Mobility Design Guide

Making Future Mobility Tangible and Experienceable

Andrea Krajewski,
Sabine Reitmaier,
Kai Vöckler,
and Peter Eckart

In view of global climate change and a simultaneous and constant increase in the volume of traffic worldwide, the strengthening and development of environmentally friendly mobility is understood more and more as a key challenge, not only in terms of transportation planning and infrastructure, but also in relation to society (UBA 2019). To cope with this complex task that demands innovation, it seems sensible to think, plan, and implement mobility within a transdisciplinary context that is both science- and practice-oriented and where design facilitates access to a complex mobility system. This requires a shift in perspective toward a systemic approach, where the innovation process is viewed from within the overall system of environmentally friendly mobility, rather than being focused on individual products and solutions (Rammler 2018: 47). This transformation involves, at the same time, changes in the disciplinary orientation and expertise of those involved in planning and implementation. Today, they must also consider the effects of digitalization in terms of the common good and climate protection, but without designing digitally oriented, enhanced mobility systems on a purely technological basis.

As a new discipline operating within this context, mobility design combines strategic foresight, planning, design, and technological expertise, while opening approaches to complex mobility systems. To convey the relevant content, the »Mobility Design Guide« was produced as a digitally supported, interactive guide based on user-centered design methods. It is intended for decision-makers and planners as well as architects and designers in the mobility sector. It presents them with content related to strategy and design to help them develop new, sustainable mobility systems. This essay introduces the Mobility Design Guide and how it was elaborated.

Mobility design is cross-disciplinary and combines systemic planning, design, and technological expertise, as well as social science knowledge. The actors involved in mobility design come from disciplines such as architecture and design, urban and transit planning, social science mobility research, and information technology. Thus, the Mobility Design Guide needs to provide relevant, accessible interdisciplinary communication tailored to the requirements of the respective target groups.

The Mobility Design Guide is intended to highlight the need for long-term, strategically oriented transdisciplinary planning of current and future mobility projects. Since more complex mobility issues have generally been framed within a purely functional, infrastructural planning context, the guide emphasizes the central role of design (understood as design and architecture and their different disciplinary forms) for the development and advancement of mobility systems. The goal is to use mobility design as a means of achieving widespread acceptance of sustainable, socially responsible mobility. Design per se mediates between systems and people, and renders visions in concrete, experienceable form while facilitating equal access to products. The possibilities for influencing the mobility experience range from process and spatial design to general and personalized information products with their full range of design dimensions (light, color, material, signs). Explaining this cross-disciplinary approach to mobility systems is a key objective of the Mobility Design Guide.

The focus of this essay will be on describing how this guide was developed, conceived, and designed. In this way, the scope of possibilities for design to mediate among diverse bodies of knowledge within a transdisciplinary research context should become clear.[01]

Initial Point of Departure

The shift toward a systemic approach in the planning and implementation of climate-friendly and networked intermodal mobility (Rammler 2018: 47) was the primary point of departure for the concept development. Here, the focus is on the immaterial mobility experience for users, which can only be grasped by taking a holistic view of an intermodal system with its different modes of transport, forms of mobility, and spaces (including their digital extension). Therefore, the concept of the Mobility Design Guide has been consistently developed from the perspective of the users. It seems necessary and advisable to convey this

perspective to sensitize the target group of decision-makers, planners, and designers to the special requirements of designing a mobility system that can be utilized in an intermodal fashion. A particular challenge in conveying the perspective of transport users is that not only do they have functional, purpose-driven needs, but they also must be addressed on an emotional, subjective level. To this end, it is necessary to identify, understand, and address the values and attitudes underlying mobility behavior (Hofmann 2019; Haustein in this volume), and from this to determine the influencing factors relevant for design (see Vöckler and Eckart in this volume). Accordingly, this is communicated in, as well as through, the design of the Mobility Design Guide itself.

The objectives of future mobility design can be summarized as follows:

> Mobility design is oriented not toward the individual mode of transport, but instead toward the mobility needs of users … The transferral of personal feelings of freedom, status, value, and security currently associated with an object (the automobile) onto movement (mobility) means that this new form of individual locomotion must offer an experience that is persuasive, sustainable, and perceived positive … The task of mobility design is precisely to make this possible: to pave the way for an ecologically sustainable and socially equitable mobility by giving shape to a climate-friendly, networked, intermodal mobility. (Vöckler and Eckart 2022: 16–17).

