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Learning loops in the public realm. Enabling social learning in communities to tackle the challenges of cities in transition

Learning through co-creation: how to solve urban problems with citizens

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Abstract: The public realm is a place where urban stakeholders interact and come into conflict. The aim of this paper is to present the LOOPER participatory co-creation methodology and platform developed in the Learning Loops in the Public Realm (LOOPER) project to demonstrate 'learning loops' i.e. new ways of decision-making which bring together citizens, stakeholders and policy-makers to iteratively learn how to address urban challenges. The methodology and platform are demonstrated in three Living Labs with different spatial, cultural and thematic contexts. The main issues being solved are traffic and mobility in Brussels; traffic and green space in Manchester; and air and noise pollution in Verona. The paper will discuss the overall approach and methodology developed in the LOOPER project to support finding solutions to urban problems in a participatory co-creation process, and its broader implications for living lab approaches to urban transformation. Some interim findings emerge in the context of three main social science strands: social learning and collective intelligence; local government and participatory co-governance; and the co-design/co-production process in the urban environment. Work in progress from the LOOPER Living Labs demonstrates these wider themes in the light of front-line experience.

Keywords: co-creation; traffic safety; air pollution

Introduction

The public realm is a place where urban stakeholders interact and come into conflict. Urban areas are coming under increased pressure caused by urbanisation that results in increased competition for the limited available space. Well-developed mobility systems are especially important for urban areas to function. Nevertheless, mobility often has negative external effects such as congestion, injuries and fatalities, greenhouse gas emissions, and noise and air pollution. In recent years, urban and mobility planners have therefore moved towards sustainable urban mobility instead of trying to satisfy the ever-increasing demand for road traffic.

Stakeholder involvement is a key aspect of sustainable mobility as it can reveal new values and knowledge, increases support for the outcome, and facilitates implementation (Banister, 2008; Larson and Lach, 2008). However, involving stakeholders in transport planning is far from straightforward as it challenges the often-used expert-led and top-down model (Booth and Richardson, 2001). Nevertheless, as urban problems are becoming more complex and citizens more vocal, policy-makers are turning towards new governance approaches like co-creation to involve citizens and stakeholders in finding solutions to urban problems (Puerari et al., 2018).

Co-creation is an umbrella term for a wide range of participatory and open-design processes that have been widely used in urban planning and design. In co-creation, stakeholders are often frequently involved throughout a planning process and are given influence in the decision-making process (Sarzynski, 2015). Co-creation in urban planning has rarely been applied, therefore we have little knowledge about the benefits of such approach to transport planning and the tools that can facilitate such a participatory approach. LOOPER adopts the broad model of the urban living lab as an approach that enables solutions to be co-produced and explicitly learnt from in specific places (Evans and Karvonen, 2011).

Methodology

Planning and implementation to improve public space can be enhanced through co-creation. In the three LOOPER Living Labs in Brussels, Manchester, and Verona, co-creation has been used in the full planning cycle. A loop starts with collective debate on topical issues, then frames the problem and collects data. The platform visualizes the data and enables the co-design and evaluation of solutions. The selected solutions are then implemented, and the results are monitored with a second loop learning from the first. The LOOPER prototype platform integrates online and offline tools to facilitate learning in each stage of the co-creation process.

The LOOPER methodology is illustrated in Figure 1 The LOOPER methodology. Each Living Lab will go through a full co-creation process twice during the duration of the LOOPER project.

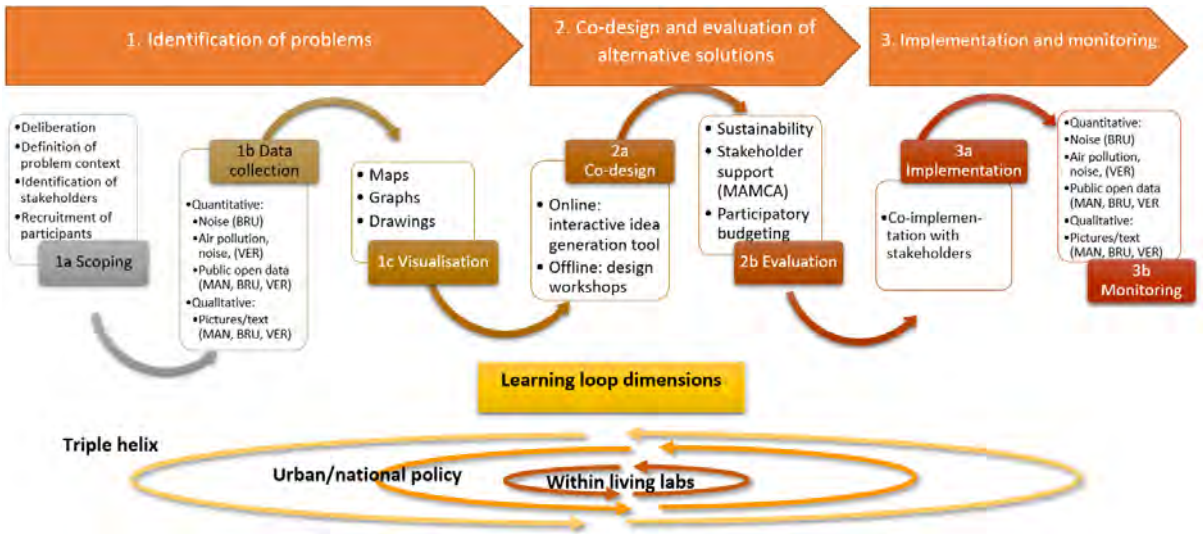

Figure 1 The LOOPER methodology

The main stages of the LOOPER methodology are as follows:

1. **Identification of problems and opportunities**: The aim is to identify the problems of a local community through a three-step process. This stage can be framed positively, referring to opportunities rather than problems:

1a. **Scoping:** The affected communities and the context of the problems will be identified. The problems are framed in a way to enable the tangible aspects to be identified through data.

