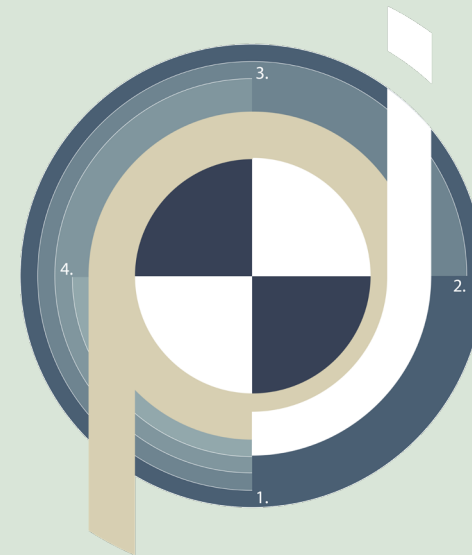


VISION **pi**

#NEXTGen Moving Tomorrow Pitch
Sustainable and Individual Premium Mobility in 2040



FRAUNHOFER RESEARCH

A couple of Fraunhofer Institutes brought together their competences to think about the luxury mobility of the future - the outcome: Vision π .

Polymer Engineering at Fraunhofer ICT has a long-standing experience in application-oriented research and development of polymer and composite material solutions. The team serves its customers with solutions for long-term social challenges from the initial idea and the concept development to the manufacture of prototypes.

The Fraunhofer project center for lightweight design and electromobility addresses a truly interdisciplinary approach as its four institutes IST, IFAM, IWU and WKI joined forces in a shared technical center offering mass production-like conditions. The experts from their respective fields of research work on the whole process chain for lightweight structures including recycling and reuse. Solutions are presented in work areas such as future interior and flexible production technologies.

Fraunhofer IAO's Mobility Innovation Lab is known as a think tank for early stage assessment of futuristic automotive innovations. The interdisciplinary team uses combined approaches between user oriented development and technology scouting. Considering autonomous driving and the digital transformation, especially smart in-car technologies and related applications are in the focus of the researchers.

VISION π

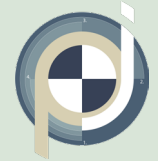
How to create luxury mobility for the world of 2040? A world driven by the idea of a circular economy and a persistent lifetime of products. A world, also driven by the wish for fast changing, individual lifestyles, inspired by global connectivity. But how to create driving pleasure between those poles? That's the goal of Vision π : A symbiotic coexistence of responsible sustainability and user individual experiences. We developed a modular vision of mobility, divided in four shells with different perspectives.

The first shell is the mode of transport - Various types of transportation modules can be connected to a vehicle cell to enable the most sustainable use of mobility resources. Successively, the "All-Cell" is the central and persistent structure of the vehicle. It is created from three layers of long-lasting but recyclable composite material and integrates essential vehicle functions. The third shell describes the "Smart Interior", based on sustainable and sensible materials. Build in a modular and upgradeable way, individually designed for the customer and adaptable to every use case. The interactive mobility experience forms the core. While smart applications will change the vehicle settings, the driver can use the "iExperience" controller for steering in the real world or navigating through virtual worlds. Ultimately, the option for VR Mobility will radically enhance individualism and decrease the number of trips to those that are necessary or a real pleasure. Persistence meets Individualism: Vision π – the future constant of luxury mobility.