In the context of the Mobility Design Guide, a mobility system is understood as the systemic interaction of human and nonhuman participants in transportation—as a form of mobility that arises from the interaction of people, technical systems, things, and information, which is to be designed within an existing or even desired transportation infrastructure.

Requirements for a Mobility Design Guide

A central question for the future use of the Mobility Design Guide was at which point during existing planning and implementation processes could the expertise and knowledge of mobility design have an impact. A widely used planning and implementation process, which is also employed in public administration, is defined in the Federal Chamber of German Architects Fee Scale for Services by Architects and Engineers (HOAI).[02] This was used as a basis for structuring possible applications of the Mobility Design Guide in »User Research.« Qualitative, semi-structured interviews were conducted with participants from all service phases (1–9) of the HOAI.[03] Interviewees came from the fields of architecture, consulting, design, public transportation services, politics, and urban and transportation planning. These interviews demonstrated the significance of the Pre-0 Phase, which is not provided for in the HOAI, as well as Phase 0; thus, additional interviews were conducted with those involved in these phases. In total, twenty people were interviewed.

It became clear that the participants in the Pre-0 Phase, as well as Phase 0 (during which

01 The Mobility Design Guide (https://mobilitydesignguide.org) was developed within the interdisciplinary research network »Infrastructure—Design—Society« (2018–2021), funded by the Hessian »Landes-Offensive zur Entwicklung wissenschaftlich-ökonomischer Exzellenz«, with the participation of researchers from the fields of design, urban design, traffic planning, information and communication technology, and social science mobility research. Project management and creative direction was undertaken by Andrea Krajewski (Professor for Interactive Media Systems, Darmstadt University of Applied Sciences) in collaboration with Sabine Reitmaier (user research, conception, interaction design), Anna-Lena Möckl (conception, content design), Julian Schwarze (conception), Beatrice Bianchini (icons), and Ken Rodenwald (animations). The project was realized together with Maximilian Brandl, Philipp Kaltofen, and Jan Meininghaus.

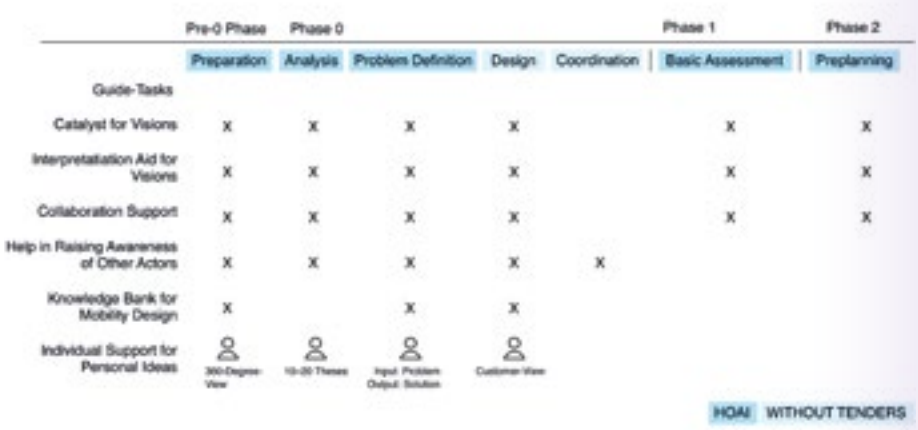

Fig. 1 Interviewee requirements for the Mobility Design Guide following a generic planning process. The procedure illustrated here considers planning processes that do not involve a call for tenders, and includes services described in Phase 0 in the interviews. (Source: Andrea Krajewski and Sabine Reitmaier)

planning specifications are determined and inspiration is sought), represent important audiences for strategically communicating a future-oriented mobility design. Interviewees from the disciplines of design and architecture, who usually work on design planning in Phase 3, explained how Phase 0 is often decisive for the project. After a project has been put out to tender, usually the basic concept or idea cannot really be changed. By including design considerations in Phase 0, the phase when strategic principles are defined and substantive objectives are set, the design requirements are more effectively incorporated in the tenders. Interestingly, interviewees from politics, administration, and business, who have a decisive influence on the Pre-0 Phase as well as Phase 0 itself, expressed the need to be able to learn about inspiring precedent projects as well as forward-looking designs and concepts. This was included as a requirement. Furthermore, it could be deduced from the survey that, in addition to the phases mentioned above, Phases 0 to 2 are also crucial for information regarding mobility design (↳Fig. 1).