1b. **Data collection:** Data to identify the scope, location and type of problems is collected with the participation of stakeholders via participatory sensing, via public databases and through face-to-face discussions.

1c. **Visualisation:** Visualisations of collected data are published on the LOOPER online platform and discussed at local workshops.

2. **Co-design and evaluation of alternative solutions**: The aim of this stage is to assess the problems identified in the previous stage, co-design and evaluate solutions, and select the solution(s) that will be implemented.

    2a. **Co-design:** Participants engage in qualitative and interactive online and face-to-face deliberation activities to propose solutions. Participants co-create alternative scenarios, explore new synergies in design or policy and define pathways for action.

    2b. **Evaluation:** After the co-design stage a more standardized method like a multi-criteria analysis is used to appraise the sustainability of alternatives and the Multi-Actor Multi-Criteria Analysis (MAMCA) is applied to identify stakeholders' preferences.

3. **Implementation and monitoring**: Based on the results of Stage 2, stakeholders implement a range of solutions and monitor their efficiency, using the same or comparable data used for the problem definition (Stage 1).

    3a. **Implementation** in the living labs involves citizens and stakeholders through their voluntary contribution.

    3b. **Monitoring:** Monitoring the impact of co-designed solutions uses the same set of tools as in Stage 1. This may involve participants through participatory sensing and open data or through other qualitative means of appraisal like reconducting interviews.

Theoretical context

Behind the LOOPER is a theoretical framework which combines three strands of social science:

- Social Learning theory, systems cybernetics and a 'collective local intelligence'
- Local government and democratic public participation
- Civic co-design and co-production in the public realm

This section is a brief review of these themes: there follows an interim review of the LOOPER experience (in progress at the time of writing).

Social learning & collective intelligence

Organizational learning theory is at the centre of the LOOPER concept and framework (Argyris and Schon, 1995). This applied the concept of reflexive feedback to organizations and institutions. It also reflects parallel ideas from second-order cybernetics and 'critical systems heuristics' (Churchman, 1996). Starting from a traditional view of learning as 'gathering facts', organization studies began to look at a 'Mode 2' 'double-loop'

type of learning. Mode 2 brings up not only information for direct problem-solving, but wider contextual knowledge and deeper values and goals as well.

The learning agenda has also expanded from the learning of information ('know-what'), towards learning active skills ('know-how'), social/emotional/networking intelligence ('know-who'), and cultural or ethical intelligence ('know-why'). This applies to individuals in the education system, but also to organizations and institutions, and increasingly to communities or social networks. This then applies to the LOOPER objective of '*learning loops in the public realm':*

- Learning of **'what'**: Is there informational or technical content (which might be provided or signposted)?
- Learning of **'how'**: Are there skills or techniques (with training or capacity building)?
- Learning of **'who'**: Can policymakers / professionals learn how the community works: and can the community learn how policy works? The community can learn to self-organize, build capacity, mobilize action; the policy system can learn to innovate and adapt. Is there mutual learning between them?
- Learning of **'why'**: policymakers may need to learn that mobilizing grass-roots activity can empower the community and lead toward a more harmonious society.

Social or collective intelligence is then the logical result of social learning. There is no single version or definition, but a practical starting point is with Gardner's 'multiple intelligences' (Gardner, 1983). In many walks of life, it is accepted that 'intelligence' is much more than technical problem-solving. 'Emotional intelligence' is now essential in business and management; cultural intelligence is vital in media and creative arts; ethical intelligence helps to manage business risks. The combination of all these is framed with the 'synergistics' framework for mapping the *collective urban intelligence* (Miles and Ravetz, 2016; Ravetz, 2017).

Organization change and learning is at the centre of the LOOPER concept, and this also calls on 'systems cybernetics' concepts of reflexive feedback to organizations and institutions. In practical terms this refers to a policy cycle which learns from experience, makes effective decisions, and evaluates the feedback and improves and adapts.

The challenge here is that large organizations, public or private or civic, are continuously asked to 'learn' and 'innovate'. However, in a large organization there are many layers. Training is delivered on specific items such as procurement or equal opportunities, but for the organization structure itself it is not easy to identify the more distributed type of learning, and the typical reality is one of barriers, gaps, inertia, 'workshop fatigue', and resistance to change and innovation. Most large organizations would already have some kind of management or monitoring system for learning, innovation, service improvement, and/or productivity and cost saving. Some of these methods are focused on citizen and community participation, and social innovation/cohesion/enterprise, e.g. 'Social Return on Investment'.

Government, citizen Participation and co-governance

Drawing from theories of democratic public participation (Ravetz, 1999), a cognitive or knowledge-based system of governance incorporates cybernetic feedback cycles of information and influence. In a complex society, decision structures tend to centralize and institutionalize, removing the 'decision point' from the 'impact point' for many sets of stakeholders. The result is often less effective and less equitable decisions, particularly where redistributive effects are concerned. Hence a stronger information feedback cycle will tend to

enable more effective and equitable decisions, with direct communication flows between stakeholders, project teams, programme managers and policy-makers.

Such participation processes can be seen in successive stages, as in the well-known 'ladder of participation' (Arnstein, 1969) which charts a range from 'manipulation', where information is rationed for specific purposes, to 'consultation', 'dialogue' and 'legitimation', where information is shared and used to form collaborative agendas. In 'delegation' and 'citizen power', not only information and control of agendas, but economic resources are transferred and devolved.