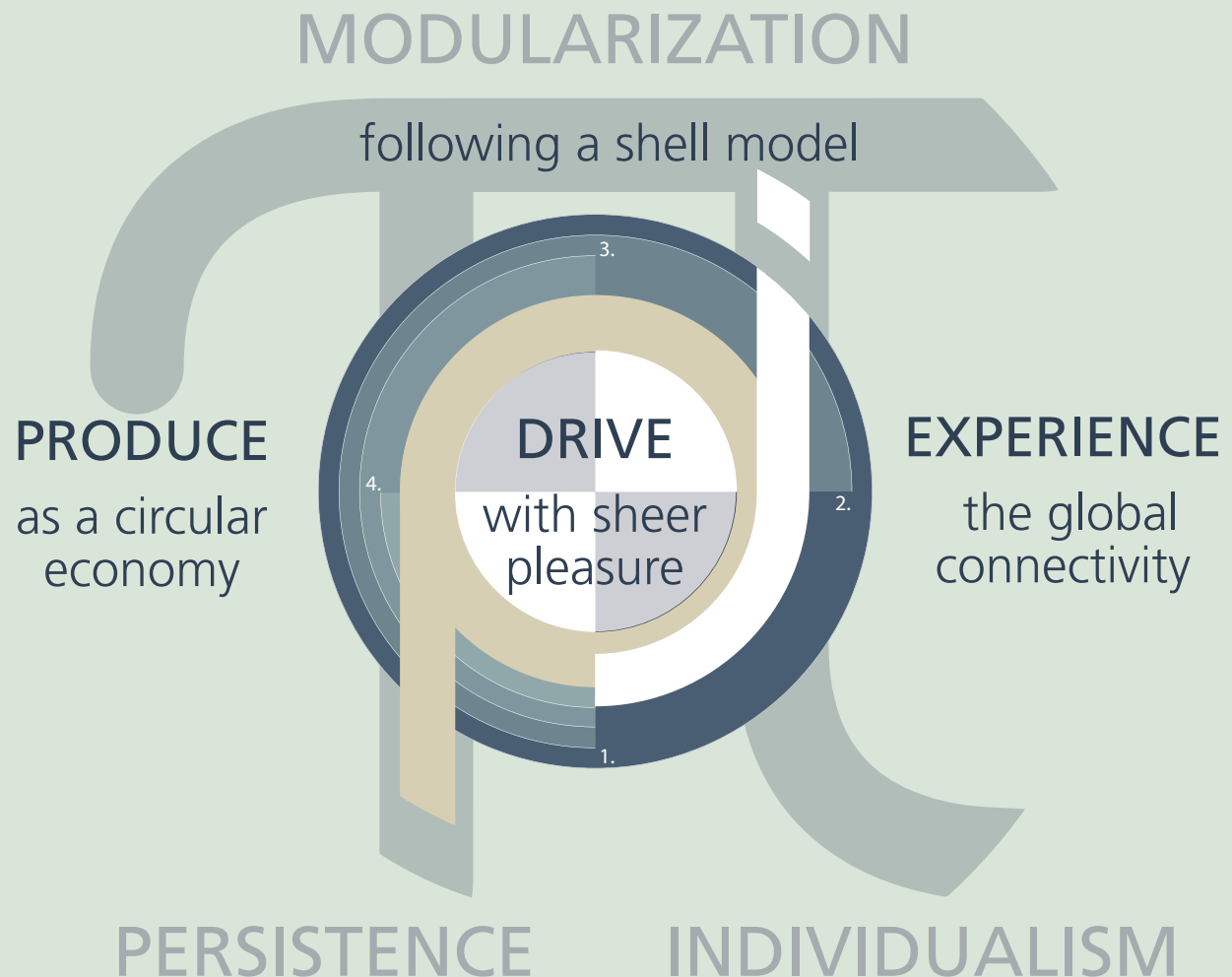
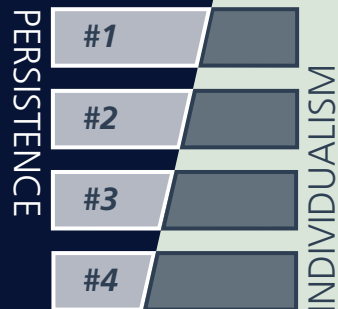
RESPONSIBLE LUXURY FOR THE WORLD OF 2040

LUXURY MOBILITY OF THE FUTURE HAS TO BRIDGE THE GAP BETWEEN SUSTAINABILITY AND PERSONALIZED EXPERIENCES – AND TO ENABLE DRIVING PLEASURE OF A NEXT LEVEL