The respondents were almost exclusively in favor of a digital, interactive application of the Mobility Design Guide so that they could use it at their own desktop screens. They stated that it would be desirable to be able to incorporate content from the guide into lectures and presentations or to be able to save a personal selection of the material. This application should always be kept up to date and ideally be maintained by several editors who would ensure its reliability and scientific quality (a collaboration among several universities was mentioned as an example). These requirements were addressed in design and elaboration. Following the principles of user-centered design, the findings from the user survey were evaluated and gradually incorporated into the design of the application through workshop-based development. Researchers from different disciplines (design, architecture, social science, and mobility research) participated in the associated workshops. A »value proposition« for the planned application was formulated as a guiding principle for the development process and acted as what is called a »constant companion.«

02 The service phases specified by the German Fee Scales for Architects and Engineers (HOAI): 1: Basic determination with examination of the budget by the client; 2: Pre-planning with cost estimation; 3: Draft planning; 4: Approval planning; 5: Implementation planning; 6: Preparation of tender; 7: Participation in the award; 8: Site supervision—construction supervision, and documentation; 9: Property management.

03 The user research was conducted by Sabine Reitmaier and Andrea Krajewski. All interviews were transcribed, graphically interpreted, and analyzed.

Value Proposition
The Mobility Design Guide is a digital handbook for mobility design. Politicians, urban and transportation planners, as well as architects and designers, are provided with inspiration, models, and research principles to support the planning and realization of future-oriented, socially conscious, sustainable mobility concepts. In contrast to classic reference works, the guide offers arguments for and examples of achieving a transformation in transportation by promoting a new mindset among transportation stakeholders through mobility design.
The guide provides a demonstration and exploration of a user-oriented method for mobility design. Points of departure are the desirable mobility focal points as well as the concrete target formulations and project leverage measures based on these goals. User-centered perspectives are then adopted within a system-oriented approach. This allows for sustainable mobility to be established as a natural transportation option through the design of easy access to intermodal mobility systems and positive user experiences, which results in the affirmation of user identity.

Structure and Composition of the Mobility Design Guide

In interviews with those involved in planning and implementation processes, one idea that often emerged was that the complex topic of new mobility could be approached via an interactive guide from different viewing altitudes as well as by navigating along different access routes: from the big picture to the details, from the abstract to the concrete. This requirement was included as a central objective in the guide's mediation strategy and was set up as a basic structure for the information architecture. In order to provide orientation along access routes and viewing altitudes, the Mobility Design Guide was based on an interactive three-dimensional map of a generic city and its surrounding area that changes with the content. The representation of the content of this three-dimensional map should be seen as an abstracted representation of the users' living space (urban or rural), which serves to position content and orientation within the guide. In this way, the Mobility Design Guide enables users to move from a highly abstract visual level (future visions and their mobility-related configurations) to a concrete, design-oriented level of action (design projects with specific goals). Starting with a view of an entire system, the map view zooms in following the user's gaze as they explore content down to a scenographic, detailed project level. In this way, the Mobility Design Guide deals the need to be able to see, plan, and, in a sense, design a project as a whole picture (↳Fig. 2-4).

The knowledge base is made up of a range of design-based and scientific projects. These are intended to be accessible to specific target groups to suit their various requirements but are interconnected in a context-sensitive manner. The design projects are always linked to a focal point of the future vision. Following strict user guidelines, these projects convey the methods that can be used to design for a mobility objective that is consistently user oriented. They also illustrate the impact of the design features (space, light, color, materials, information systems, typography, activity structuring). By means of interlinking, the design projects are placed in a reciprocal context. In this way, interrelationships among intermodal mobility become visible. The design projects are also linked to the relevant scientific projects. Furthermore, the scientific projects are centrally grouped according to research focus and can be searched by keywords. Thus, the Mobility Design Guide meets the requirements identified during research: inspiration and strategic openness, communication of methodological expertise, and detailed fundamentals (↳Fig. 5).

The Mobility Design Guide has been implemented in an initial functional, user-oriented basic version. It does not yet contain the complete range of functions (such as personalized use). However, it allows the target groups to get closer to the viewpoints, range of possibilities, and visions for mobility design; it also allows them to become intuitively acquainted with the structure of the guide through a process of discovery.