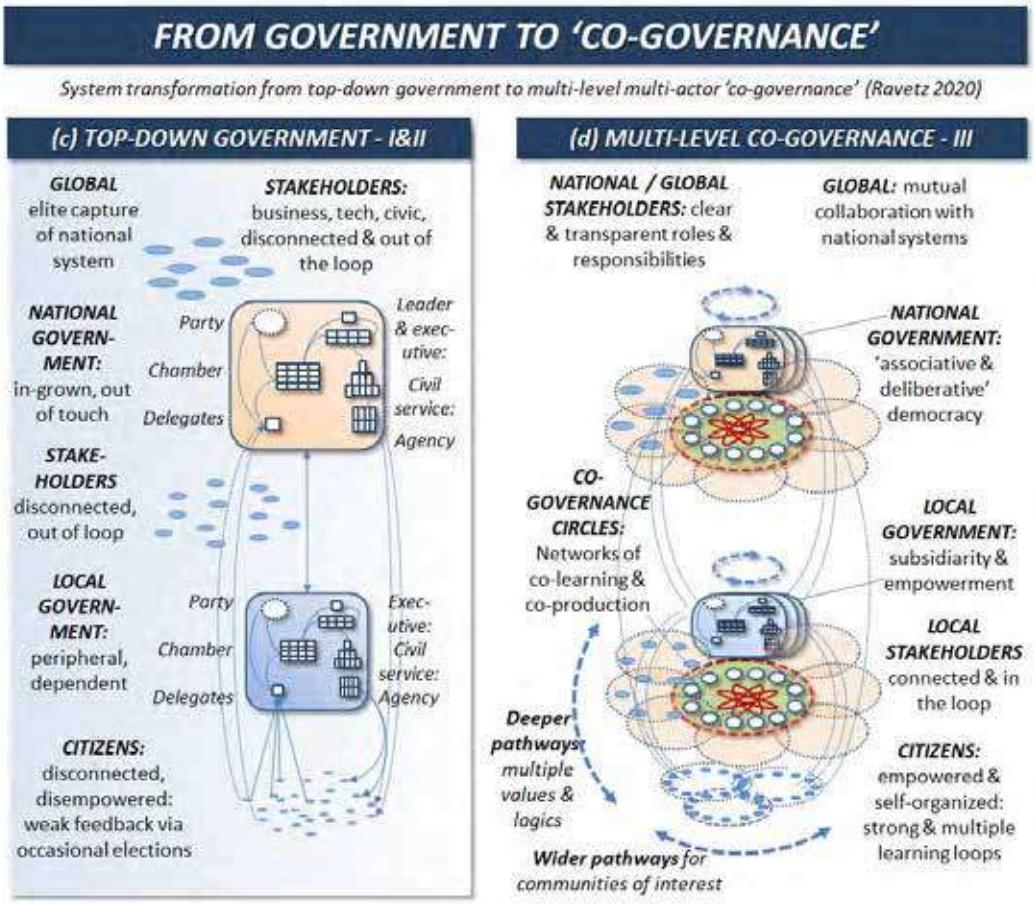

Figure 2 From government to 'co-governance'

From this cybernetic view of participation, a government of representative democracy in fixed units seems quite unsuited to these complex, overlapping, multi-layered dynamics. Moreover, the internal structures of decision-making also seem quite archaic. The diagram at Figure 2 shows, on the left a ***(C),*** a typical parliamentary democracy (e.g. UK), with the local government as a smaller replica of the national level.

There are strong reasons for a complex series of checks and balances, but the overall system configuration shows a lack of feedback channels, with inefficiencies piling up, ingrown and self-serving institutions, and a 'democratic deficit' or lack of engagement with stakeholders. As a result, the needs of cities and neighbourhoods go unmet, resources are wasted, and citizens are alienated. Moreover, results on the ground include urban sprawl, car dependency, rising inequality and destruction of local assets.

Alternative thinking starts with the principle of the round table and its cognitive system properties, of collaboration, co-learning, and co-production. A round table configuration allows formal government units to sit alongside other stakeholders, both formal and informal, as sketched on the right at ***(D).*** Overall there is potential

for a more responsive structure with higher levels of *collective political intelligence* – a roundtable or circle of so-called '*co-governance',* i.e. collaborative and co-produced modes of decision-making.

The model shown above is a hybrid partnership based on networking and collaborative relations, not to replace formal decision-making structures but to enhance them. It works best with multi-level inter-connections, horizontally or vertically between the formal units of cities or districts, to allow for problems and opportunities which do not fit in formal units. The central circle can have any number of special interest or project circles attached, all linked by a common platform for information sharing, co-learning and co-production. It promotes 'associational' or 'deliberative' forms of democracy, which looks for the balance of formal and informal interests, where citizens, neighbourhoods or whole cities can be empowered and self-organized.

Living Labs

The three LOOPER Living Labs have different spatial, cultural and thematic contexts. The Brussels LOOPER Living Lab is situated in Helmet, a neighbourhood with many traffic safety problems within the municipality of Schaerbeek in the north of the Brussels Capital Region. Its location was selected after consulting local and regional governments as well as NGOs in the area. The living lab was set up in February 2018 and will run until June 2020. The lab is run by the Mobility, Logistics and Automotive Technology Research Centre (MOBI) at the Vrije Universiteit Brussel and BRAL, a Brussels citizen NGO.

The Manchester LOOPER Living Lab is situated in the Brunswick neighbourhood, a former social housing estate close to the city centre that is undergoing regeneration. The neighbourhood has a diverse population and is bordered by major roads on three sides. The Manchester Living Lab explores five interconnected issues: air quality, traffic safety, security, community spaces and greening. The University of Manchester is the coordinator of the Living Lab but works in cooperation with the social housing organisation S4B.

The Verona LOOPER Living Lab is located in the south of the city of Verona. The borders of Verona South are delimited by train tracks, roads, and a river. Air pollution in the area is a problem as it exceeds limit values imposed by EU laws. This problem is partly caused by the city's location in the Po Valley but is exacerbated by the emissions of old heating plants as well as mobility related emissions. The Verona LOOPER Living Lab officially started in December of 2017. The lab is run by IUAV University of Venice with the cooperation of environmental NGO Legambiente and the City of Verona.