#SHELLzero
approach



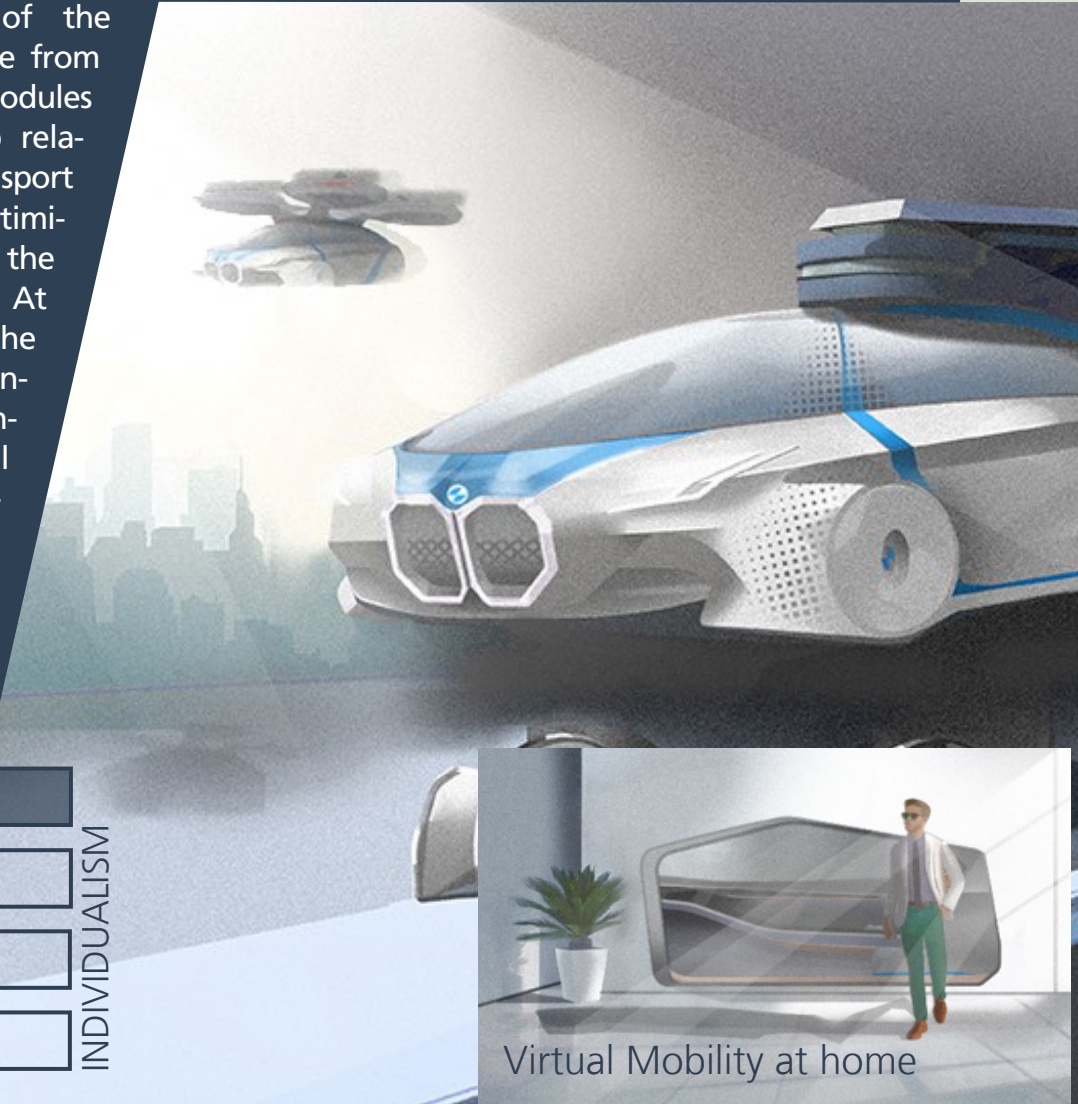
Modularization builds a bridge between the wish for a persistent lifetime of products and fast changing individual life styles. Being divided into four shells, the concept enables a high utilization of product features related to physical resources and an individualization of such features, related to user experiences.



SHARED MOBILITY MEETS PRIVATE SPACE

MOSTLY PRIVATELY OWNED PASSENGER CELLS CAN BE LINKED TO A HUGE VARIETY OF TOTALLY DIFFERENT KINDS OF MOBILITY MODULES THAT ARE OWNED BY MOBILITY PROVIDERS

The separation of the passenger module from the mobility modules will allow a trip related choice of transport modes and an optimized utilization of the mobility systems. At the same time, the journey can be enjoyed from the inside of a personal mobility module or as a virtual experience that connects the whole world.



#SHELLone
mobility modules



USERS' MOBILITY PREFERENCES

Share of users who presume a relevance as mass market / niche market in 2040:

- Autonomous Driving:** 52.2% / 37.7%
- Urban Air Mobility:** 28.6% / 50.4%
- Hyperloop:** 41.2% / 42.8%
- Virtual Mobility:** 51.8% / 36.1%

- Source: Global user survey from Fraunhofer IAO on mobility trends
- 2.220 participants from GER, USA, KOR
- Collection period: October 2019

VIRTUAL MOBILITY

- Smart windows allow VR simulations
- Cells can also be linked to houses if not used for mobility issues
- Cells will become a part of future architecture and worldwide lifestyle

