

The City and Complexity – Life, Design and Commerce in the Built Environment

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INCITING ENGAGEMENT AND COLLABORATION THROUGH INTERACTION DESIGN: AN URBAN TRANSPORT SYSTEMS DIGITISATION CASE STUDY

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ABSTRACT

Over recent decades the importance of enabling diverse stakeholders to deliberate, provide input or co-create has resonated with built environment, governance and design discourses. However due to their complexity, matters concerning urban systems present significant challenges to communicative and collaborative engagement activities in practice. This article provides a case study of interaction design led communication, knowledge sharing and collaboration on sustainable and open urban transport systems. It presents novel interactive online and offline formats that aimed to incite comprehension, critique and ideation activities for broad audiences despite the complexity involved. Namely, it shares learnings from the creation and application of an online taxonomy as well as a printable card deck created in alignment with interaction design principles. The dual formats are found to be useful tools that could be utilized in education, policy making, consultation and innovation fields as part of solution finding processes for the increasingly complex digitization challenges facing cities and societies.

INTRODUCTION

Cities are becoming increasingly complex in theory and practice. Digitization of public and private space, governance and across industries, underpinned by dynamic local to global networks and actors, are deepening the complexity of cities as objects of inquiry and contexts for action. The science of cities (Batty 2012, 2018) presents evolving dynamics, actors, relations, flows and multi-dimensional scales whose scenarios are difficult to model and coupled with uncertainty. Conceptualizing cities requires consideration of changes underway in their various interdependent systems within systems, including transport, energy, food, land use and population, which are each in turn constantly in flux (Baynes 2009).

Indeed, the complexity of cities appears to be overtaking our ability to comprehend (Batty 2018). The long-established problem of not being able to precisely define what a city comprises has conflated

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with new technology infused dimensions. This heightens the importance of finding new ways of thinking and learning about cities to further develop our ‘spatial imaginations’ (Healy 2006, 2007). Novel tools and perspectives for city makers and inhabitants are needed for communication, learning and collaboration so that multi-stakeholder strategies and solutions can be formulated and implemented that align transformations underway with sustainability.

One approach to address the communicative and collaborative barriers provided by complexity is the employment of design. Specifically, interaction design principles applied in human computer interaction (HCI) praxis can be utilised to mediate urban systems complexity to enable stakeholder comprehension. This paper provides evidence that interaction design led communication and collaboration is a useful means for enabling understanding, interest and engagement. The case study activities concerned urban transport systems, however the overarching design principles applied could assist in inciting engagement in any topic riddled with complexity whereby broad public engagement, facilitation of learning, interdisciplinary dialogue, problem solving, or ideation are sought.

COLLABORATION IN CITY MAKING

Communicative and collaborative practice has a longstanding history in urban planning, public policy and architecture (Presscott 2000). With governance transitions, devolving government and diversifying service providers (Kearns and Paddison 2000), collaboration has become a staple of political rhetoric with a fluid meaning (O’Flynn 2008). The term is used to represent many different types of working together, including networking, coordination, cooperation and collective decision making (Himmelman 2002, Esteban 2020). Looking past semantics, ideally collaboration is voluntary, involves mutual engagement and goal setting, autonomy and trust (Sullivan & Skelcher 2002).

Considerable research attention has been paid to issues of collaboration. Healy (i.e. 1999, 2003) has extensively examined the implications of communicative acts and power structures in urban planning process. Mantho (2018) examines the issue of trust and the negation of self in collaboration in architecture. Margerum (2011) provides methods for public management that might bridge the gap between consensus building and implementation, whilst Huxham (2003) outlines problems and unrealized opportunities of collaboration within the themes of common aims, power, membership structures and leadership. Others highlight the difficulties in interdisciplinary and public collaboration due to heterogenous backgrounds of participants, and the multitude of perspectives involved making consensus difficult (Moirano et al 2020, Malhotra et al 2017).