Results problem identification

The scoping of problems to be addressed in the LOOPER Living Labs was done together with local stakeholders and citizens. Living Lab organisers used their knowledge of the area but also had meetings with stakeholders such as local authorities and schools. Emphasis was put on engaging residents in the project and suggest ideas for the Living Lab. This was done via workshops, neighbourhood events, local newspapers, and posters and leaflets. These outreach events resulted in the selection of traffic safety, greening and traffic calming, and air quality as the topic of respectively the Brussels, Manchester, and Verona LOOPER Living Lab.

Each Living Lab developed a plan to collect data on the identified problem. The Labs had an online geotagging application developed by IUAV at their disposal through which residents could identify places in the neighbourhood that they found especially good or bad regarding the identified problem (see Figure 3). In Brussels, residents collected data on traffic speed and traffic volumes. The Manchester Living Lab collected data with residents on air quality using mobile Airbeam sensors and data from the fixed government air quality sensing station. Primary data was also collected on existing green infrastructure in target intervention areas using observation and geographic information systems (GIS) mapping. Resident preferences and notes on the local area were collected using the online geotagging application and, where residents were either unable or unwilling to use the app, through offline consultation using maps and photos that were then uploaded to the

online platform. In Verona, residents collected data on air pollution by using mobile (low-cost) and fixed (official body) sensors as well as data on noise pollution using stationary noise boxes built with a smartphone, an app and a calibrated microphone. Furthermore, in Verona qualitative data about perception and appreciation of urban spaces were collected using the online geotagging application.

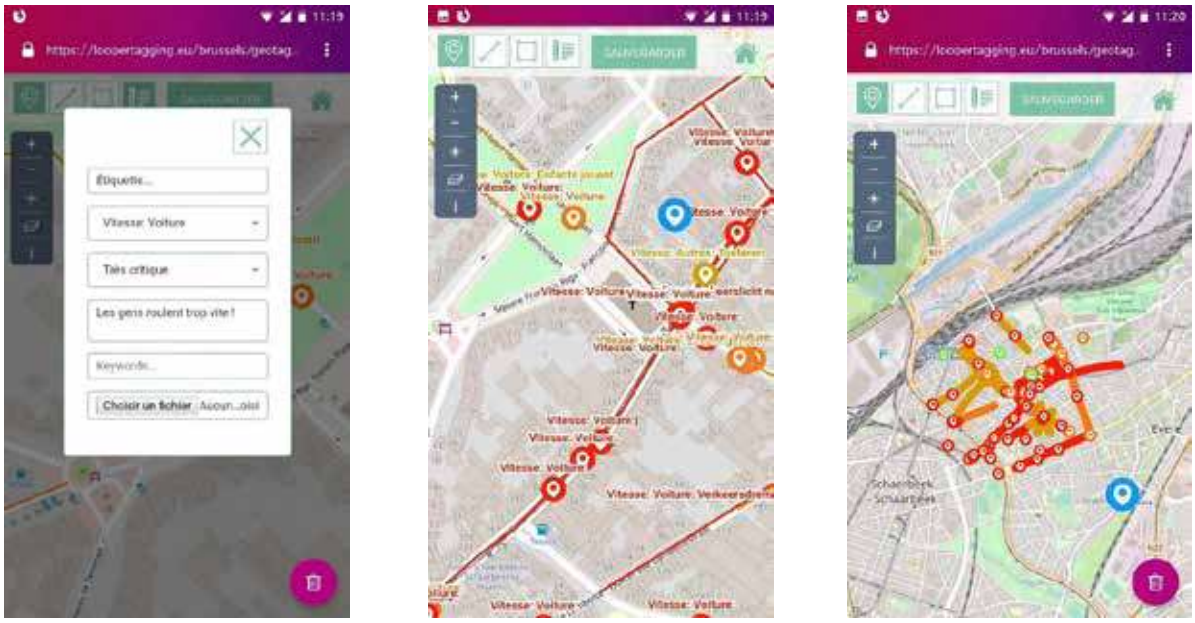

Figure 3 Screenshots of the LOOPER geotagging application

The collected data was visualised on each respective local LOOPER platforms, which is a website in the local languages used as a communication channel towards citizens as well as providing a data collection, visualisation and idea generation platform for the whole co-creation process. In Brussels, the platform showed the results of the speed measurements and traffic counts. The collected data showed that one in three cars go over the speed limit of 30 km/h and that majority of road users were either on foot or in a car. In Manchester, air quality was visualised to show the concentrations along main roads and around a local primary school. In Verona, the collected air quality data was displayed on the LOOPER platform (see Figure 4).

