

Increasing gender sensitivity with codesign

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Abstract: The Horizon Europe 2020 TinnGO (Transport Innovation Gender Observatory) project¹ aimed to facilitate and empower the inclusion of underrepresented and diverse groups in smart mobility. Women are still considered to be an underrepresented group across the transport sector, forming less than 30% of all employees in the sector. Significantly women's travel needs are not met by current transport provision, despite widespread evidence that they make different types of journeys and have different mobility concerns. It may be hypothesised that even less is known about other minority groups (such as those from the BAME (Black, Asian, Minority and Ethnic community and those with disabilities). The design of future transport services and products is further skewed by the predominance of male undergraduate transport designers and engineers. While there are many noteworthy attempts to attract young women into STEM (Science, Technology, Engineering and Mathematics) careers and provide support for them in the male dominated sector, the work conducted by TinnGO's Coventry team focussed on developing gender and diversity sensitive smart mobility solutions to highlight everyday mobility issues for women. These have been termed 'Design provocations,' 50 such designs were produced over 18 months in conjunction with 4 undergraduate design interns and are available for comment on our Open Innovation Platform². From this experience, the team have produced a series of design tools to facilitate undergraduate student's empathy and awareness when designing gender and diversity sensitive smart mobility products.

Keywords: empathy, undergraduate designers, journey mapping, hexagon spindle model of ergonomics, sustainability, concept design, smart mobility.

1. Introduction to H2020 TinnGO project

The H2020 Pan European TinnGO project¹ ran between 2019 and 2021, with the objective of increasing gender and diversity in the transport sector, especially in relation to smart mobility. With 20 partners working to support 10 national hubs, the TinnGO project has highlighted intersectional differences in the mobility patterns and experiences of transport users, employment and educational experiences. This has been achieved through, for example, mobility surveys, Gender and Diversity Action Plans to guide the development of more diverse workforces through gender mainstreaming, policy notes, guidelines, and recommendations to reduced barriers of entry into STEM (downloadable from our websites). The 10 national hubs (Baltic, French, German, Greek, Italian, Scandinavian, Portuguese, Romanian, Spanish and UK) were tasked with engaging transport stakeholders to effect changes within the transport sector, and to engage women and 'transport disadvantaged groups' in conversations about smart mobility and transport needs.

¹ <https://www.tinngo.eu/>

² <https://oip.transportgenderobservatory.eu/home>

There is a sizable communication gap between transport providers, operators and the users of transport services (Tovey et al, 2016). The emphasis on moving people into and out of the city and servicing the ubiquitous car as a private mode of transport has fractured our cities, created pollution congestion and unattractive urban landscapes (Banister, 2015). It has also meant that some groups and communities live in transport poverty (Lucas, 2012). Current transport provision may not be affordable or accessible, reducing life opportunities. The recent emphasis on intersectionality (Crenshaw, 1989) has shown that many suffer multiple forms of transport poverty, which can lead to economic and social isolation (Uteng et al, 2020).

The transport sector is alert to this problem. However, consultation processes and surveys may not be as extensive or empowering as expected (Woodcock, 2018). On the one hand they may simply fail to capture the detailed insights into people's lives needed to provide high-quality service offerings and vehicles which meet the needs of a diverse population, and on the other, there may be a lack of wherewithal on how to use the information provided.

Pirra et al (2021) demonstrate that the needs of women are not met by current transport provision. Women may be subjected to greater forms of transport poverty because of their gender. This is notable, for example, in the different types of journeys women take) as they face dual burdens as workers, mothers, housekeeper and carer) in the modes of transport available to them, and their preferred most of transport (women use more sustainable modes of transport out of choice and necessity), their greater awareness of safety and security issues which leads to them having to use more expensive forms of transport to be safe (Faiz et al, 2020).

The focus of this paper is on design as the starting place for the creation of better services and vehicles – to enable smart mobility for all. User centred design approaches stress that design should proceed from an understanding of the needs and requirements of service users and a willingness and ability to act on this. Over 18 months we have worked with TInnGO interns to help them better understand and empathise with female transport users. The tools outlined in later sections are the ones we have developed to help bridge current gaps in understanding of the needs of female transport users, in particular.