Nevertheless, the interdisciplinary and complex nature of contemporary societal challenges requires yet greater collaboration and joint working. The wicked problems of cities such as housing affordability and uneven economic development, as well as climate change and the sustainability of urban systems require new linkages between previously siloed actors, institutions and enterprises (Crowley & Head 2017, Davidson & Gleeson 2017, Fab City 2019). Vertical collaboration for multi-level governance as well as horizontal collaboration across industries and sectors are integral for the accomplishment of global sustainable development goals (Vazquez-Brust et al 2020), particularly in terms of enabling innovation.

INTERACTION DESIGN FOR COMMUNICATION AND ENGAGEMENT

Whilst city making and governance have increasingly pursued stakeholder engagement and collaboration, ubiquitous computing has transformed dominant means of information dissemination and communication norms. With declining faith in institutional authorities, the world wide web has provided an almost paralysing number of sources and formats, making information overload a modern-day problem (Dhavan et al 2017). This abundance has created a struggle to attract and retain attention (Franck 2018).

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The speed and volume of digitally mediated content and interactions have added new dimensions to notions of participation and collaboration. Whereas referring to in-person engagement would assume a two-way conversation or marked exchange between parties, engagement in digital terms refers to milliseconds of a person's attention, a fleeting moment of recognition. Decades of 'digitality' are creating a new type of cognitive space (Negroponte 1995) and this environment calls for new types of thinking and learning (McKenzie 2019). Juxtaposed with the complexity of cities, these are challenging trends for urban practitioners and others seeking wide communication, engagement and collaboration in city making activities.

In light of these transformations, the utilisation of interaction design within human-computer interaction (HCI) best practice is one-way communication and collaboration could be oriented in the pursuit of optimal engagement. The goal of interaction design is to create a positive user experience, commonly with interfaces for software and websites, but principles of interaction design are also applied with non-digital products. Interaction design is increasingly used to incite emotion with physical products (and the will to purchase) or to actively engage audiences in gaming, social media or online shopping (Chong 2018, Salmond & Ambrose 2015).

To apply interaction design principles to collaborative or communicative practice, participants are considered the users, and the collaboration action or communication output replaces the digital media or physical artefact for interaction design intervention. Best practice principles of interaction design set out by Heim (2008) are identified hereafter. The principles are explained in terms of how they relate or could be applied to collaboration and communication activities in urban practice to unravel complexity and enhance engagement of participants.

Usefulness

- Utility

Utility refers to what can be achieved and how easily in context. With communicative and collaborative practice, the utility of the activity could be to inform, to educate, to ascertain feedback, to conceptualize ideas or questions, or to design solutions.

- Safety

Psychological safety is pivotal for optimising engagement. When individuals feel they will not be embarrassed or reprimanded for their participation they will be more open to new ideas, willing to contribute and take risks. Psychological safety has been found to be the most important aspect of well-functioning and innovative teams (Rozovsky 2015, Edmondson 2018).

- Flexibility

Flexibility refers to the range of situations the activity or output can be used and the range of needs that can be met with it. Flexibility includes customisation according to the participant's or user's needs or preferences.

- Stability

Stability refers to the reliability of the activity or offer, that it will consistently be functional or available and that it will provide a reliable basis that utility can be achieved.

Usability

- Simplicity

Simplicity is paramount to usability not only in terms of design aesthetics but also regarding content to enable comprehension and sensemaking. The multidisciplinary nature of urban challenges requires

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accessibility for non-experts to be included in the overall concept through consideration of cognitive load.

- **Memorability**

Memorability makes things easier to use and learn. It includes location of design elements and information grouping. It enables communication or collaboration activities to be easily comprehensible and allows the application of previous knowledge.

- **Predictability**

Predictability, such as through consistency in colours, headings and text location or as practiced through certain actions or gestures in-person, creates a sense of security for participants. Conventions and familiar design elements prompt comprehension and intuition.

- **Visibility**

As much information as possible should be provided, but no more than necessary. Visibility can be driven by the principle of simplicity to determine what should be visible and when. Feedback mechanisms when an interaction should occur as part of this process e.g. with a click more information appears, in-person dialogue and information sharing according to participant questions or interests.