The Mobility Design Guide is also to be understood as a design product itself. The objective of the concept—as with mobility design itself—is to achieve user-oriented, easy access and to

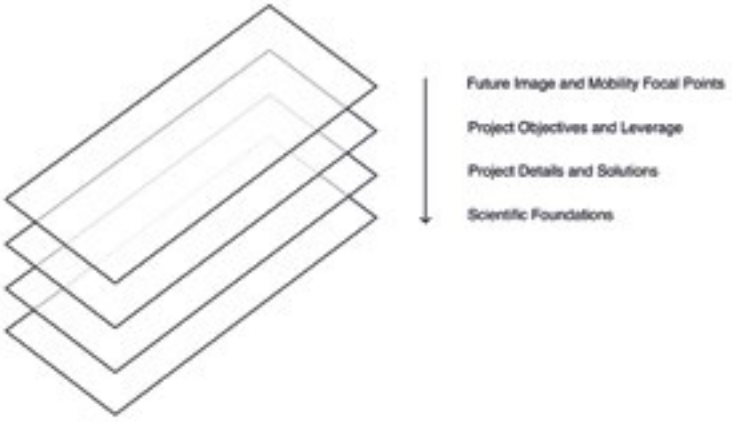

Fig. 2 Moving across the levels at different »altitudes« (Source: Andrea Krajewski and Sabine Reitmaier)

Fig. 3 Map showing zones of different mobility functions (Source: Andrea Krajewski and Sabine Reitmaier)

Fig. 4 Configuration of the »altitudes« (Source: Andrea Krajewski and Sabine Reitmaier)

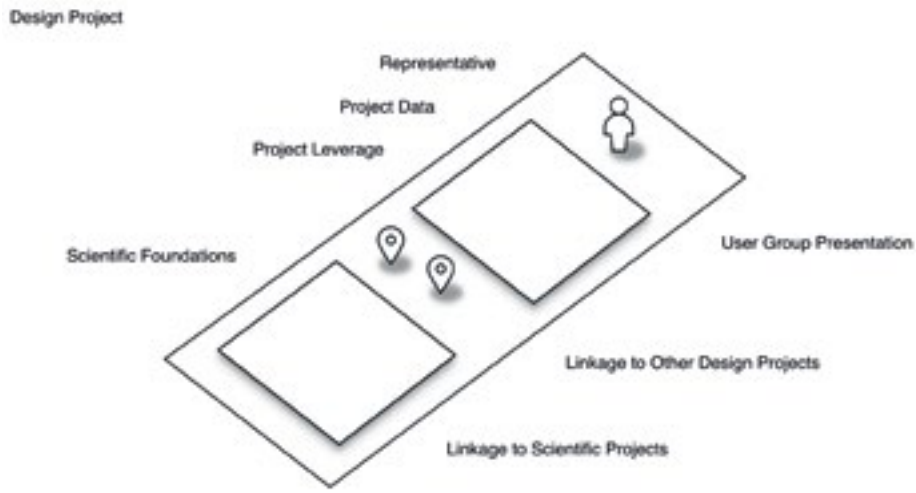

Fig. 5 The design project as a demonstration of user-oriented, systemic integration in a mobility network (Source: Andrea Krajewski and Sabine Reitmaier)

encourage emotional engagement and personal identification through design. For this purpose, design tools such as storytelling, user guidance, hierarchization of content, color palette, pictograms, fonts, and a layout that adapts to different screen sizes were applied. These are to be understood as a kind of grammar that enables consistent, easy-to-learn access for a broad group of users at different points of interaction with the guide (↳Fig. 6).[04]

The Mobility Design Guide's Future Image

One of the most significant findings from the interviews of those involved in the planning and implementation of mobility projects was that the knowledge of the Mobility Design Guide should be strategically anchored and capable of being deployed in the future. This highest »altitude« in the systemic view is referred to in the Mobility Design Guide as the »future image.« This is intended to capture and depict mobility modes that are preferable and desirable, but not to make predictions about how events will unfold. Future images in the Mobility Design Guide illustrate ways in which decision-makers in transportation policy, managing directors of transportation companies, urban and transportation planners, and project managers involved in implementation can approach the complex topic of future, networked, environmentally friendly mobility from the standpoint of mobility design and research.