2. The design process

Creating a paradigm shift in transport requires building up the capacity of future transport designers and engineers to enable them to create more gender and diversity sensitive smart mobility products. To understand the barriers to this, design and engineering students worked on concept designs (or provocations) using internally generated ideas submitted from the 10 TInnGO hubs relating to current, context specific, mobility related challenges (Magee et al, 2021). Student involvement was voluntary. With all design activities conducted during lockdown, we were not able to conduct the planned Europe wide codesign activities with vulnerable transport users. Members of the largely female, UK, TInnGO team served as proxies or expert witnesses, recounting own experiences.

At the outset of the design phase, we did not prescribe which student should work on which brief or how they should address it³. Tutorials and group discussions directed their activity with critical reviews on a weekly basis, for 2 -3 hours, with 4-6 partners. In these, we discussed ideas and teased out what these meant in relation to the ambitions of TInnGO. To achieve our target number of design provocations, design sprints took 2-3 weeks from briefing to a suitable item that could be posted on the Open Innovation Platform - maintaining momentum. Our designers tackled a number of novel smart mobility issues related to women's everyday mobility problems found in multimodal end-to-end journeys (from planning to arrival at destination) such as breastfeeding, carrying shopping, safety and security at bus stops, exercise, traveling with dependents, community-minded bus stops, planning and complaining about services.

³ Examples of design briefs and provocations can be found here <https://oip.transportgenderobservatory.eu/home>

In our earlier paper (Magee et al, 2020) we have discussed the affordances of the Open Innovation Platform as a vehicle to dissemination of ideas, and the use of Design Provocations as a conversation stimulator, not requiring a fully developed design – but as the visual embodiment of an idea that can lead to in depth communication. Importantly, creating the design provocations, requires the designers to present and defend an idea. The ensuing discussion leads to reframing the problem, exposes gaps in knowledge, lack of empathy etc and requires designers to think of ways to reinforce claims or resolve issues. What is different in this approach is the use of design and design thinking ‘upfront’ to generate and understand mobility requirements

Working with the students, all of whom were young and two of whom were female, it was clear that not being co-located was a key issue in co-design. When working in isolation, our student designers were not able to work alongside users, gain insight or develop empathy for the end users. Also, wider stakeholders (such as hub members we were designing for, the project team and transport operators etc) could not easily contribute to or learn from discussions. As such we could not investigate how women’s storytelling, as a citizen science method (Richter et al, 2019) could be used to increase empathy and understanding across the project.

3. Critical analysis of the extent to which students were able empathise with female transport users

As our young interns were designing smart mobility products for people unlike themselves, key skills were their ability to understand another’s experience, empathise and translate that into a useful and usable product conveyed in a visual manner to inspire comment and reflection. Based on our experiences with the students we have evolved a series of methods which can be used to increase empathy and understanding of intersectional factors when designing smart mobility products and services. The purpose of engaging with citizens is to learn from their experience; to ‘walk in their shoes’; to empathise with them and their situation. If, as enquirers, we fail to probe deeply enough due to communication limitations, then our understanding is shallow, designs do not meet user needs and opportunities are lost. From a mobility perspective this means that smart mobility innovations (both products and services) may ‘exclude’ certain groups – as a consequence the paradigm shift of the next generation of transport stumbles.

The phrase ‘gender and diversity sensitive smart mobility’ is difficult for those new to the area, and indeed the terms are evolving as the industry and technology matures. For example, ‘smart’ may be technology enabled, refer to vision zero, or may be entirely flipped to mean a system which reduces the need for travel and societal inequalities. The relationship between ‘smart’ and ‘sustainable’ is also poorly defined. Designing into this space requires an appreciation of its wickedness (Rittel and Webber, 1973) requiring multi-agency and multidisciplinary actions. Even seemingly stand alone, gender and diversity sensitive smart mobility innovations, such as child bicycle seats are complex - they need to be informed by experiences and lifestyles unfamiliar to many young designers, but their usage takes part in a wider context (e.g., bicycling culture and infrastructure. Many of the designs, when discussed in detail, were service or systems oriented, relying on or requiring integration with other agents/devices/systems before they could be implemented. Which leads us to question whether asking transport designers to design for an existing flawed system, is not only skewed but also reinforcing the problem.