The following case study demonstrates the utilization of these principles in communication and collaboration artefacts.

EXPLORING URBAN TRANSPORT SYSTEMS FUTURES: A COMMUNICATION AND COLLABORATION INTERACTION DESIGN CASE STUDY

How might engagement be achieved with a broad range of stakeholder groups utilising design research methods to explore topics at the intersection of open source and sustainable urban mobility? This was the underlying question that prompted the research which led to the design and development of a web-based taxonomy, a card deck and an accompanying workshop format presented in this case study. They were the culmination of exploratory research which identified that the lack of clarity and comprehension of what a sustainable and open mobility ecosystem comprises is a key barrier to the creation of, or even initial dialogue about, sustainable transport systems that included attention to foundations needed for sustainable digitisation. The complexity of transport as an urban system was overwhelming and its elements unclear, particularly when coupling transport with concepts of openness, innovation and emergent technologies.

The research question was conceptualised within the context of an experimental transdisciplinary think tank, tasked with generating knowledge, debate and collaboration about urban transport futures. The target audience of the research was the general public as well as those working in transport, policy, startups and product design. The exploratory research phase (April – June 2019) included desktop research as well as informal semi-structured interviews with experts and individuals representing the aspired audience. The taxonomy, cards and associated materials were thereafter created and implemented between July 2019 and March 2020. The materials developed are now in the public sphere as creative commons resources.¹

Envisioning complexity

The Sustainable Open Mobility Taxonomy is an interactive online system visualization to help people navigate potentials and explore best practice of urban transport transformations aligned with digitization and multi-stakeholder innovation (Figure 1)². The taxonomy includes 18 components at the third level with additional 200-300 words of explanatory text including references for best practice

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examples that can be accessed through user interaction (clicking the text or + sign). The taxonomy headings represent topics that are core elements of urban transport systems, others are simply desirable, depending on the political, social and economic conditions, progress of the subject context and perspective of the user.

