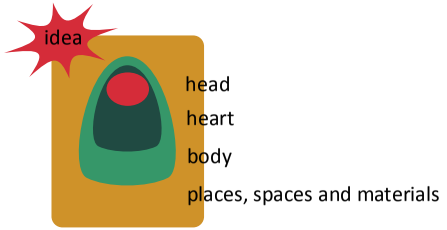
Emotion drives cognition.
Positive emotional states increase creativity.

Individual creativity

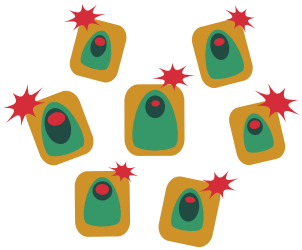


Creativity takes place in time.
Enactment and improvisation can facilitate creativity.

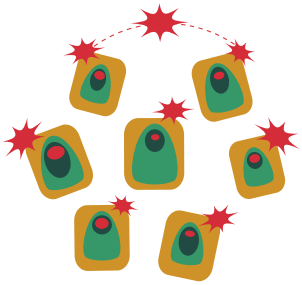
Individual creativity



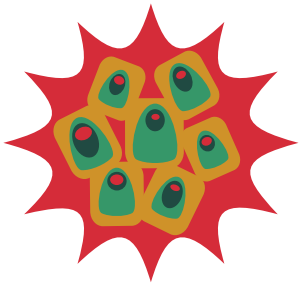
The materials present in the environment can also foster creativity.



brainstorming



brainstorming

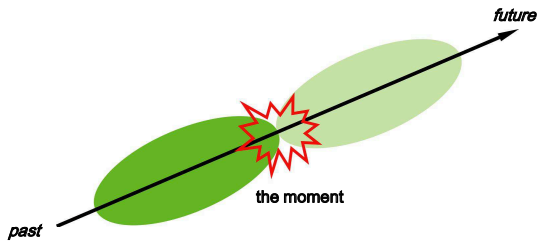


collective creativity

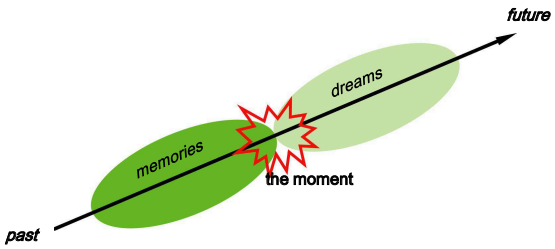
transdisciplinarity

Understanding experience

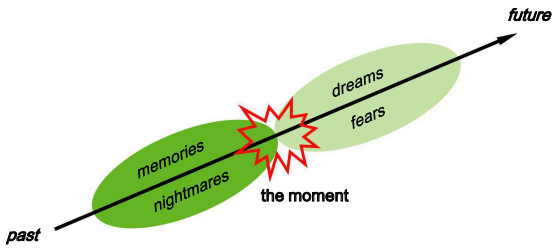
Understanding experience



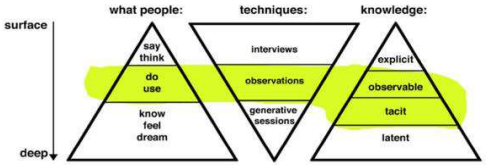
Understanding experience



Understanding experience



Understanding experience



Different levels of knowledge about experience are accessed by different techniques.

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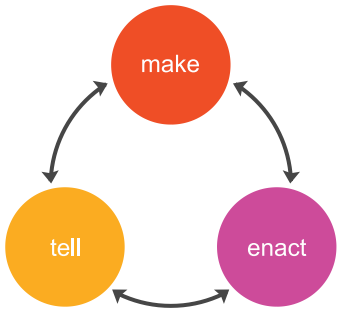

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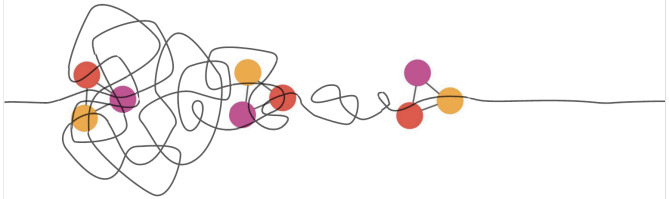

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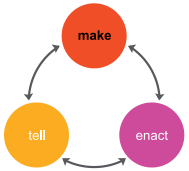

Making

2-D collages using visual and verbal triggers on backgrounds with timelines, circles, etc.