For the designers, the contexts and users were unfamiliar; an experience which is not unusual. Open discussion about ideas and sketches is also familiar; design teams regularly present ideas or to simply leave on show for the wider team to absorb, adapt and learn from. Because we were working remotely, it was more effective to encourage a low-level digital presentation (and indeed a good learning experience for the interns) where we would hear their narrative and provide feedback or questions. Challenges to ideas were based on the lived experience of TInnGO team members who adopted the role of expert informants. In this sense the UK hub team provided knowledge, through which we could validate or challenge a proposed idea. Being reflective; we are all experts in our own experience – yet our own knowledge is not definitive. Had we been able to travel and meet face-to-face then the pool of knowledge may have been greater but given the circumstance, we used the knowledge that was available.

Viewed through the COVID impacted lens of TInnGO, did the interns find ways to address the experience of female transport users? The UK hub and several of our partners shared experience, that informed insight-led ideas that would not have been communicated so easily without the design provocations. Through this mechanism students were able to develop and communicate more empathic insights into the mobility needs of women and diverse transport users.

Intersectional issues exist at the heart of gender transport poverty. It is therefore worthwhile to use design research methods such as co and participatory design, at the start of any transport innovation to ensure that the design team and wider stakeholders have a sound understanding of the users and usage context and wider barriers which may affect uptake of their schemes; and indeed, that the communication of such is uninhibited.

4. Overview of TInnGO methods to support the development of gender and diversity sensitive smart mobility

From the preceding discussion we have recognised that undergraduate designers and engineers working in this area need additional guidance in understanding basic underlying concepts of intersectionality; key factors which should shape their design thinking and understand how their designs will be evaluated in this sector in terms of Effectiveness, Affordability, Accessibility, Sustainability and Inclusivity (the EAASI criteria which strike at the heart of inclusive and sustainable design, above and beyond basic ergonomics); methods to help them understand and breakdown barriers to mobility and ways in which they can use empathy in understanding the user journey – the needs and requirements of different travellers from a service perspective. The following sections provide a brief overview of the TInnGO design tools, using examples of women's every day journey experiences. The tools have been generated out of a need for a more sophisticated understanding of the context in which designs might be used in the real world, and how

4.1 Supporting understanding of intersectionality

Intersectionality can be a difficult concept to understand and explain to others. In terms of transport, peoples' mobility patterns depend upon many factors, where they live, what they earn, their caring responsibilities, as well as characteristics such as race, gender, sexuality, and age (Levin et al, 2020). Using intersectional analysis can show how these factors can overlap and influence access to transport mobility. Unequal access to transport, for whatever reason is a major contributory factor in social and economic exclusion. The role of designers here is to make sure that they are not creating products and vehicles which exclude certain groups by failing to understand different needs and requirements, e.g., not designing spaces/ramps for wheelchair users and prams, overreliance on technology when latest devised may be incomprehensible, unaffordable or unusable by large numbers of the population. The digital divide is a good example of the need to take apply intersectional thinking to transport and smart city initiatives (van Rynevald, 2021). Students are digital natives, their friends are all digital natives, as such they believe technology will solve all problems and struggle to understand or have empathy towards laggards (Woodcock, 2014).

To assist with this, the team developed a model, based on a wheel of 3 concentric discs, the TInnGO Intersectionality Mobility Indicators (TIMI) (Figure 1 and downloadable from TInnGO web site). This can be used to enable transport policy makers and practitioners to visualise the overlapping (intersectional) nature of individual characteristics and structural aspects of transport poverty, and how they relate to smart mobility and mobility patterns. The origins of the tool came from the principle that transport is the glue that holds many facets of everyday life together. Where you live, work, go to school, shop or socialise is influenced by transport. We have symbolised this as the strands of a fibre optic cable all wound together.

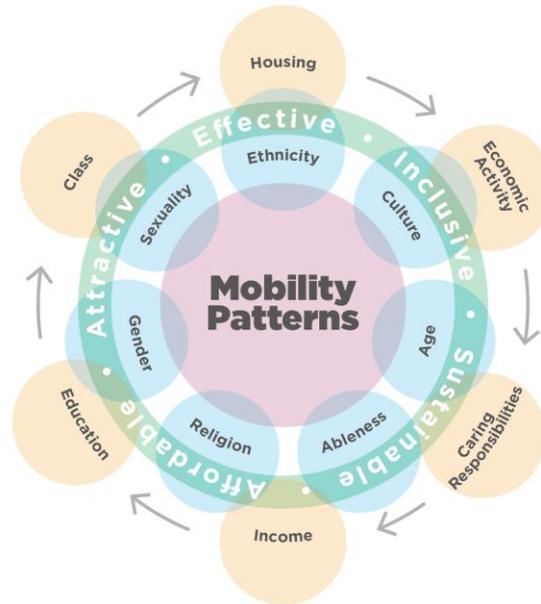


Figure 1. TlnnGO Intersectional Mobility Indicators (TIMI) (Bridgman et al, 2021)