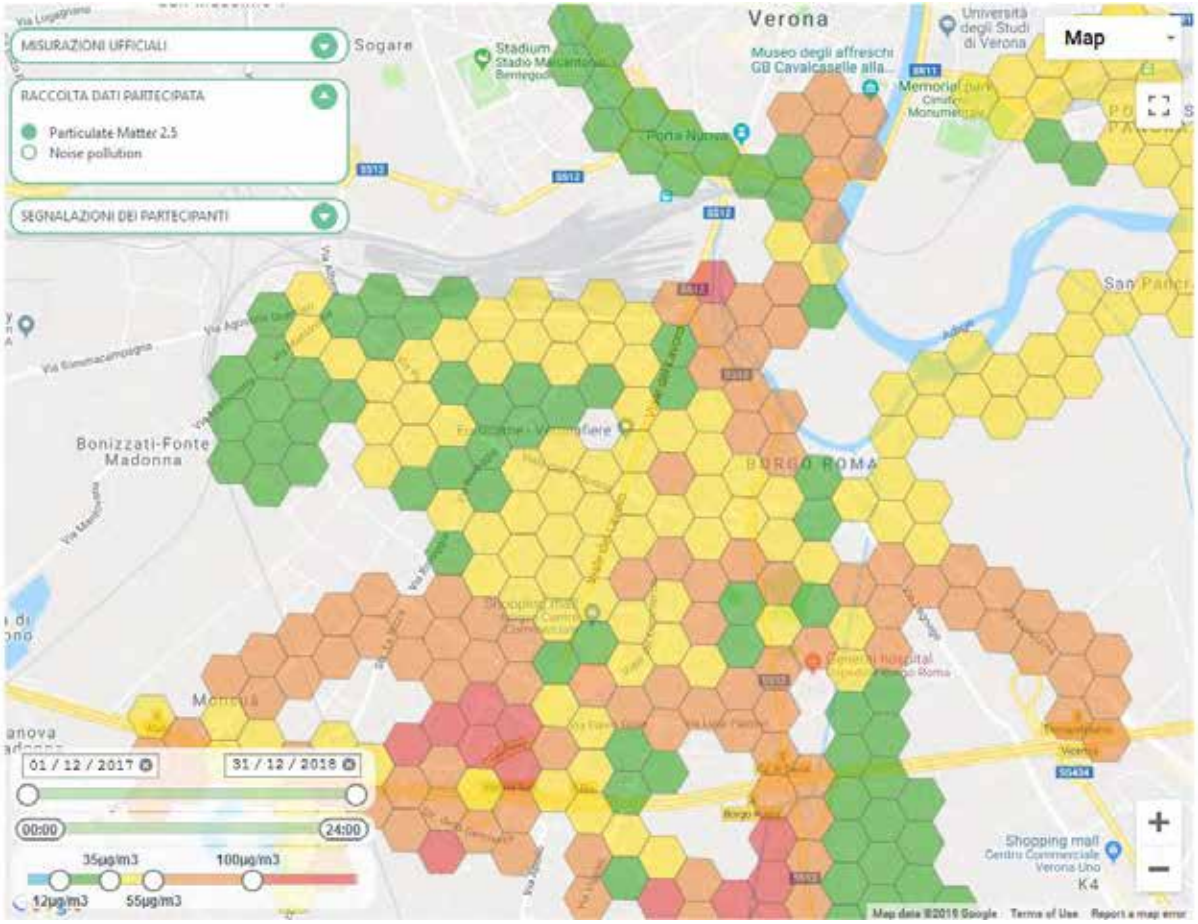

Figure 4 Data visualisation of air pollution in Verona on the LOOPER platform

In Verona, both qualitative and quantitative data were collected and displayed on the LOOPER platform. Figure 4 shows crowdsensed particulate matter (PM) 2.5 data, collected with mobile low-cost devices. The data from Verona showed that the spread of PM2.5 was almost homogeneous across a larger area, and mitigation solutions were needed across the whole Verona South area.

The data in Figure 4 shows how data collected throughout a one-year period give a homogeneous picture of the PM typical distribution. However, variations and peaks of particulate matter levels can only be seen on larger scales. This low difference of values inside on a regional scale can also be found when considering data collected in a shorter period of time. Figure 5 shows that even when considering the period with the highest levels of air pollution in Verona (a ten-day frame between January and February 2018), the collected data show no differences within close-by areas. Nevertheless, this campaign demonstrated that in some periods of the year, air pollution levels in the city are quite high and that some mitigation solutions and policies are needed.