2-D mappings using visual and verbal components on patterned backgrounds

3-D mock-ups using foam, clay, Legos or Velcro-modeling

Low-tech prototypes

Provotypes and design artifacts from the future

3-D space models (small scale) such as the doll house toolkit

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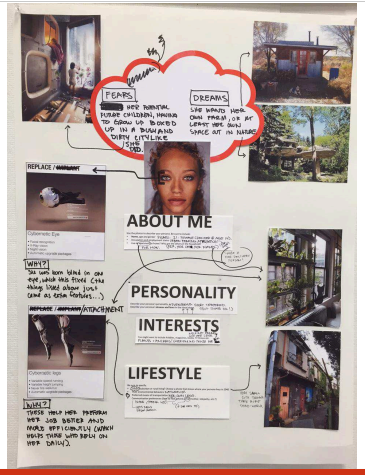

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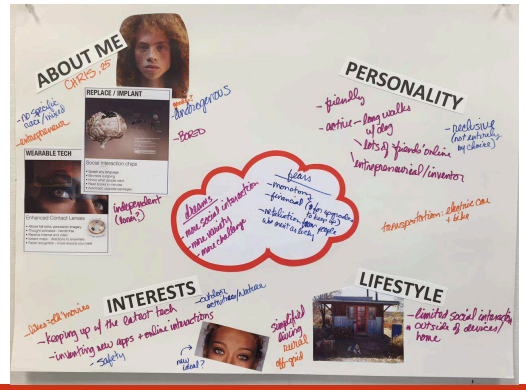

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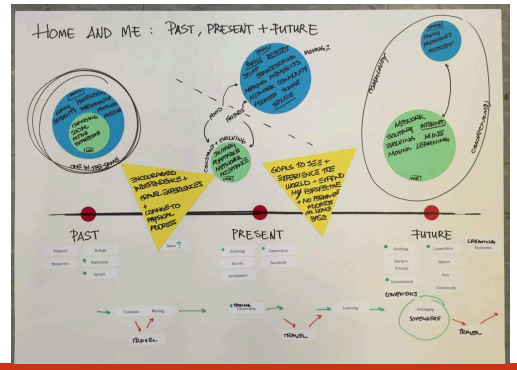

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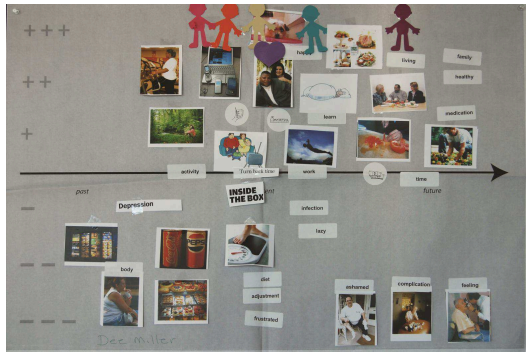

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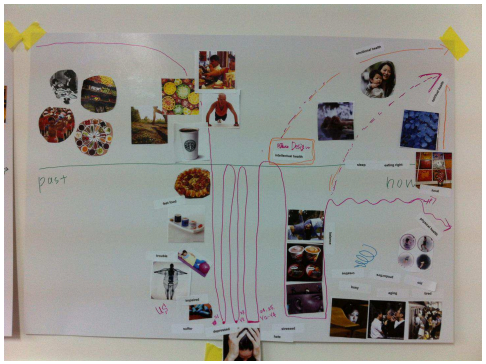