The TIMI model draws attention to the overlapping nature of smart mobility. The outer, orange ring contains structural and political factors of transport poverty and social exclusion such as housing and economic activity and the blue circles highlight intersectional characteristics on a more individual level which are traditionally associated with excluded groups (such as gender, ability, ethnicity). Every person has a profile formed by these and other characteristics. These in turn interact with the structural factors. A person is not defined just by their gender, but other factors as well. Some of these will create multiple levels of deprivation and exclusion.

Lastly the cyan circle represents the 5 gender smart dimensions (effective, attractive affordable, sustainable and inclusive) which need to be considered in the design of gender and diversity sensitive smart mobility products (Breengard et al, 2021). These form the basis of the EAASI tool discussed below. This downloadable tool is designed to prompt discussion but equally could also be used to measure impact. It highlights how all systems need to be read together to foster equity-based policy solutions and the wider context in which smart mobility is placed.

4.1 Operationalising the TlnnGO TIMIs to guide the design and evaluation of gender and diversity sensitive smart mobility products

Whilst Figure 1 can be used to stimulate thinking on intersectionality and how intersectional factors may influence, or be influenced by transport provision, the TlnnGO team have applied the Effective, Attractive, Affordable, Sustainable, and Inclusive criteria into an 'EAASI' checklist tool to guide the development and the evaluation of smart mobility concepts/products. The tool is to make gender- and diversity-smart thinking an *explicit* and prominent part of the development of 'smart mobility' solutions. This differentiates it from more generic 'usability' methods and assessment tools. The tool was developed as a way of helping the design students understand and apply social and environment factors (such as United nations Development Goals) from receipt of the design brief – rather than trying to justify their choices when presenting the final design.

The tool is in 3 parts:

Part A : product description in words and images, with links to course documents, with prompts concerning the product goal, design purpose and USP, how the brief was generate, who it was designed for, task context and user needs.

Part B: set of prompts for considering each of the 5 criteria in relation to specific travellers or characteristics.

Part C: Qualitative overall evaluation and summary of each section,

In a design context, the tool can be used to develop a brief or develop empathy for diverse user groups; and can also be used to evaluate a product for procurement to check how ‘diversity or gender smart’ it is; or by independent evaluators perhaps comparing marketplace products for review. Using the tool can help designers to:

- Evaluate a product or design for each criterion according to explicit design goals
- Evaluate a product or design against EAASI goals, Effective, Attractive, Affordable, Sustainable, and Inclusive.
- Take account of intersectional diversity and inclusivity: consider diverse group needs and identify who may be excluded from using the product and why
- Compare evaluations through a 5-point rating system

Part C: Overall Assessment				
This is intended to summarize how the product fits with its own defined goals and how far it meets ‘Gender and diversity smart’ criteria. The Evaluator should complete a rating based on the ratings per each indicator already completed.				
Does the design meet its own goals?	Percent	Smiley	Notes	
e.g. The e-scooter meets the design brief needs of appealing to young people and active, reasonably fit commuters who may choose to integrate use of an e-scooter into their daily commute from a train or bus hub.	80%			
e.g. the e-scooter could be an alternative to bringing a car into the city	70%			
Does the design meet the Gender & Diversity Smart goals - EAASI?				
1 - Effective Is the product effective?	43%		Effective for those who can use it – speedy and anywhere within city	
2 - Attractive Is the product attractive to a wide range of users?	34%		Attractive to certain groups of users, mainly younger persons, possibly more males, but not others	
3 - Affordable Is the product affordable to a wide range of users?	52%		This is a Shared transport solution so affordable depending on charges for users and <u>break even</u> point for providers	
4 - Sustainable Is the product sustainable / does it encourage sustainable behaviour?	55%		Good sustainability, as alternative to car travel, easy maintenance, OK so long as they are not stolen	
5 - Inclusive Is the product inclusive from the point of view of gender and diversity? From the point of view of Accessibility?	6%		Not very inclusive , does not support chained trips, useful only for those with fitness and confidence, appropriate clothing, minimal luggage, reported to have negative effects and even dangerous to some disabled and elder pedestrians. Not inclusive for people with disabilities.	
Key				
Excellent (70 to100%)	Good (60-69%)	Satisfactory (50-59%)	Poor (40-49%)	Fails this indicator (0-39%)

