

Mobilizing Publics

Reconsidering digital design as a catalyst in co-creation processes

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Digital design has developed methods to address complex urban planning issues like the transformation of mobility using analytical tools and urban data. Simultaneously, such wicked problems require negotiation among involved stakeholders and situated knowledge. Even though contemporary City Digital Twin and urban data initiatives acknowledge this sociotechnical aspect (1&2), linking data analysis and participatory negotiations remains unresolved. In this paper, we bridge this gap by reconsidering digital design as a hybrid practice mediating between quantitative and qualitative approaches, between different stakeholders' perspectives, and urban strategies (3). We explore this approach in the EU-funded New-European-Bauhaus initiative project "NEBourhoods". Our action within this project addresses the mobility transformation of a car-centered late modernist housing estate in Munich. This initiative involves a digitally supported co-creation process, including a participatory platform, workshops, and two physical demonstrators for multifunctional mobility stations. Building upon earlier research in the context of design-decision support, collaborative design, and gamification, we discuss how these elements can be articulated as a hybrid strategy, mediating between heterogeneous aspects of urban mobility and different stakeholders' perspectives. Firstly, we introduce spatial data analysis tools in participatory workshops with local experts and multipliers. Hence, the participants contextualize geospatial data and augment analytical data with situated knowledge. Successively we define possible locations and functions for the prototypical demonstrators. Consecutively we delve into these selected areas: Using a gamified mobile phone app, we gather information on local mobility practices and facilitate a co-creation process on the configuration of the demonstrators. Finally, the participatory app allows discussing and monitoring the implemented demonstrators and thus fosters a broader discussion on mobility transformation. In conclusion, we discuss how digital design assembles and mediates this strategy for mobility transformation. Thus, we focus on how digital tools gather and re-configure relevant perspectives, interactions, and elements in this hybrid co-creation process.

Keywords: Participation, Mobility, Urban Data, Gamification, Collaboration, Mobility, Design-Decision Support

INTRODUCTION

For years the German traffic sector was not able to substantially decrease its carbon footprint (Hendzlik, et al., 2023). Now the German government has committed itself through a climate protection law to decrease the carbon footprint. Therefore, the law uses carbon budgets for every year and sector until the net zero is reached. The traffic sector, again, was one of the few sectors to fail this agenda. While the public discussion now is about a speed limit and cuts of the federal business car subventions, we want to support a change in the mobility behavior of the city people in their daily routines. This change should not only cause for saving carbon emissions but also raise life quality and boost the health of the inhabitants.

Part of many European cities' mobility strategy, is therefore refitting urban areas with infrastructure for more "climate" friendly means of transport – such as bike- and car sharing and related infrastructure (like e-bike chargers or repair stations). A part of this strategy are decentral mobility stations, distributed in the city and complementing conventional means of traffic like public transport (busses, metro).

But this decentral point-infrastructure is often planned in a centralized top-down manner. As Peters argues one central issue of traffic planning consists in the path-dependency of the established planning instruments: standards, simulation-models, available information, and planning media today are still influenced by car-centric top-down approaches of the 50s to 70s (Peters, 2019). Following Peters, a resulting challenge in traffic planning is the development of planning tools and approaches, taking into account different modes of traffic and the perspectives of different traffic participants.

While conventional tools of traffic planning facilitate the dimensioning of highways for cars, they are not usable for decentral mobility planning (for hubs, sharing stations), since in this case it is less relevant to know about street capacities, but about contextual traffic behavior - like in what context you would need a cargo bike, or what practical circumstances could make you take a bike instead of a car. To create this kind of knowledge, classical top-

down perspectives and statistical planning data have to be complemented with cocreation strategies, and situated, qualitative knowledge.

This perspective goes hand in hand, with contemporary City Digital Twin and municipal Urban Data projects, combining heterogeneous data sources in decision making (Tomko & Winter, 2019) and including conventional data-bases as well as more experimental tools for participation and cocreation (Connected Urban Twins, 2023).

Decentralized bottom-up planning with a lot of people requires a hybrid collaboration approach, which brings together digital data perspectives, with social co-creation formats, and bridges between digital and physical urban spaces. Therefore, we develop our mobility solution based on data from the inhabitants and within a co-creation process closely with stakeholders, local initiatives and officials.

As an implementation research project we develop a wholistic strategy to include different professions and perspectives in a coherent planning process. We will test a new form of co-creative digital planning and evaluate its success. Therefore, we apply existing research by our chair and others on a participation process leading to the construction of two Neighbourhood Hubs.