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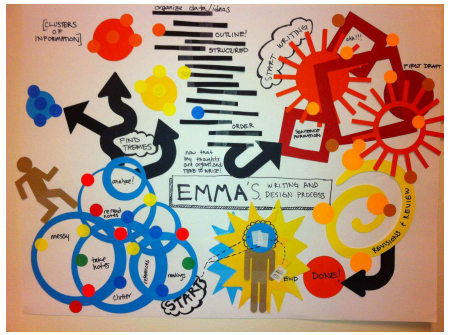

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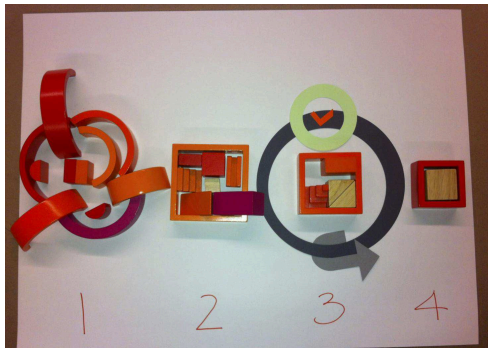

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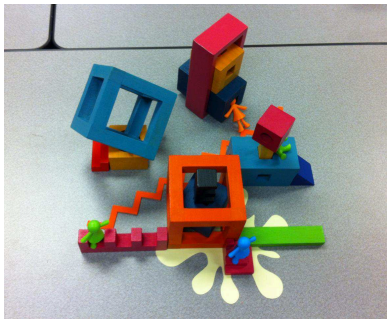

How is it being done?

Designfakulteten. KTH Innovationsstudion June 15, 2011

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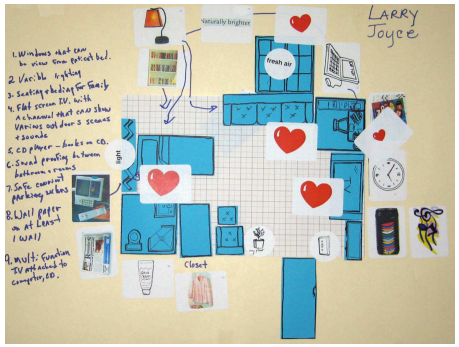

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Gus Colvin, University of Dundee

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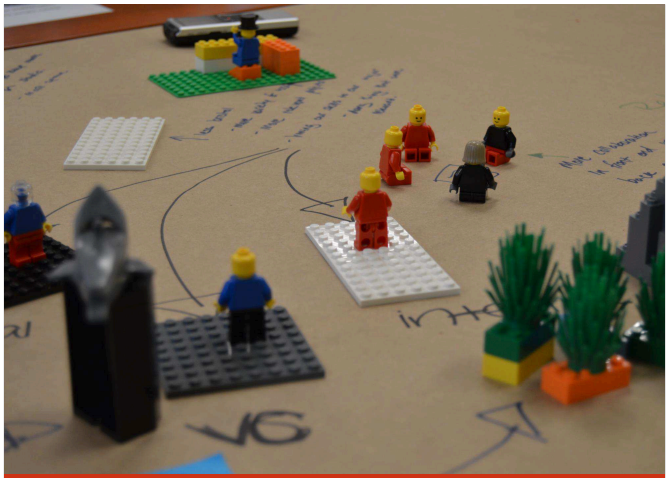