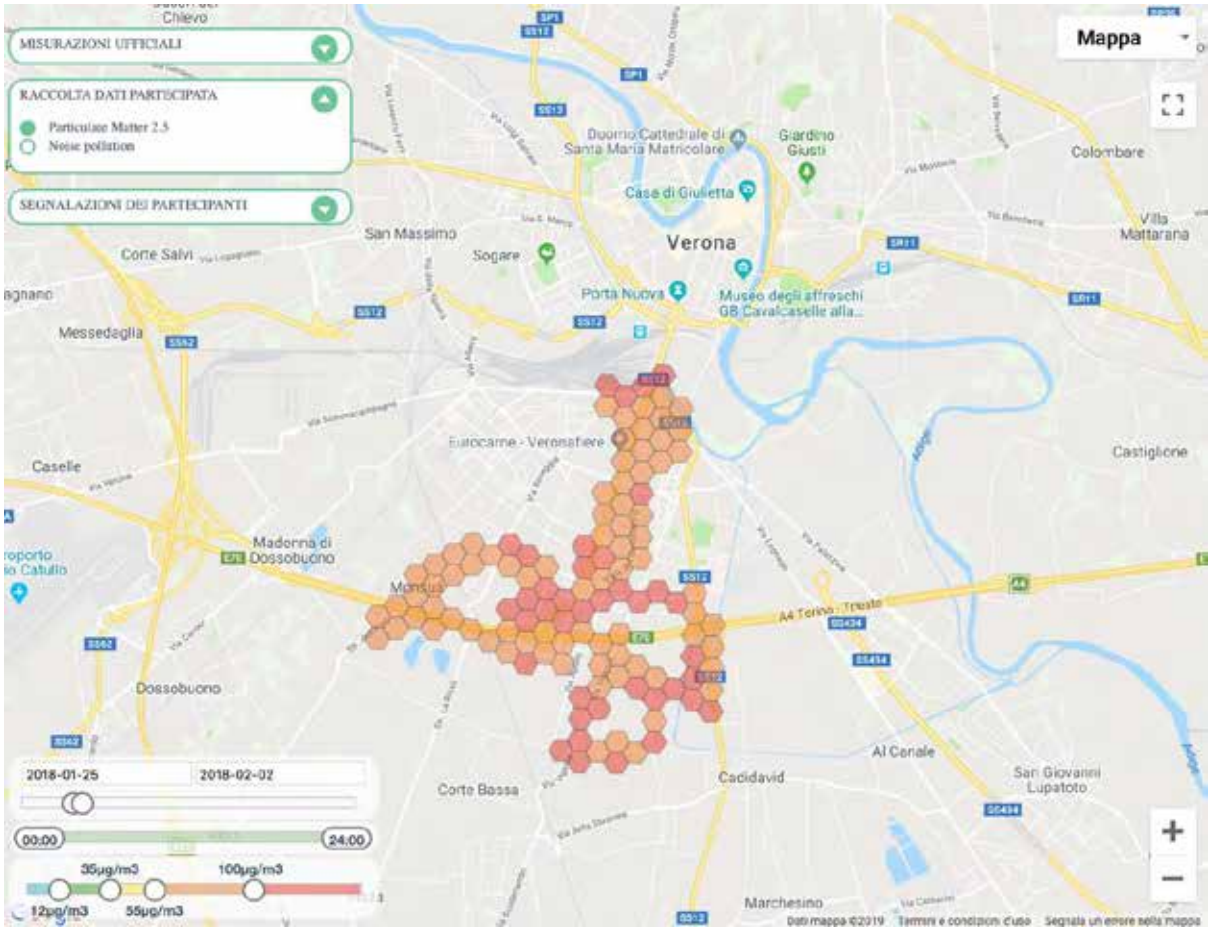

Figure 5 Data visualisation of period with highest levels of air pollution in Verona

Participants also collected data on noise pollution. Noise boxes positioned around Verona Sud showed that noise levels were close to or just over legal limits. This helped raise awareness on diseases caused by high noise levels which usually are considered as less important compared to air pollution.

Results co-design and implementation of alternative solutions

Each LOOPER Living Lab held workshops with residents and stakeholders to present and explain the collected data and to start the second stage of the LOOPER co-creation methodology: the co-design and evaluation of alternative solutions. Using their local knowledge, residents could submit solutions to the problem identified in the previous stage via the local LOOPER platforms where an idea generation tool was set up as well as through face-to-face co-design workshops (see Figure 6).

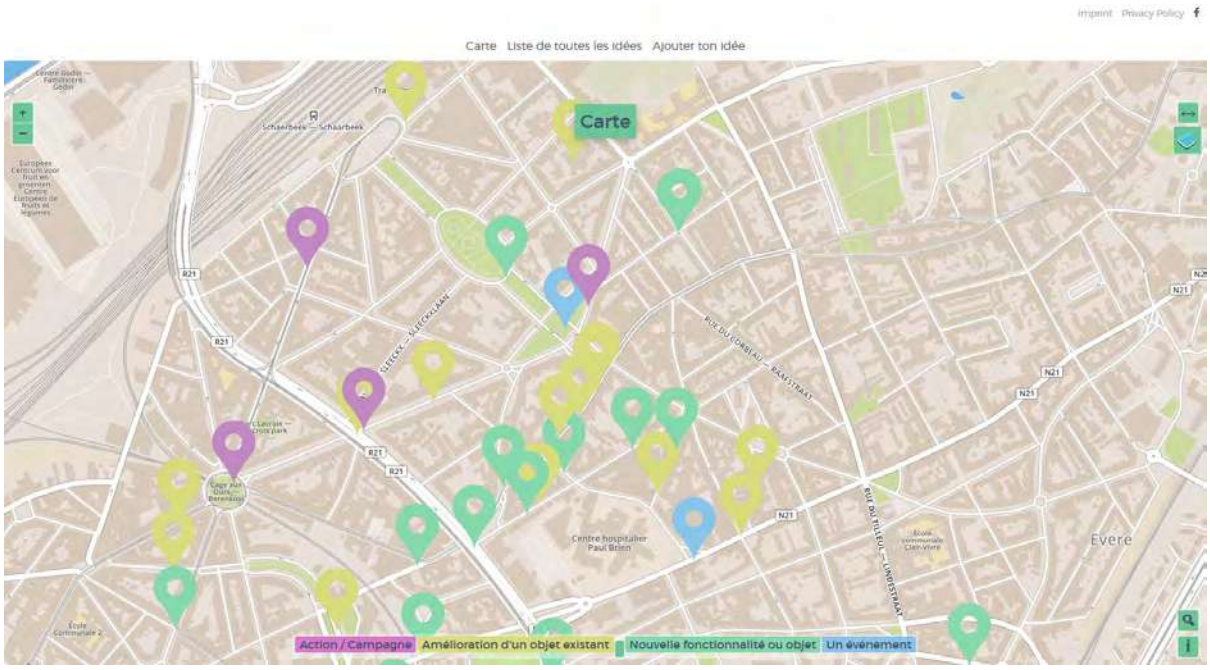

Figure 6 Location of possible solutions submitted by residents to the Brussels LOOPER platform

In the Brussels Living Lab, 43 ideas/solutions were suggested by residents. The co-designed solutions included changes in the infrastructure, awareness campaigns, and stricter enforcement of traffic laws. In the first co-design workshop, residents discussed, merged and rewrote ideas submitted via the platform and then decided on their five favourite solutions. Then, the impact of the proposed options on sustainability (MCA) and their stakeholder support (MAMCA) was evaluated. The sustainability MCA showed that none of the co-designed solutions would have a negative impact on the sustainability of the neighbourhood. Moreover, the MAMCA showed that none of the stakeholders (municipality; public transport operator; regional ministry of mobility; local cycling association; citizens) would be negatively impacted by the co-designed solutions. Residents then decided during a second co-design workshop that the solution to be implemented would be an awareness campaign for the presence of children in the streets.