As a part of the New European Bauhaus, the NEBourhoods project focuses on Co-Creation of experts and inhabitants as a big part of the research methodology. So our digital process of participation and evaluation goes hand in hand with local Co-Creation and the implementation of concrete prototypical mobility hubs. By this, we prototypically develop a strategy and a toolkit, which can be adapted to different areas and contexts.

METHODOLOGY

Our aim is to conceptualize and place the two Hubs in a way that they are most useful and attractive for the inhabitants. To do that, we propose a digital analogue hybrid co-creation process with inhabitants stakeholders and creatives.

The hubs should be connected to local needs, institutions and structures. In this way it is ensured, that locals can- and want to use both of the hubs. In short, the Hubs need to become a natural part of the local relational network (Löw, 2001, p. 224 ff.). Therefore, we use a digital platform to collect data from the inhabitants.

They know best about their living area and its needs. Though in this way it will not be possible to collect all the data needed to understand the whole relational network, it should be possible to make sense of the collected data in a way the relations regarding the mobility of the inhabitants are revealed. But the Hubs are not only there to become a new, but natural part of a local mobility space. They are meant to support a mobility transformation by altering the behavior of the locals. As Löw et.al (2007) point out, spaces and behaviour are interconnected and presuppose each other. So, spaces can change behaviour and the other way around.

“Die Rede von einer Dualität von Raum bringt so die Überlegung zum Ausdruck, dass Räume nicht einfach nur existieren, sondern dass sie im Handeln geschaffen werden und als räumliche Strukturen, eingelagert in Institutionen, Handeln beeinflussen können.” (Löw, et al., 2007, p. 63)

“Talk of a duality of space expresses the consideration that spaces do not simply exist, they are created in action and as spatial structures embedded in institutions, they can influence action.”

The digital platform should ask the inhabitants to place the different functions they want at a place they prefer. With that, they do the first step of knitting a new part of the urban fabric (spacing).

But they should also be asked to connect their configuration of the hub with its surroundings (Synthesis). To accomplish that, they need to be able to explain why they choose the one or the other function.

There also should be a strong incentive for participants to include the surrounding structures into their design and don't just fulfill the task of configuration with their own needs in mind. This could be done by providing a Multiplayer feature which allows participants to rate each other's designs regarding their functions and location. Also this could foster their overall motivation to explore all the functions of the digital platform by competitiveness (Muehlhaus, et al., 2022). To have built the best rated hub, they have to think also of the needs of other people, of the best connection to local entities or build structures. Because other people rating them take that into consideration. In every suggestion of a function, there is a problematization of a function that is missing at given place. To be high on the leaderboard, they need to think about the best solutions for everyone. In 2015 a german urban research team focused entirely on problematization to analyze differences in local horizons of the meaning of different cities. Their idea of problematization is one of a distinct point in an urban discourse pointing out a wide range of aspects of a collective understanding of a city.

“Problematisierungsleistungen müssen [...] anschlussfähig an local dominante Deutungsmuster sein, um als legitime und politisch relevante Bestandteile des Diskurses Anerkennung erfahren zu können.” (Barbehön, et al., 2015, p. 44)

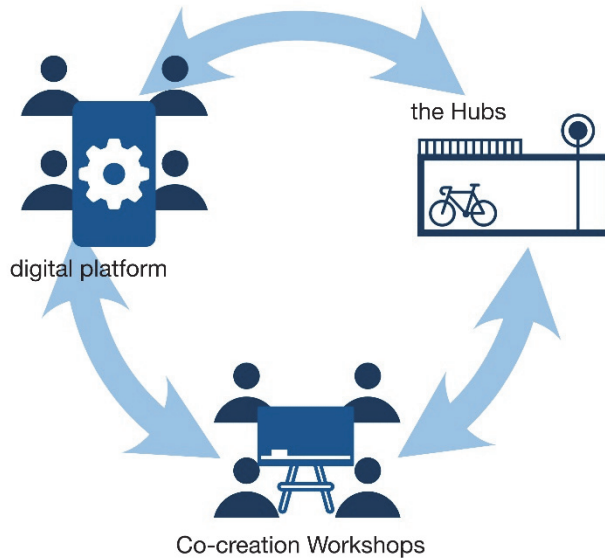


Figure 1
Hybrid participation process: The single elements of the project are part of an interconnected analogue and digital dataflow of qualitative and quantitative information

("Problematism performances must [...] be connectable to locally dominant patterns of interpretation in order to be recognised as legitimate and politically relevant components of the discourse.")