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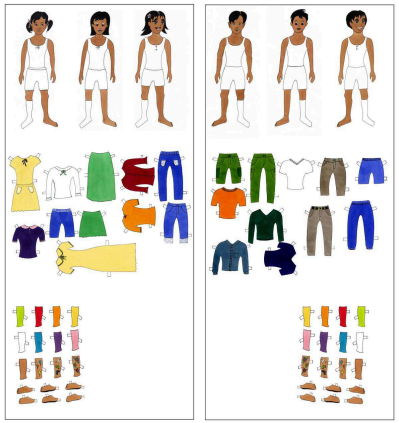
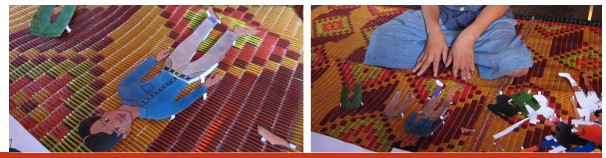
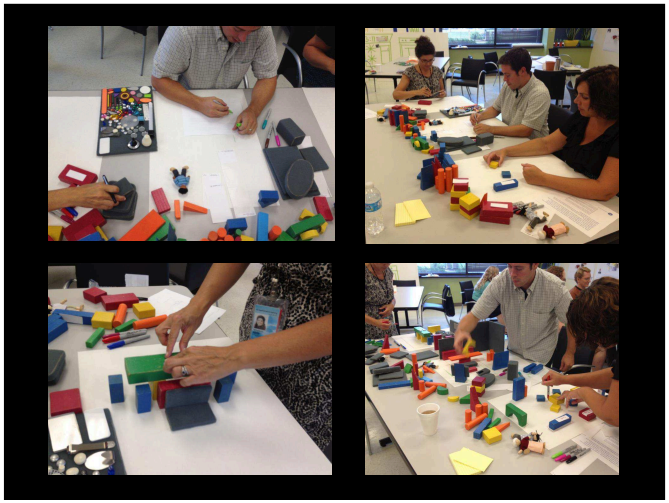
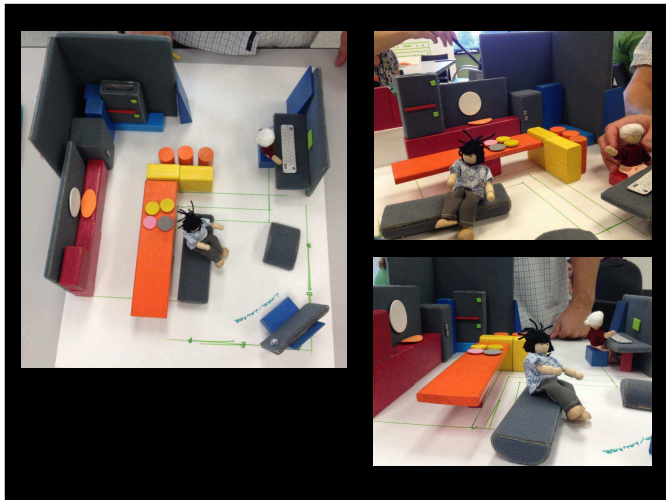
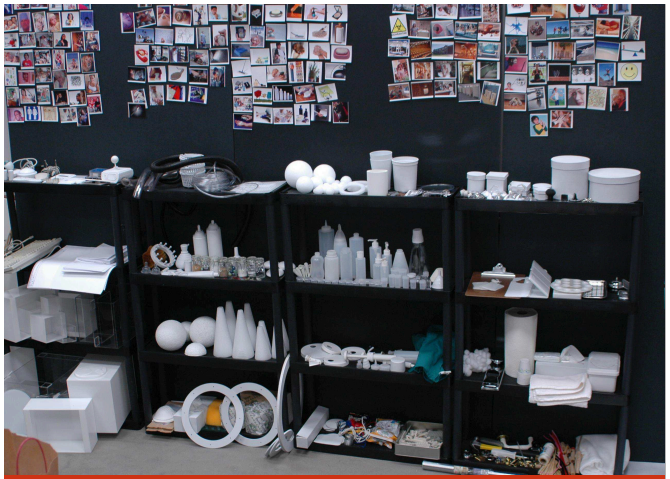


Sofia Hussain and Sanders, E.B.-N. (2012) Fusion of Horizons: Co-designing with Cambodian Children who have Prosthetic Legs by Using Generative Design Tools. *CoDesign: International Journal of CoCreation in Design and the Arts*.1-37