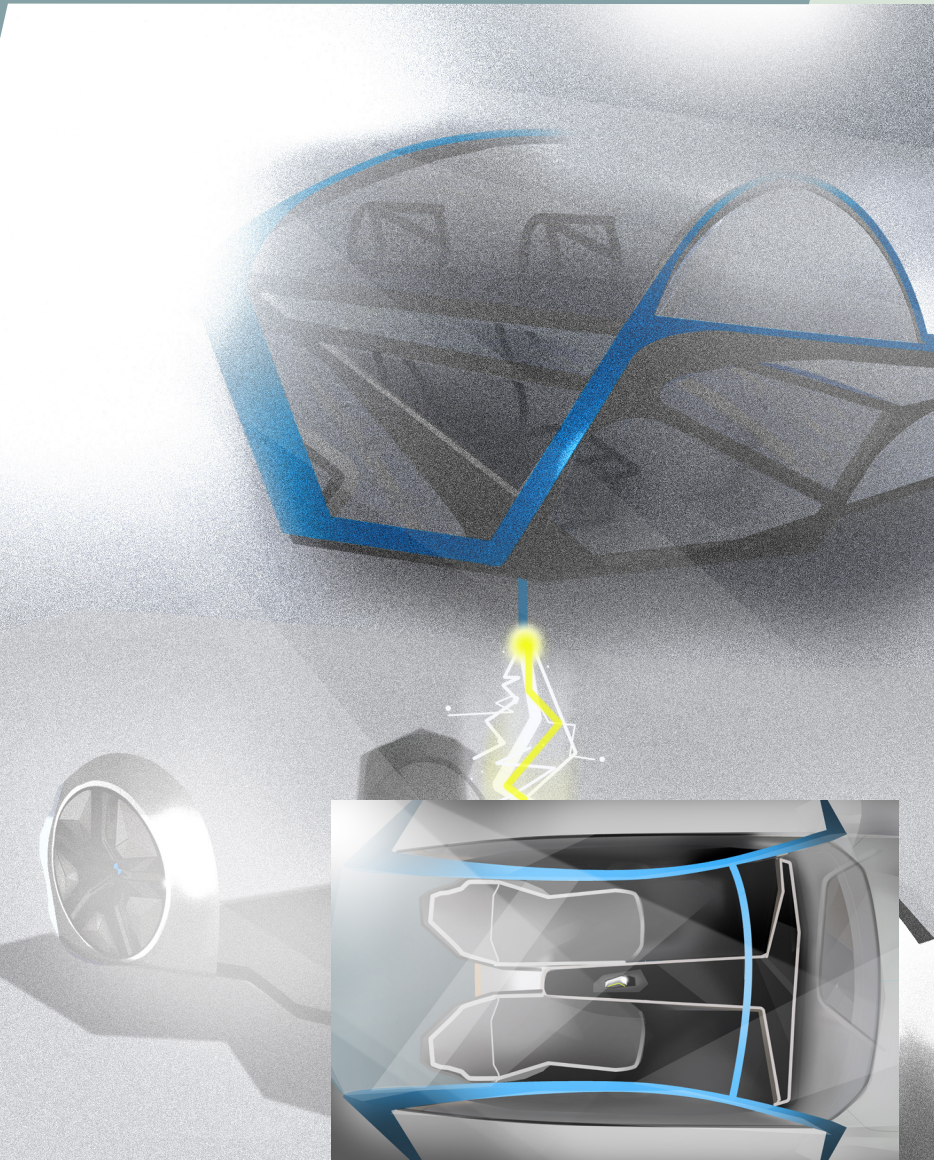
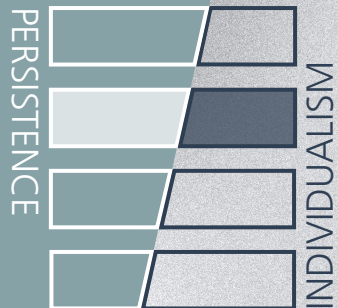
A LONG LIFE MONOCOQUE AS MAIN STRUCTURE

THE ULTRA-LIGHT AND ROBUST STRUCTURAL CELL WILL BE PRODUCED WITH SCALABLE ADDITIVE MANUFACTURING PROCESSES TO ENABLE INDIVIDUAL CONSTRUCTIONS

#SHELLtwo
all-cell



The All-Cell is designed as a long life construction that can be used in a most persistent way. It will be produced in individualized shapes by additive manufacturing processes. Standardized interfaces allow retrofitting it, to keep it up to date or to meet the requirements of special trip purposes.