In the Manchester LOOPER Living Lab, 36 ideas/solutions were proposed by residents, focusing on two specific roads and two neighbourhood wide issues (green spaces and street spaces). Overall, solutions responded to a desire to enhance the appearance and experience of the neighbourhood. On Brunswick Street three sets of ideas were proposed to address the problems of speeding traffic, lack of greenery and lack of connectivity / poor wayfinding. Specific proposals included 20mph speed limit plus a range of horizontal and perceptual traffic calming features, adding trees, shrubs and planters onto the pavement and other public spaces, adding hanging baskets and/or ivy screens and hedges in front of houses and other private spaces, and extending design elements from Brunswick Park and signposting entry into the Park from Brunswick. Wadeson Rd runs to Medlock Primary School and ideas included turning Wadeson Rd into a School Street (meaning closing down the road to non-essential residential traffic during school entry and collection). This included park and stride with neighbouring shop car parks, whereby parents could park nearby and walk the final part of the journey. Turning Wadeson Rd into a painted street and mitigating air pollution inside the schoolyard by planting hedges around school were also suggested. In terms of wider neighbourhood greening, suggestions focused on adding elements to make existing greenspace more interesting, such as wildflower meadows, woodlands, benches, play equipment, community activities, and green belt / active transport routes. There were also proposals to create citizen-led small green spaces: creating orchards with fruit trees and grapevines managed by neighbours. Finally, there were proposals to improve street spaces across the neighbourhood. These included improved

signage, connecting with design elements in the new Brunswick Park, adding benches and campaigning to prevent staff and students from the neighbouring University of Manchester to park in the neighbourhood. The MAMCA workshop was very effective in enabling the key stakeholders to rank ideas in terms of feasibility, cost and impact. This led to a desire to focus on Brunswick St, which was seen to be the most problematic element of the neighbourhood and thus the element that would produce the greatest benefits from targeted improvements. There is considerable interest in whether greening and general public realm enhancements could create a perceptual traffic calming effect. Treatments around the school were seen too complex due to existing initiatives focusing specifically on schools and air quality, while neighbourhood wide treatments were seen to be rather too diffuse to generate significant impact in a project of this scale.

In Verona, 34 ideas/solutions were proposed by residents. These possible mitigation solutions included: street closures to create calm and less noisy aggregation spaces; implementation of 30km/h zones to make neighbourhood spaces more quiet and secure; street closure during enter/exit school hours to allow children to reach school on their own; implementation of cycle lanes to have a more homogeneous network to boost the use of bicycles and to connect existing greenspaces; implementation of trees and greenings around the area of Verona Sud to make spaces more appealing and less polluted; introduction of green noise barriers on the main highway sides as it cuts through the area dividing it. The MAMCA was supported by a preliminary selection of sustainable solutions with policymakers and council employees that participated at Living Lab meetings, and the sustainability of the proposed options was evaluated while ideas were proposed. Indeed, the MAMCA was done considering the various stakeholders, and results showed that the proposed ideas could be implemented with no negative impact on stakeholders. After the MAMCA, three ideas were implemented as they had the highest, and most consistent, evaluation score for each stakeholder. The three ideas that have been implemented, and are being monitored as this paper is written, are: street closures in one part of the neighbourhood as a pilot case to propose it around the rest of the of the area; crosswalk islands near schools to be re-proposed in other school areas; and street closures at entry/exit hours to have safer spaces for children.

Results of implementation and monitoring

The last stage of the LOOPER co-creation methodology includes the implementation of (a) co-designed solution(s) (see Figure 7) and the monitoring of their impacts. Due to differences in timing between the LOOPER Living Labs, so far only the Verona Living Lab has implemented some of the proposed solutions (i.e. street closure, crossing islands for pedestrians), and started to monitor the effect of the co-design process (while writing this paper the data collected during the monitoring campaign are still to be analysed). To monitor the co-design process, the monitoring campaign is taking place using the same monitors positioned in the same locations from the 2018 campaign. This is done in order to have data as much comparable as possible, with the aim of having stronger results to support the whole process and do what is best to transform the situation.

In Brussels, an awareness campaign using temporary road paintings made by children will be implemented in June 2019. Speed measurements will be done before and after the implementation to see whether the solution has had an impact on the speed of cars.

In Manchester, a set of interventions focusing on Brunswick Street will be implemented between June and July 2019, with traffic speeds, resident perceptions and preferences, and car drivers' perceptions and preferences being monitored to assess the effectiveness of the overall treatment of the street and satisfaction with each specific intervention.

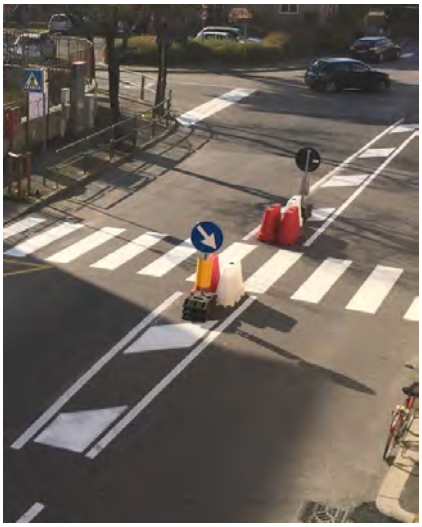

Figure 7 Examples of a to be implemented co-designed idea in Brussels and of an implemented idea in Verona

Discussion and conclusion

The LOOPER living labs have applied and investigated a number of aspects of co-creation that can be useful for other co-creation initiatives. The application and usefulness of online and offline tools, the combination of co-creation with analytical evaluation methods such as the MCA and the MAMCA, and the role of co-creation in social learning are the three most important aspects being explored.

Co-design is usually facilitated by a professional, who might choose a certain approach, and within that various methods or tools to spark creativity and keep a process of reiterative questioning, refining, reflection going. Scenario or prototypes can be built and reviewed. While co-design as an approach asserts users to be capable experts of their own experiences, they must still be supported through tools that allow them to express themselves (Voorberg et al., 2015). In LOOPER we have used a combination of offline and online tools. One of the learnings from the living labs is that online tools should have a low entry threshold in terms of previous knowledge of similar tools and in terms of access (e.g. need to register). Moreover, online participation tools can but do not always replace offline participation. A combination of online and offline participation is therefore necessary to involve as many people as possible.