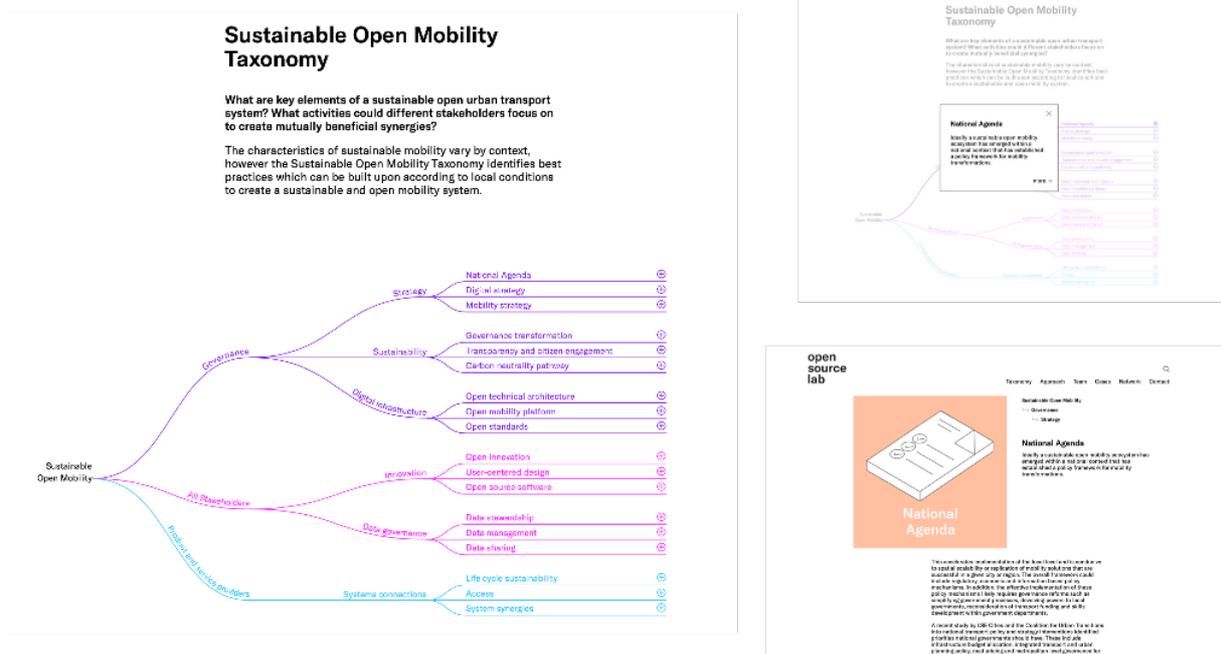


Figure 1. Three levels of interaction with the online taxonomy.

Satisficing, that is balancing between satisfying and sufficing, was a key component to striving for an engaging format. The taxonomy branches do not encompass all of the possible elements of an urban transport system, but a strategic basis to engage with the concept of transport systems within cities and array of themes that can affect them. In light of communication trends and Pareto's 80/20 principle (80% of effects come from 20% of causes), the taxonomy was designed in a way that the user doesn't need to read every element or the underlying research to get an understanding of the complexity, challenges and opportunities involved in the topics at hand for learning, critiquing or building upon. It sought to connect visual literacy and a low-threshold entry point for a highly complex and oftentimes technical subject matter, which is normally limited by silos, for instance in scientific or academic publications. As articulated by Hebing et al (2017), the taxonomy format aspired to counter the linear narrative of scientific papers.

Progressive disclosure is also utilised i.e. the user is only shown what is necessary at any given moment during their interaction (Heim 2007) to counter overwhelm that might arise if all the explanatory text for system components were provided on one page. As demonstrated by the 'more info' button, pop up boxes with summary text and links to additional resources on the explanation pages (Figure 1). The taxonomy can be navigated in a non-linear manner, allowing a personalised journey through the research outputs according to interest or curiosity. For predictability and memorability distinct colours are applied according to meta topic groupings and universal icons designed into the graphics for each topic.

The taxonomy was published online in January 2020 and in the following 6 months it had 604 visits. According to the page views undertaken on each level three topic explanation page, a score was calculated based on the highest possible views to a page as the baseline. The percentage for each page

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according to the baseline was calculated then multiplied to create a basic whole number, rounded to one decimal place. Thus, ‘National Agenda’ was the baseline and the highest ‘Inquiry score’ (10) as it had the most interactive engagement (Figure 2).