Figure 2: EAASI Checklist summary page

The EAASI checklist has been iteratively developed by the project team and applied to the evaluation of number of designs on the Open Innovation Platform. Worked examples relating to the nurturepod and ‘fido’ shopping companion and blank templates are available from the TInnGO web site.

4.3 A systematic approach to understanding and plotting barriers to women’s mobility

Woodcock has applied the hexagonal spindle of ergonomics to transport design (e.g., Tovey et al, 2015; Woodcock et al, 2021). Taking a user centred approach, a user is placed in the centre of a hexagon (See Figure 3 which uses a breastfeeding mum as an example) and the multiple levels of factors which may inhibit their mobility are systematically broken down and divided between organisational (infrastructure and management), personal (social and individual) and contextual (task and design) issues. These barriers can occur at an interface/workstation level) e.g., the design of a touch screen or seat), through to organisational (lack of workforce diversity, poor customer sales support) and macro/ external level factors, such as corruption, lack of gender equity.

Data to populate model may come from a variety of sources such as surveys, literature review, ethnography, interviews. As a pragmatic tool, categories within the H-S model can be used to thematically group barriers to mobility into categories from which solutions can be developed, targeted against the right sector and

stakeholder. The data in Figure 3 was derived from an analysis of discussion forum threads and interviews with migrant women (Gut et al, 2021). This has led directly to 2 design provocations for breastfeeding space on TlnnGO's OIP and created lively discussions about societal attitudes towards mothers with small children. Of key interest for designers here is the wider view provided by the H-S model. The design sector forms only 1/6th of the model, and a lot of the barriers to women's mobility are not related to vehicle design but wider transport infrastructure, service provision and attitudes of staff and passengers. Here design thinking and representations can contribute to the bigger picture.

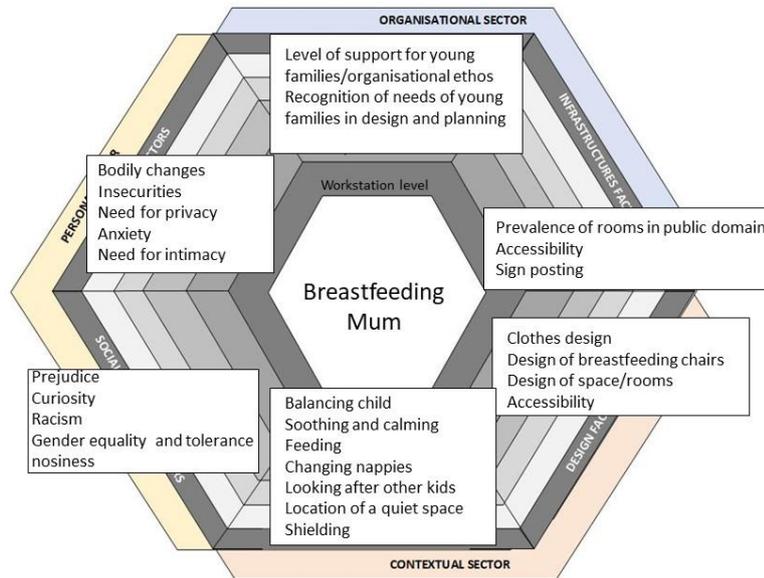


Figure 3: Hexagon spindle model showing some of the barriers to mobility for breastfeeding mum