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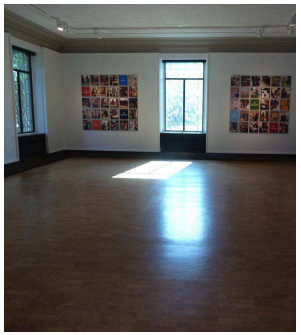

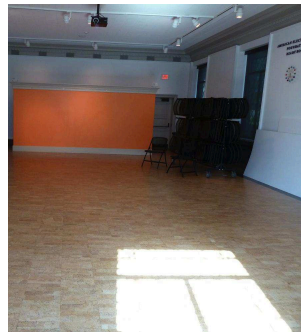

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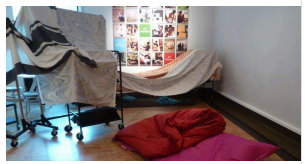

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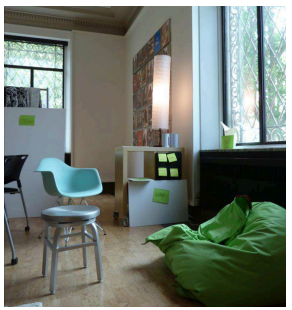
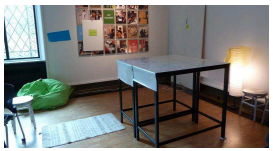


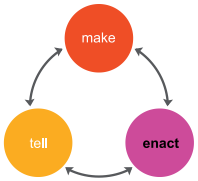


A Participatory Design Process Addressing Ergonomics of Hospital Patient Rooms

Goal: To develop guidelines that will allow healthcare facility designers to address the physical, cognitive and ergonomic needs of **all stakeholders** who provide patient care and services within a patient's hospital room.

Hospitalist	Nutrition aides (food service worker)
Nurse	Echocardiographer
Patient care assistant	Ultrasound tech
Safety care associate (sitter)	Vascular tech
Case manager	X-ray tech
Patient transporter	Housekeeper
Physical Therapy	Clinical engineer
Occupational Therapy	Building operation
Respiratory Therapy	Zone tech
Speech language pathologist	System shop
Dietition	Mechanical shop (plumber)
Diet tech	

How is it being done?



Enacting

Props and **black boxes**

3-D space models (full scale)

Scenario-making in the space models or through **sandplay**

Participatory envisioning and **enactment** by setting users in future situations

Improvisation

Acting out, skits and **play acting**

Role playing with actors, pretenders, puppets, dolls, etc.

Bodystorming and **informative performance**

How is it being done?

How is it being done?

How is it being done?

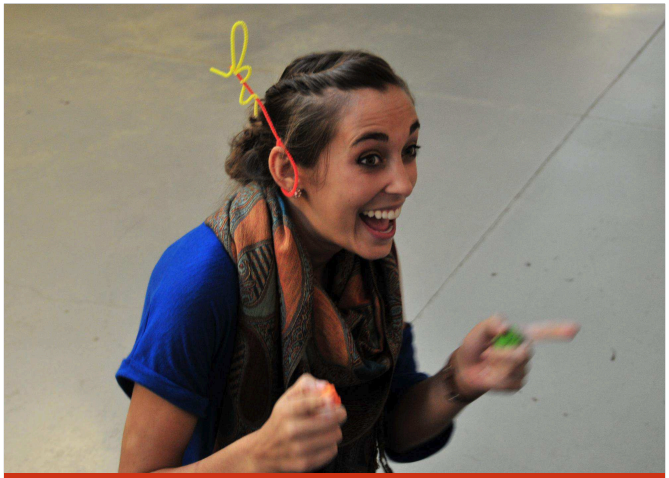
How is it being done?