To further knit the Hubs in the relational Network of the city quarter there should be also a strong element of cooperation and discourse for the local stakeholders, creatives and officials. Therefore we use Workshops that are organized and conceptualized by a research partner. The workshops are the analogue platform to organize the different functions of the hub. This Co-Creation process should activate local initiatives for the project or kickstart new communities which use the Hubs and take care of certain parts of it (Figure 1). This way local initiatives can take part in the process and make the new structures their own. For doing that and making the best decisions

they are provided with analyses of all the data the App collected from the inhabitants.

After fabrication and positioning of the physical hubs, the digital platform can again be used to survey the acceptance of the new mobility infrastructure. The obtained data is then able show if the co-creative hybrid process was able to support the local transition in traffic.

RELATED RESEARCH

In this chapter we will introduce a small selection of research of mobility hubs and their planning processes as well as the potential of digital tools for participatory planning issues.

Mobility Hubs

The research "Mobility Hubs of the future - towards a new mobility behaviour" rather is a sketch of an idea than a full research project. Yet the idea this interdisciplinary team consisting of members of the RISE research institute and the planning firm Arup outlined is closely related to what we are planning.

Their idea to expand the understanding of mobility hubs to social functions supporting the shift to climate friendly modes of transportation is one we share.

“...the future mobility hub becomes more than a transportation hub. It serves a specific purpose within each respective neighbourhood. Through becoming a new community centre, exhibition, event or office space, the hub becomes a vital part of the urban fabric. (Schemel, et al., 2020, p. 3)”

Furthermore we also see the necessity to modularize all the possible functions of the hubs to support an efficient planning process and to allow for circularity in construction.

“A modular and standardised approach to the design of the mobility hub enables the development of highly location-specific solutions, based on fast implementation, flexibility and adaptability. (Schemel, et al., 2020, p. 10)”

This location specific design is in their methodology gained by site analyses made by experts – as they exemplify show in their Linköping case study. Although going through the concept phase with concrete sites, their method didn't include actually building at least one of the hubs nor evaluating its success with the citizens. We aim to include the citizens into the planning process via a digital platform and analogue co-creation workshops. Afterwards two hubs are build and their impact in the city quarter evaluated.

In 2022 the citizen mobility team of the Munich urban colab started a project aimed to build a Mobility Hub planned by experts using innovative digital tools and activating citizens by surveys. They choose a vivid Munich city quarter for their case study and started the planning process aiming to build one hub.

The digital planning tools were provided by startups and used different datasets to rate sites regarding their fitness for taking a mobility hub. While one startup used drop of points of free-floating micro mobility like e-scooters or bikes to map the best suited locations another startup focused on visibility using 3d data of the city.

The citizens were approached via a digital survey tool to fill in a rather classical mobility research. The questions reached from sociodemographic check boxes via reasons for using private cars to check boxes of the most needed mobility offers. Also, they used the survey to create a modal split of the target area. Although they found a fitting site and having enough data to formulate offers fitting to the local citizens, they didn't accomplish the actual construction of the hub due to tight restrictions and a lack of interest of the city. We are continuing in their sense and also expand on the idea of citizen involvement.

Participation and urban data

Many contemporary Digital City Twin and Urban Data projects address issues of traffic planning and logistics and discuss digital analysis to enhance the sustainability and efficiency of urban traffic flows (Marcucci, et al., 2020). However, they often focus on aspects like optimization, real-timeness and technological development.

Authors like Tomko and Winter suggest a more socio-technical perspective on urban analysis (Tomko & Winter, 2019), to combine classically quantitative and qualitative approaches, and thus get a better understanding of complex urban issues – like, in our case developing distributed and situated mobility infrastructure.

This approach does not merely imply a comparative analysis of classically infrastructure-related data and qualitative participatory feedback, but targets at a more collaborative understanding of analysis and digital tools. For instance, Nochta et al. complement the development of digital infrastructure with a creative participation process, embedding digital analysis in democratic decision

making and stakeholders' situated knowledge (Nochta, et al., 2021). Moreover, Solman et al. interpret „digital twinning“ – creating representations of complex socio-technical systems – as „boundary work“ between stakeholders – a political negotiation between heterogeneous actors, who negotiate a common understanding of the issues at stake (Solman, et al., 2022). This perspective highlights the importance of juxtaposing different formats of collaborating with urban data – open qualitative discussions, gathering of local knowledge, interpreting and contextualizing urban data. In the case of cocreating a traffic infrastructure – we have to juxtapose data on mobility with situated knowledge about (potential) traffic behaviours and several affected stakeholders.