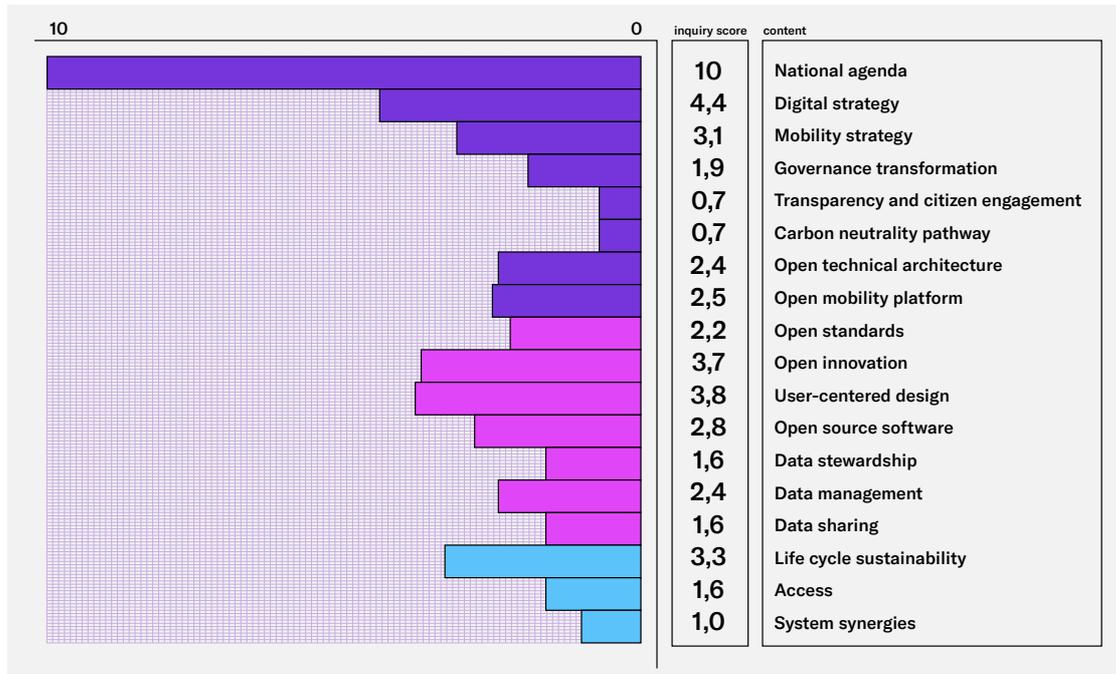


Figure 2. Frequency of interactive engagement by individual users for the online taxonomy topics that provided explanatory text (third level headings) (Graphic design by Olya Bazilevich)

The taxonomy engagement results highlight the importance of the lead content and the non-linear engagement patterns with the research. Whilst most people visiting the site visited the National Agenda entry, this is likely due to its position as the first topic listed that can be chosen for further information. However, it can't be discounted that the high score was also attributed to the level of interest in national policies also being higher across all visitors. Ideally this would be tested by placing the topic groupings in a different order and comparing the results with the alternative (A/B testing), which was outside the scope of this research.

The topics ‘transparency and citizen engagement’ and ‘carbon neutrality pathway’ received the lowest engagement scores from all the topics. The Open Source Lab network is mainly comprised of professionals already working in transport or related spheres, as well as Masters students studying urban mobility from the Berlin Technical University campus neighbouring the Lab's working location. The low engagement level is thus assumed to reflect the nature of existing knowledge within this network. These being longstanding mainstream topics in urban planning and transport discourses, failing to incite interest compared to novel and emergent topics also included in the taxonomy such as ‘open innovation’ and ‘digital strategy’.

Re-shaping complexity

The Sustainable Mobility Kit is a set of 21 printed cards at the scale of an oversized traditional playing cards deck.³ They were developed to enable further engagement in the research results that developed the Sustainable Open Mobility Taxonomy and to provide a tool for others to utilise for purposes including transport planning collaboration, policy making, education, training, design workshops and

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innovation sprints. The cards replicate the online taxonomy headings with condensed explanatory text set out in point form. Each of the 18 topic cards contain question prompts that interrogate key challenges or opportunities for further consideration of the topic. In addition, 3 stakeholder cards represent different actor spheres.



Figure 3. The Sustainable Mobility Kit printed card deck (Photo by Olya Bazilevich)

Whilst the nature of engagement for the online taxonomy is digitally mediated between individuals and electronic devices, the Sustainable Mobility Kit creates a tool for in-person group interactions to discuss, debate and ideate solutions to mobility and urban digitisation challenges. It was developed in line with rationale that underscores the importance of social interaction and collaboration for learning (Auer et al 2018), reflective reasoning (O'Madagain et al 2019), innovation and problem solving (Yström 2018). The cards were tested in two workshops with programmes including brainstorming (culminating with an idea lottery), card sorting rounds, 'how might we' ideating and systems mapping. The workshops hosted 20-25 people and activities therein were undertaken in small groups of 3-5 people.

The workshops highlighted the usefulness of the cards as a training and sensemaking tool. Particularly for individuals and teams in larger organisations that work as part of the transport sector but in siloes, the cards provided a balance of introductory knowledge, systems thinking insights including feedback loops and identification of potential relationships between different elements and actors. In this way they can be used to support a 'middle out' approach (Frederiks et al 2016) for built environment practitioners such as engineers, planners, architects, service delivery specialists etc to effectively mediate between top-down and bottom-up stakeholders despite the complexity involved. Sensemaking is a pivotal basis for innovation and problem solving, and on its own can create new knowledge and value within an organisation (Gioia & Thomas 1996). More broadly, the cards are could be a means of

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sensemaking for activities with the general public, supporting concepts for participatory citizenship (Shah 2017).