SANDWICH STRUCTURE

OUTER LAYER

- Sustainable self-reinforcing plastics
- Integrated exterior functionalities

MIDDLE LAYER

- 3D printed foam with variable density
- Integrated functions (e.g. AC chanel...)
- Integrated IT and energy bus architecture

INNER LAYER

- Sustainable self-reinforcing plastics
- Integrated connections for interior-functions, smart textiles and shy tech

STANDARDIZED INTERFACE

- Connection between cell and mobility modules
- Integrates physical, IT and energy functions
- Light weight design out of foamed metal
- Harmonized with interface structure for seats and center console

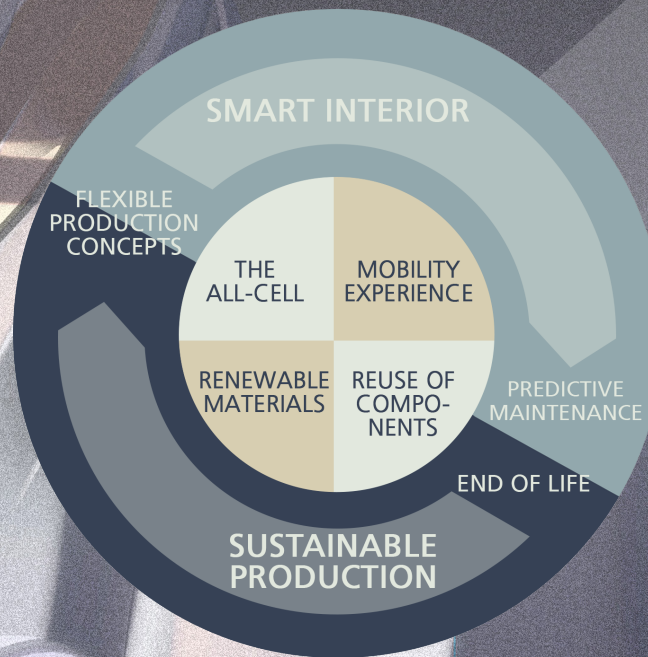
A FLEXIBLE INTERIOR FOR CHANGING PURPOSES

TRAVELING FIRST CLASS AND RESPONDING TO THE NEEDS OF FUTURE TRAVELLERS WILL BE A MATTER OF A SMART AND INDIVIDUALISED INTERIOR

#SHELLthree
smart interior



The modular approach allows a efficient design and most persistent use of materials and components as well as a high degree of individual interior setups, e.g. as moving lounge, conference room or office on wheels depending on the individual needs and preferences of the passenger.



SUSTAINABILITY AND INDIVIDUALIZATION TAKE EFFECT ON SEVERAL LEVELS

MODULAR EQUIPMENT

- The interior can quickly be adjusted according to current needs
- Structural elements of the all-cell offer links for components, media, energy and data supply
- New production approaches score for individual parts in a large-scale production environment

INTEGRATED SENSORS

- The interior includes smart surfaces and components for control and condition monitoring
- Overall feedback to the autonomous car in combination with exterior sensors
- Basis for the driving experience

SUSTAINABLE DESIGN

- Design for circularity: component and material cycles reduce the resources needed
- Renewable materials offer new functions and decrease the CO₂ footprint
- Single design relevant or individual components of the interior can easily be replaced and renewed



EXPERIENCE THE FUTURE FROM THE DRIVER'S SEAT

DIGITAL APPLICATIONS AND VIRTUAL REALITY WILL ENABLE INDIVIDUAL AND CONTEXT AWARE SETTINGS FOR A UNIQUE EXPERIENCE OF PHYSICAL AND VIRTUAL MOBILITY

#SHELLfour
iExperience



The option for virtual mobility will reduce the amount of trips to those that are really necessary and those who let you experience sheer driving pleasure of the next level. As ultimate pleasure, the iExperience allows manual driving in a fully-automated world, user and context specific personalized by smart applications.

STEERING THROUGH THE REAL WORLD Inspiration Helicopter Joystick

- The Sixth Level of Automation enables real steering, supervised by the automated functions
- The iExperience can control the (automated) mobility modules in an abstract but also direct way
- Allows 3D movements of Flying Cabs
- Driving behavior will be set up by personal preferences

NAVIGATING THROUGH VR WORLDS Inspiration 3D CAD controller

- The windows become displays, the cell a digital VR cockpit
- The iExperience allows multidimensional control with user individual logic
- Enables virtual mobility and phantastic entertainment experiences
- Enables user individual 360°communication or office-features



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TEAM