Following Friedrich, however, we need to remain critical about how this co-creation is framed, through participatory formats as well as the disposition of digital infrastructure and interfaces and ask how relevant citizen involvement can be facilitated by different interdependent approaches (Friedrich, 2021). In this regard we can build on a register of digital participation, playful and collaborative approaches towards urban data – as have been undertaken at our institute in the Project Critical Modelling, addressing heterogeneous socio-technical urban issues, ranging from safety to traffic planning (Förster & Bratov, 2022).

Gamification and collaboration

In the context of the project, multi-layered secondary areas can be identified. Based on a hybrid participation process, the areas of human computer interaction (HCI), gamification and simulation-based design or design decision systems can be highlighted from an information technology perspective. In the context of gamification, several projects have investigated the potential of using

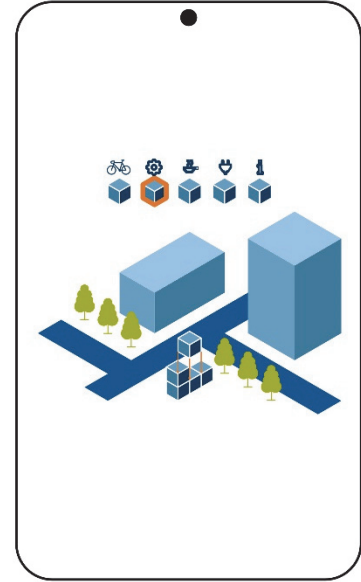
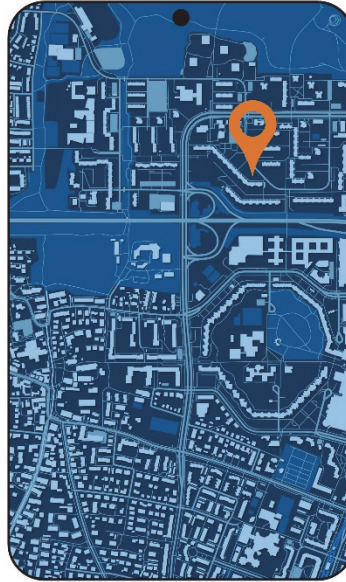
gamification methods in participatory tools (Lobna & Hamari, 2019). E.g.

Muehlhaus et al. suggested a connection between the avatar game element and the motivational affordances autonomy, in meaning of task, perceived competence, and perceived social relatedness, as well as suggested that the use of gamification changes the relationship between a user and the participation level they engage in (Muehlhaus, et al., 2022). In addition to the area of participation, a close relationship between gamification and learning success can be observed in the learning context (Barata, et al., 2013). This is particularly relevant since participatory processes are not only opinion polls, but also a learning effect on the part of the participants is desired. Another important topic is the human-computer interface. Our own preliminary work in this area has been investigated in many ways over the past 10 years (Schubert, 2021). A particular focus here is on coupling established design methods with digital content. This enables intuitive design with additional digital layers, so that objective factors can contribute to decision-making alongside subjective views.

CONCEPT

We use a digital platform to start a co-creation process leading to the construction of to Neighborhood hub prototypes. Within the digital platform, the Inhabitants will be able to locate their own Neighborhood hubs and add different modules (Figure 2) with functions to their liking. With a survey function they are then asked to explain their choices. This way qualitative data is collected to later help interpreting the quantitative data and deepen the possibility of collecting local specific information. The generated quantitative data contains on the one hand of a georeferenced database with the location

Figure 2
within the digital platform it will be possible for inhabitants to place their own hubs on a location they prefer and configurate the hubs with different functions.



of the hubs and each configuration of it. Out of that information heatmaps of the most popular locations can be created as well as maps of the demands regarding to the different functions which were chosen.

In addition there is a survey module which allows participants to earn ingame currency for doing different surveys regarding their mobility behaviour. They will be asked how they move through the quarter on workdays, how often they use public transport or shared mobility. This data is then used to provide the co-creation workshops also with a mobility-scientific perspective when deciding for locations and functions (figure1). But this data is also used later in the process to evaluate the acceptance of the hubs.

As mentioned in the methodology section there is also a need for a multiplayer function. For that we will give participants the ability to rate the creations

of their peers regarding their location and their functions mix. The best rated hubs will be publicly listed. The data of the best rated hubs then also can be used to support the workshops.