The methodological approach used for developing the future structure of the Mobility Design Guide is called »backcasting« (Robinson 1982; Miola 2008: 14). Backcasting is understood as a normative, design-oriented method that formulates desirable future developments in a standardized manner, thus creating spaces in which measures and objectives can be determined as to how this desirable future can be achieved. In the design field, this is used among other methods, for example, in »transition design« (Candy 2019: 18). In terms of methodology, this was transferred to the planning, design, and implementation of projects in the mobility sector. Accordingly, the Mobility Design Guide shows thematically grouped perspectives for development that can be used to discuss key tasks. In addition, possible areas in which a systemically oriented, user-centered mobility design can be applied are clarified. Structured in this way, the content is intended to inspire people to work together with other stakeholders to conceive of networked and environmentally friendly mobility as a coherent whole, as a system, and to use the application structure thus developed to draw up new guiding principles for planning and design.

The Mobility Design Guide's vision of the future is based on central theses that were developed in a »ten-year horizon« workshop and then condensed into four key future mobility topics during subsequent workshops.[05] These describe the social,

Fig. 6 Design details: »Inter« Font, Color Palette, Icon Set (Source: Andrea Krajewski and Sabine Reitmaier)

economic, technological, and ecological dimensions of a more desirable, user-oriented vision of future mobility. The textual interpretation of their focal points is as follows:

– Future mobility is smart enough.
– Future mobility is needs-based.
– Future mobility is accessible to all.
– Future mobility is designed for the long term (↳Fig. 7).

The guide uses design projects as examples to show how ideas about future images can be explored through a step-by-step design process. However, these design projects do not only provide visual material and inspiration; they also provide a methodical framework for developing systemically conceived mobility solutions based on the key aspects of mobility (vision), the definition of project objectives (mission), and the associated actions (levers), which answer the needs of transportation users on rational, socioemotional, and symbolic-emotional levels. These design projects are linked to the findings of the research projects carried out as part of the »Infrastructure–Design–Society« research network—also documented in the Mobility Design Guide. The contents of the guide include concepts and design projects from the fields of design and architecture, scientific investigations of transportation planning and social science mobility research, and communication technology experiments, which also include research conducted on an interdisciplinary basis. In addition, there are existing precedents realized by external practitioners.

In this way, it was possible to meet the essential requirements for a Mobility Design Guide as they emerged from the interviews with potential future users:

– A consistent narrative and strict user guidance facilitate access to the complex topic of future mobility design.
– Different entry points are provided for various target groups and interests.
– Strategic and design approaches are methodically combined in one process.

04 The »Inter« font family has a high x-height to improve legibility of uppercase and lowercase letters. Also included in the package are open font features such as contextual alternates, tabular numerals, etc. As an open-source product, this font is under constant development.

05 The workshops were held as part of the design subproject within the research network »Infrastructure–Design–Society« (see note 1). Andrea Krajewski, Sabine Reitmaier, Anna-Lena Möckl, Julian Schwarze, Janina Albrecht, Peter Eckart, and Kai Vöckler participated.

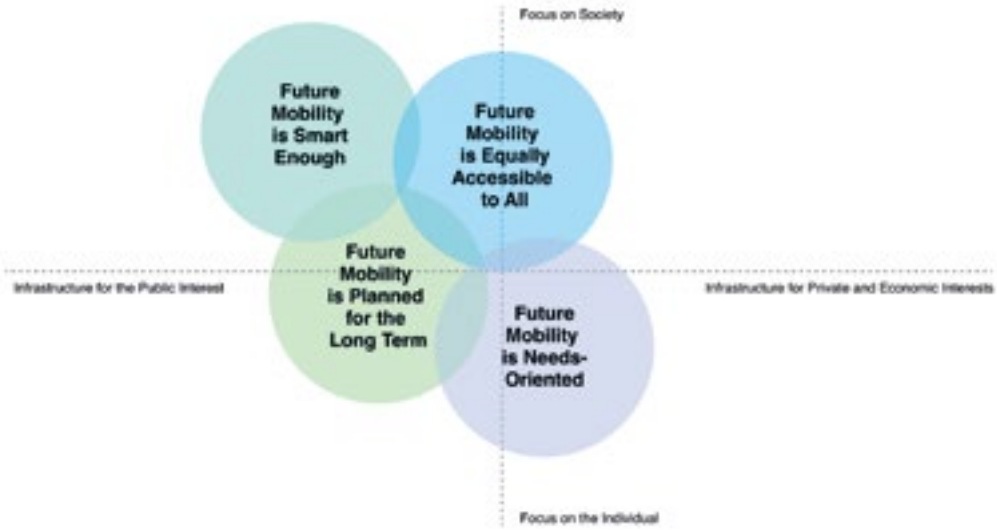

Fig. 7 Vision of the future with focal points (Source: Andrea Krajewski and Sabine Reitmaier)

– Low-threshold access and the networking of disciplinary perspectives enable interdisciplinary exchange.
– Furthermore, an expandable structure is flexible enough in itself to accommodate additional and new insights from mobility design.
– Last but not least, a strategically forward-looking guide anticipates future developments and thus also supports decision-making processes(↳Fig. 8).