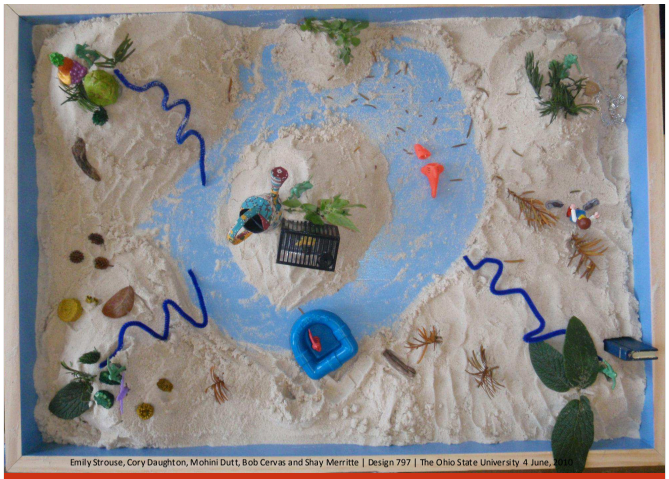
How is it being done?

The picture is from Herlev on a cold day full of enthusiasm from participating citizens, a retail shop, the caretaker, the municipality, and designers from 1508, 3PART and DKDS. See the video of the enacted future scenario at www.1.affaldshistorier.dk!

How is it being done?

Westerlund, B. (2009) *Design Space Exploration: Co-operative Creation of Proposals for Desired Interactions with Future Artefacts.* Ph.D. Thesis, Human-Computer Interaction, Stockholm: KTH.

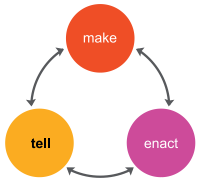




Emily Strouse, Cory Daughton, Mohini Dutt, Bob Cervas and Shay Merritte | Design 797 | The Ohio State University 4 June, 2010

How is it being done?

How is it being done?



Telling

Stories and **storyboarding** through writing, drawing, blogs, wikis, photos, video, etc.

Diaries and daily logs through writing, drawing, blogs, photos, video, etc.

Self observation through photos, video, blogs, writing, drawing, etc.

Documentaries and **movie-making**

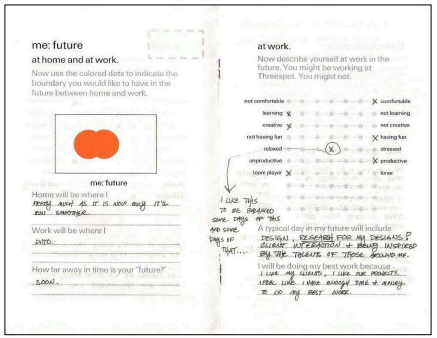
Experience timelines or **maps**

Paper spaces to collect, organize, categorize, reframe, chart and/or make decisions about ideas or concepts.

Cards to organize, categorize and prioritize ideas

Voting dots to prioritize ideas.

How is it being done?



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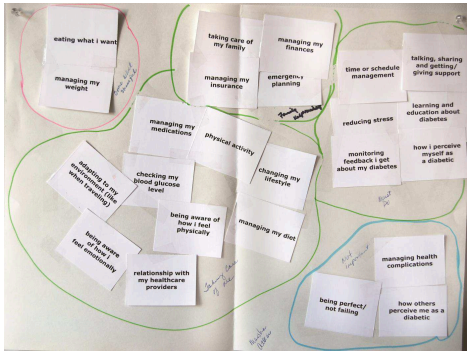

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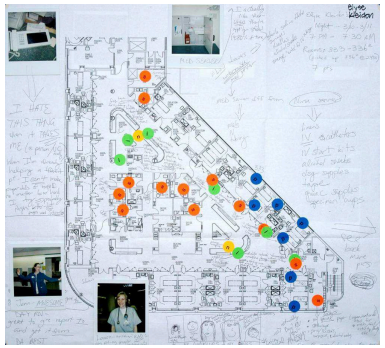

How is it being done?