Another previously mentioned aspect of the digital platform is the in game currency. Of course there are more and less attractive modules according to their functions. So we will try the idea of giving different functions different value hence the anticipated effort to organize and build the prototypes with that individual function. They can earn this in game currency taking part in short mobility surveys (as explained above). We will test this feature before release with a small number of volunteers to gain knowledge about the best balancing between prices and the effort

the participants will have to invest for it. All the data the participants produce is than collected and used to create maps showing the



Figure 3
The hubs will feature different mobility functions as well as supporting and social functions for inhabitants and local initiatives.

popularity of different locations and the needs of different functions or services in their spatial distribution in the city quarter.

This maps will be used in the two workshops with officials from the local governments, the local public companies, creatives, local initiatives and sme's to together to find the best locations and the best mix of functions for each location. Also this workshops are used as a co-creation process to together develop fitting functions, shared usages with local initiatives and operator models. Where most of them placed a hub, which functions they included, how they justified their decisions and how they rated each other.

After that we will order the design and the construction of the hubs with a suited company and bring them to their locations (Figure 3). Once the hubs are brought into their final destination, our

digital platform has its second live. Allowing the participants to earn benefits like a free coffee or a bike-tire via taking part in a second round of surveys. Where they again will be asked how they move through the quarter on workdays, how often they use public transport or shared mobility. These data is than compared to the data from the first phase to determine whether the hubs cause for a change in mobility behavior of the participants or not.

SYSTEM CONCEPT OF THE DIGITAL PLATFORM

The development is in general split into two main layers: the frontend is the actual app that will run on user's end devices, and the backend, which is the infrastructure that handles our data, stores it and converts it for our analyses.

Because we want to reach as many people as possible in the city quarter and want to avoid filter effects on our data caused by the spread in specific groups of society linked to one or another OS, it is necessary that we develop the digital platform for the two main mobile operating systems, iOS and Android.

Because of that, we decided to use flutter for the frontend. It's a cross-platform UI toolkit that enables us to develop for both Android and iOS. One advantage of Flutter is that it is easy to switch to platform-dependent code, in case certain functions of the digital platform need to be implemented platform-dependent anyway. Flutter is very widely used and supported by big companies. Thus, with Flutter we get a functioning framework, that on top also has existing libraries for common use cases, such as including a geographical map or Unity, a widely used game engine.

Since Flutter is a UI toolkit and is specifically developed for 2D UI widgets, including and working with 3D models is not an easy task. Nevertheless, since we will need 3D functionality for the Hub editor and for our visualization, we will use the included Unity integration.

The communication with the backend needs to be set up for two main functions: First, we want to survey the users of the digital platform, to get their personal opinion on the topic at hand.

Second, we want to show users what other users have already created, and give them the option to interact with these, by rating them. To collect this information, we want to send it to

some remote machine, where the data gets aggregated and made accessible for later use.

Flutter already includes integration to Google Firebase, a Google Cloud offering that enables a fully managed backend infrastructure. So this by google provided infrastructure is being used. In this way we can shortcut many of the troubles connected to implementing an individual app to server connection. Because google offers also Servers located in Frankfurt the whole system can be made DsGVO-compatible. In general, we store only

information that we explicitly asked the user for. And we do not plan to ask for more than a nickname, age, and occupation because this data is relevant for mobility surveys. Also, we plan for temporarily collecting data needed for security purposes.

CONCLUSION

This finished concept for a hybrid Co-Creation process in mobility planning shows the feasibility of such an undertaking. It is an enormous effort to coordinate the three professions of participation planning, mobility planning and informatics into one coherent and working flow of information. Starting from the digital platform we will use the quantitative and qualitative data to make the most informed decisions in a co-creative process.

This Project will show, that using digital tools for participation can start and support urban planning processes in an efficient way. Including citizens, stakeholders, and officials in one process while giving all involved appropriate roles to participate and contribute. Combining this effort with the digital twin of the city allows for well-informed decisions of all participants and a smooth planning process regarding obstacles on the civil-engineering side of development. This project will not only show that all that is possible in one streamlined process, but it will also provide the public with the necessary information to decide whether co-creation building Mobility hubs is possible with appropriate effort and whether this process leads to an increased acceptance of the new infrastructure. The actual implementation of our digital platform starts now and all the other described steps will follow within the next two years. So the schedule is tight and we are eager for the first results.

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