Outlook and Further Development

The Mobility Design Guide was implemented as a basic version for teaching mobility design. It introduces the methodological approach of desired mobility visions and human-centered design of mobility systems based on scientific research. A subsequent, future version of the Mobility Design Guide could build on this by incorporating more detailed methodological principles of mobility design and additional illustrative design projects.

Furthermore, usage options could be expanded according to the requirements of the target group. In this context, it was suggested that the contents of the guide could be exported and made accessible to regular users in their profiles. In this way, they could collect content and, for example, use it as a discussion aid in meetings. It would also be conceivable to use the guide as the basis for strategic cooperation among stakeholders in a mobility project, where guiding principles and design and scientific projects could be brought together in a joint process adapted to the respective urban region.

The Mobility Design Guide could also serve as a strategic platform for further interdisciplinary research and development in the field of mobility design. One research topic that has developed over the course of the project is an updating of the concept of mobility with regard to the increasing use of digital technologies in all areas of life, as well as their influence on user expectations and mental models. For all those involved in mobility design, this means turning to the planning, design, and organization of multioptional action scenarios in a technologically supported, complex overall system (see Krajewski and Reitmaier in this volume).

Finally, the Mobility Design Guide can be expanded into a digital, interactive real laboratory for the participatory development and design of visions of the future. In virtual workshops and digital discovery courses, desirable future scenarios can be created that could be experienced and evaluated with the help of designed digital artifacts. The objective of such experiences is, on the one hand, the development of alternative mental models among transportation stakeholders, political decision-makers, and urban and transportation planners.[06] This will help to facilitate the introduction of innovative sustainable mobility

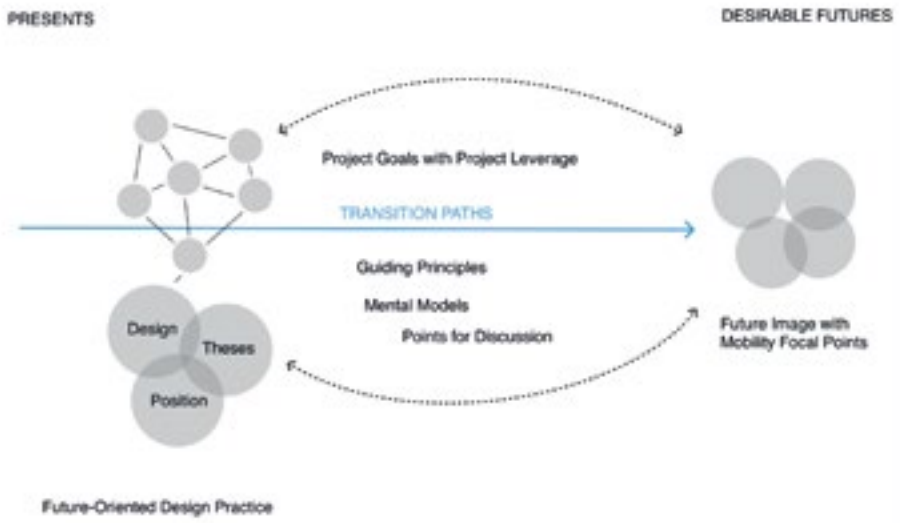

Fig. 8 Diagram of the development of the future vision in the Mobility Design Guide inspired by Stuart Candy and Terry Irwin (Candy 2019: 19) (Source: Andrea Krajewski and Sabine Reitmaier).

concepts, since existing models will then no longer act as a kind of brake.[07] On the other hand, the future images thus developed can be investigated by means of common user-experience research practices with potential users. The Mobility Design Guide here serves as an interactive platform and a location for knowledge transfer between mobility design and research on mobility and the future.

06 The term mental model refers to conceptual ideas based on experience that are used to deal with an artifact or system and the resulting consequences and meanings (Dutke 1994; Krippendorff 2013). Addressing specific mental models in a targeted manner is particularly important in the design of innovative systems.

07 Of interest in this context is the research of Corina Angheliou, who specifically examines how methods of futurology and design can contribute to sustainable, innovative transformations (Angheliou et al. 2020).

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