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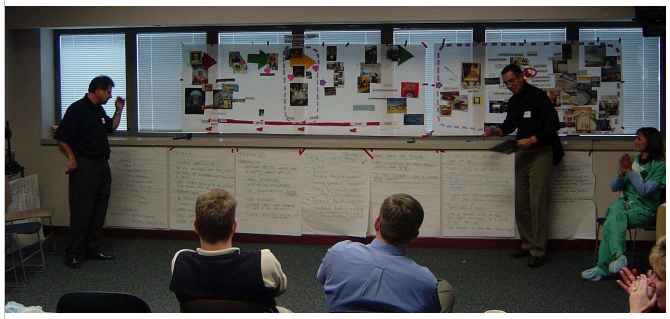


Where are we going next?

designing

Where are we going next?

designing
co-designing

Where are we going next?

designing
co-designing
collective dreaming

Thank you

ANNEX III

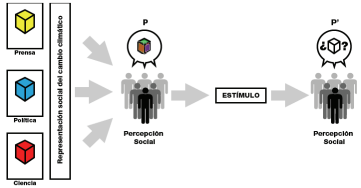
Co-designing with citizens on climate change: the IC3 case

Designit

IC3

The Catalonian Climate Institute (IC3) sponsored by a big national bank, La Caixa, wanted to make a significance positive change on people's general indiferent attitude regarding the climate change.

Exploring people's perceptions and attitudes regarding the climate change. The co-creation activities helped identify the barriers and leverage points for people to act about it.

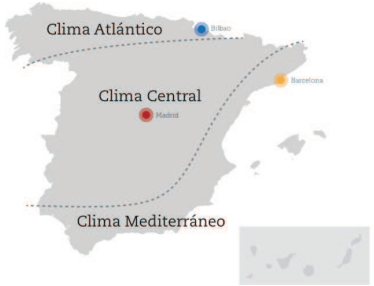


Designit

Innovation happening

IC3

1. Design Research



Recruitment of participants from the different climate zones in Spain

People with awareness

People without awareness

Negacionists

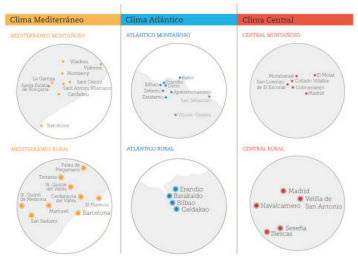
Designit

Innovation happening

IC3

1. Design Research

Sample - 40 participants

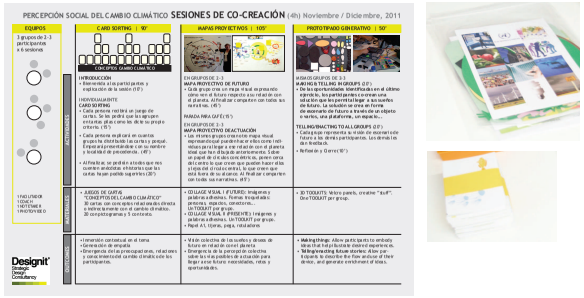


Designit

Innovation happening

IC3

2. Co-Creation



Designit

Innovation happening

IC3

2. Co-Creation

Card Sorting

Designit

Innovation happening

IC3

2. Co-Creation

Projections of the future

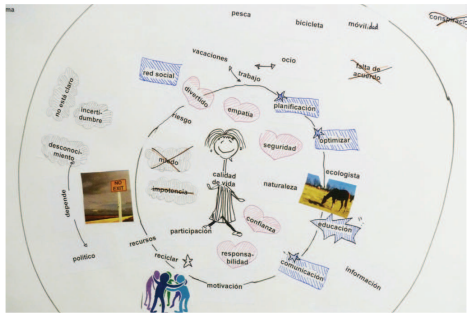
How would you like to be your **ideal relationship** with our planet?

Designit

Innovation happening

IC3

2. Co-Creation



Present vision

What do you think or believe that is **on your reach** to get into that ideal relationship?