The card's tactility and visual design made a significant positive impact on the nature and extent of workshop engagement. When distributing the cards for the first time, participants received the cards with awe and delight, and were eager to explore each card as one does with scrolling through photos or browsing a magazine. When given more time, workshop participants did not tire of reviewing the cards repeatedly, taking in more information or noticing different cards, navigating with the graphic designs. Upon being shown the Sustainable Open Mobility Taxonomy interactive webpage in addition to the cards, workshop participants preferred the cards, but found the taxonomy to be very helpful to review independently during workshop breaks for a strategic systemic overview of the issues being discussed.



Figure 4. (Top left) Reflecting on the complexity of urban systems with the Sustainable Mobility Kit card deck. (Top right) Card sorting results during a workshop. This group chose the perspective of Berlin's public transport agency and identified topics it should prioritise. (Bottom right) DIY cards created as a result of user feedback. (Bottom left) The cards also formed the basis for generating alternate scenarios for urban transport challenges. (Photos by Olya Bazilevich)

Feedback from workshop participants also highlighted that some scope to appropriate the cards according to the user's perspective would be ideal. During the workshops many participants improvised their own cards from materials at hand. Inventing ways to make the cards applicable to differing contexts and actors, deepening possibilities for their own engagement in the collaborative activities through a DIY ethos (Rheingold 2008). To encourage this kind of spontaneous and individualised adaptation of the card deck in future use cases, additional cards were designed and are now included in every deck so that topics or stakeholders can be created by participants intuitively.

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CONCLUSIONS

Complexity, diversity and uncertainty are innate to contemporary urbanity. Those tasked with the design and governance of cities and their system components would be well served to have an increasing array of methods and tools for effective communication, engagement and collaboration with each other, as well as those affected by city making and shaping endeavours. In particular, tools for learning in multi-stakeholder and interdisciplinary settings as well as ways to learn from the progress and experiences of other cities.

In this sense, the Sustainable Open Mobility Taxonomy and the Sustainable Mobility Kit offer two approaches that can be utilized as part of broader programmes seeking to not only understand and address challenges, but also to create opportunities in digitization underway for cities and societies. As open source resources, they can be used, appropriated and further developed by anyone for any purpose. Their current design caters to uses including education, policy making, consultation, design and innovation. They can support capacity building, solution finding processes, sensemaking and consensus building on topics dealing with the intersection of urban transport, digitization, open source concepts, sustainability and human-centered design. Most notably, the Sustainable Mobility Kit cards with their do-it-yourself element, offer a promising tool for fostering collective intelligence and supporting active citizenship.

Interaction design principles provided an effectual framework in striving for engagement in the case study formats. Consideration of utility, safety, flexibility and stability, adopting simplicity, memorability, predictability and discreet visibility framed the information and graphic design. Application of the Sustainable Open Mobility interactive taxonomy and the Sustainable Mobility Kit card deck demonstrated that interaction design can be a valuable approach for understanding and enhancing the quality and depth of engagement and collaboration in complex topics of urbanism.

The formats presented are intended as a starting point for engagement and collaborative working with urban transport systems themes. They are a conceptual entry point for forming an understanding of the diverse scope of stakeholders and factors involved or that should be taken into consideration. Naturally, they do not represent the scope of expertise and technical insights that are needed for detailed and localized comprehension of the subject topics. They do not seek to reduce or avoid the complexity of urban systems, but rather to initiate engagement with a broader audience and on wider programmes to embrace complexity.

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¹ Code for the taxonomy Wordpress plug-in can be found at <https://github.com/open-source-lab-DFKI>

² View the taxonomy at: <https://opensourcelab.dfki.de/taxonomy/>

³ The cards are downloadable at <https://opensourcelab.dfki.de/new-resource-sustainable-mobility-kit/>

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