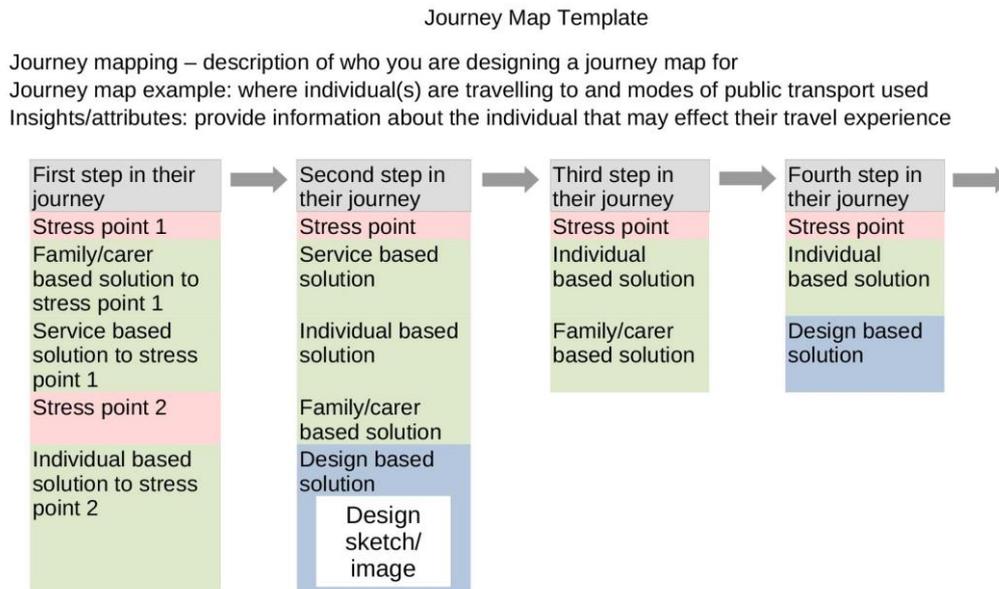
4.4 Understanding the journey experience

The journey map template (Figure 4) has been created to help designers empathise with different users, to increase their understanding of what barriers individuals from disadvantaged or vulnerable groups (such as individuals with existing medical conditions, limited mobility, women travelling alone) may face on a day-to-day basis when using public transport. This template is a tool to help designers to break down a user's journey into individual steps and analyse what stress points may occur for the user at these different steps, and what the solutions may be to the stress points, and who can offer these solutions. The solutions may be service based (educating staff, increasing the frequency of public transportation offered), design based (smartphone apps to improve user experience of public transport, design of products or improve existing designs at interaction points, vehicle design), family / carer based (help individual to plan journey, find maps, book tickets in advance), and individual based (travel at quiet times of the day, take relaxing music with them to listen to if feeling stressed on the journey).

Designers can add images to the journey map, such as their own design concepts, or images of existing transport that illustrate the stress points. This journey map template tool can be used to create journey maps of singular or multiple modes of transportation, being in a spreadsheet format, the tool invites designers to empathise with the user, keep adding steps to the journey and exploring a variety of solutions to the stress points that occur, facilitating an in-depth analysis of a user's experience of public transport and how it can be improved in the future. What we are trying to do with this tool is bridge the gap between hierarchical task analyses and experiential design.

Journey map examples we have explored within TInnGO, from a gender and diversity sensitive smart mobility perspective have included individuals with neurodiverse conditions travelling to an event, and what their journey may look like accompanied or unaccompanied by family / carers, or another example may be an elderly couple, one that uses an electric wheel chair, and one that walks, and what their experience of public transport may be when travelling to the shops (journey map template and examples can be found on the TInnGO transport gender observatory website, under TInnGO tools: <https://transportgenderobservatory.eu/journey-map/>).

Figure 4: Journey map template



4.5 Conclusions

Given the constraints of working in 2020/21, the modest experience of our interns and our inability to engage in codesign activities with women and those from vulnerable groups, we have explored the way in which design activities can be used to share conversations about mobility problems. In bonding with designees through relating our stories we have tried to develop their empathy and wider appreciation of the complexities of designing smart mobility which is gender and diversity sensitive. Exit interviews with them revealed that they had been stretched by working with us, developed new skills and a wider understanding of transport design, which made them less willing to design just another concept vehicle.

From an ergonomics perspective designing for the weakest, most vulnerable groups is known to increase the usability and satisfaction of products for the wider population. Women are not weak, current transport design forces them into positions where they are vulnerable and comprised. This is true for other excluded groups.

Out of this work and our experience as design educators we have produced a set of easy-to-use tools for design students to encourage them to think more widely, to see transport as more than just another vehicle, and to grapple with emergent concepts of intersectionality, smartness and sustainability.

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