Designit

Innovation happening

IC3

2. Co-Creation

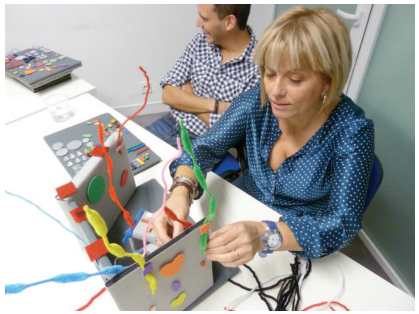
Present-future reflection

Designit

Innovation happening

IC3

2. Co-Creation



Tangibilization of ideas

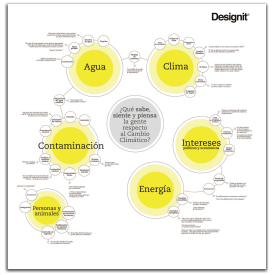
IC3

2. Co-Creation

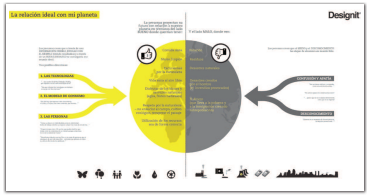
Analysis

IC3

2. Co-Creation



Synthesis



IC3

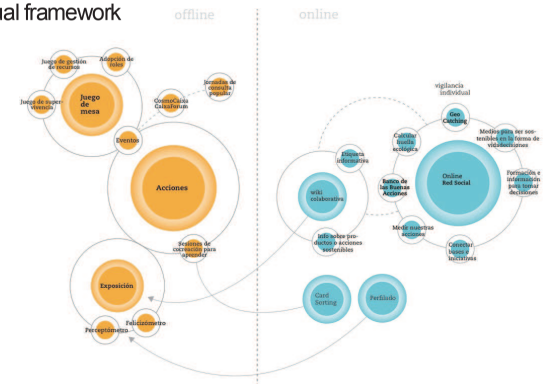
3. Conceptual framework

Strategic Design workshop

An effective ideation and strategic decision-making workshop with key people from IC3 and La Caixa

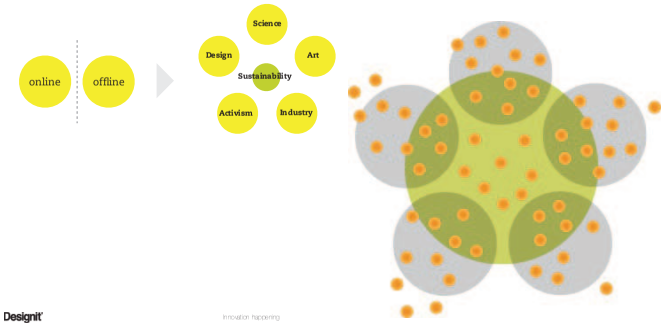
IC3

3. Conceptual framework



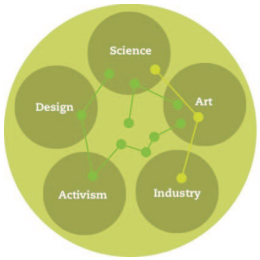
IC3

3. Conceptual framework



IC3

3. Conceptual framework



IC3

4. Conceptual Design

The actions focus on participation, content building and exploration.

Actions

Participation

Iniciativas por plataforma · Iniciativas por categoría · Iniciativas por localidad · Iniciativas asistidas

Platform initiatives
Initiatives by category
Local initiatives
Assisted initiatives

User Content Generation

Lanzamiento de iniciativa · Apoyo a iniciativas · Información de tu localidad · Debates y preguntas

Launching initiatives
Support initiatives
Your local information
Debates and questions

Exploration

Infografías · Material didáctico · Artículos · Videos y podcasts

Infographics
Learning material
Articles
Videos and podcasts

IC3

4. Conceptual Design

Good Habits Bank

4. Conceptual Design

Sustainable catches

It is based on observation, meeting and/or termination of situations related to sustainability.

4. Conceptual Design

Sustainable resources management game

A game to make **sustainable resource management** a fun activity through an application that proposes a list of **activities in an environment of popular culture stories**.
They are rewarded as they complete tasks.

4. Conceptual Design

Co-creation workshops

4. Conceptual Design

Interactive Visual Data Exhibits

Thank you!

merce.graell@designit.com

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