In Brussels, the online idea generation tool was used by more citizens than the LOOPER geotagging tool, most likely because no account creation was necessary for the online idea generation tool and submitting an idea was a rather straightforward exercise. However, in Manchester the online idea generation tool was not used by citizens. It is unclear whether this is because of disinterest in the project or because the citizens lack digital skills to use the tool. No direct discussion between citizens, however, took place online in the three Living Labs. Whereas lively discussions about traffic safety and air quality took place during physical meetings, this was not the case online. Citizens used the online idea generation tool to submit ideas and view ideas of others but did not use the commenting function.

In addition to the online tools, we organised face-to-face meetings with citizens. These meetings served as a way to present the project to citizens, to get a debate started between citizens about the problems that the living lab would address, and to get citizens involved in finding solutions for the problems identified in the living lab. Moreover, these physical meetings allowed for the participation of those that were not able or did not wish to participate online. In Brussels, 25 people submitted ideas and 8 residents came to the two co-design workshops. In Manchester, more than 40 residents were engaged, primarily through meetings with 10 community

organisations and participation in 11 community events. In Verona, 33 ideas were submitted via the platform and around 50 residents came in total to the three co-design workshops.

In Brussels and Verona, most participants were already engaged in the topic of the Living Labs and had a relatively high educational background. In Manchester, resident engagement took place through existing community groups that showed considerable enthusiasm for the goals of the project to respond to citizen concerns and improve the local area. The Living Lab coordinators also visited citizens as part of the neighbourhood liaison role performed by partner organisation S4B in order to get input on what the problems are in the neighbourhood and how they could be solved. There was less appetite from residents to be involved in monitoring, as they felt they already knew there were problems that required attention, and less enthusiasm to engage with digital technology. This may have reflected the demographic and socio-economic make-up of the area and raises questions concerning the most effective ways to engage hard to reach groups with digital technology.

Another novelty of our approach is the integration of multi-criteria analysis and the multi-actor multi-criteria analysis with co-creation. While co-creation is a loosely structured, bottom-up method, MCA and MAMCA are very structured and can be perceived as complicated. Nevertheless, the potential added value of using MCA and MAMCA for evaluation is to show to what extent the co-designed ideas are sustainable taking into account 16 criteria of economic, social and environmental sustainability (Keseru et al., 2016); and to determine to what extent they would be supported by a wider range of stakeholders (e.g. public transport operator, police, municipality) beyond the citizens' group. This is a vital precondition for effective upscaling, as the solutions that are tested in the living labs must be feasible and practicable if they are to be adopted more widely by other organisations, places or policy makers. As Voytenko et al. (2016, p. 49) argue, "the degree to which ULLs [urban living labs] are able to stimulate broader changes beyond their institutional and spatial boundaries is directly related to the exact composition and structure of ULL partnerships, which determines which actors are included and the collective rules of experimentation." The LOOPER approach ensures that the stakeholders responsible for upscaling solutions are involved in the design and operationalisation of the living labs and their solutions.

The MAMCA and the MCA was only carried out fully in Brussels, as the method was perceived as time-consuming and requiring a lot of stakeholder input in the other living labs. That said, the process of engaging stakeholders through a value mapping process in advance of the MAMCA workshop proved to be exceptionally effective in ensuring stakeholder participation. In the second loop we will investigate how the burden on the analyst and the stakeholders can be alleviated. The role of the second learning loop will also be critical in determining how effectively local evidence concerning solutions is translated into more general insights (Hodson et al., Forthcoming).

The results in the LOOPER Living Labs show that reality is messy and unpredictable. The learning loop cycle may go around several times, especially at the co-design stage (Voorberg et al., 2015). The search for funding or the political process could be at the centre of the picture, more than any co-design options: a road safety/traffic congestion problem may be controversial, where different groups (e.g. residents / businesses) have different views and look for different data to support them. The design of traffic calming is quite technical and expensive, and the engineers might need time to learn how to do community participation and co-design. When the official approval is given for funding and traffic management, there may be 3-4 design stages, from sketch to outline to detail, each needing participation, from both a core group and a wider community, which is costly to organize. Meanwhile there are social innovations which might be quicker and cheaper, working in parallel, but where the effects are difficult to monitor. However, even if funding is difficult and little is achieved on the ground, there may be a positive effect on community capacity building.

A further issue is that of systemic scale and hierarchy. For instance, the problem of traffic pollution and noise can be framed at different levels, and the problem/response learning loops may be co-created at different levels, each with different interaction opportunities between policy, professionals and the community. All this should not suggest the problems are so complex and controversial, that nothing can be done. It does suggest a role for creative social entrepreneurs/community planners or mentors, who can bring together the different groups, navigate through uncertainty, coordinate the right level of technical/scientific evidence, and help in the co-creation of useful responses.

This paper is drawn from a project at mid-point, so any conclusions are very preliminary and subject to further feedback. We can summarise the main experiences and their implications for other Urban Living Labs so far:

- Practical interventions in the LOOPER Living Labs need to be fitted or 'embedded' around the realities of urban planning development, which is often very complex, slow-moving and in many cases controversial with different sections of the community, and/or the local government. With hindsight, the Living Labs could start on two parallel consultations, both with the community and policy-makers.

- Following that, issues of power and organizational dynamics cannot be ignored in a technically enhanced urban monitoring and policy development: i.e. the technology can enhance the political participation process, not to replace it.

- Citizen monitoring should include for both sides of the digital / non-digital divide, and it may be that non-digital offline methods are more effective, if the conditions for 'embedding' can be met.

- Evaluation methods need to be fitted to the reality of community and organization working, where the dynamics of projects are often messy, contingent, complex and unpredictable.

All these are themes for further debate and practice, in the evolving interface of policy participation, digital or non-digital learning loops, and the overall potential for '*collective local intelligence'*. The findings presented in this paper will be used to further improve the second co-creation loop in the LOOPER Living Labs.

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