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THE FUTURE OF DRIVING EXPERIENCE: AN INTERDISCIPLINARY STUDENT PROJECT

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ABSTRACT
What will car-driving be like in the future? Will people be managers programming transportation devices? Will people be pawn in the hands of a service industry? Will people be committed to inaction despite all safety apparatus? Will there be a joy of driving? This paper presents an interdisciplinary students project that aimed at investigating the future of driving experience.
There were 25 participants from the fields of industrial design, interaction design, knowledge architecture, communication acoustics, traffic psychology and automotive engineering working in teams. Each team developed an innovative approach on multimodal experiencing of autonomous urban transport. The participants worked on the same task as teams at two competing European universities, the task has been instructed by a large German car company.
The projects followed a generic procedure of exploring the topics, identifying and defining problems, developing approaches and concepts, designing product-related ideas and implementing the ideas in physical models and multimedia. The results were presented in two themes, immersive dynamics and holistic interaction. The themes comprised of three design proposals each. The proposals ranged from drive gloves and haptic steering wheels to active seats and urban exploration devices, addressing human interaction with the car as well as the environment. The interdisciplinary composition of the teams and the consequent incorporation of prototyping throughout the process allowed presentations of the results that could be experienced and interacted with.

Keywords: Interdisciplinary, student project, mobility, multimodal, interaction, prototyping.

1 MOTIVATION

The subject of piloted or even automated driving is a hot topic in the automotive industry. Driving enjoyment, the most significant sales argument of the premium manufacturers, often represented with sporty and dynamic, does not quite fit into a scenario where the driver is expected to only watch. The question how passengers pass their time in such a vehicle is an aspect that claims new approaches for the development of future automobiles. This signifies profound changes for the accustomed concept of mobility and a shift to increasingly focusing on user experience [1] and the human machine interaction (HMI).
For the specific configuration of the driving experience, not only automotive values matters, also the multimedia contend and the composition of interaction and perception have a great impact. Therefore was the incorporation of other branches essential and if nothing else, a substantial argument for the acquisition of the project. Detached of the current consolidation of subject areas and subject overlapping trends, the reduction of the developing time requires a minimization of iterations and consolidation efforts. An interdisciplinary product development becomes more and more important for the success of a product. Having these aspects in mind, interdisciplinary projects are an essential party of today's education [2].

2 INTERDISCIPLINARY APPROACH

Thus with good reason the Audi AG, industrial partner for the student project here introduced, asks for the "real experience"– theme of the interdisciplinary summer project 2015 with an interdisciplinary research network of the TU Dresden as a junction at the base of quite different subject areas and competencies. Lecturers and students from the fields of industrial design, media design, knowledge architecture, automotive engineering, communication acoustics and traffic psychology contributed to

this project, representing six chairs of four faculties. These cover a large field of knowledge with their own courses, research topics and experimental laboratories, which provide extensive input for the outlined problems. Correspondingly wide embattled are the own expectations towards the project. Next to addressing multimodal (involving several perceptual channels) interaction, truly tangible experiences are intended to arise. Automotive technical relevant and intelligible prototypes with design aspiration are therefore another pivotal topic of the project.

3 FOCUS MULTIMODALITY

Next to the general possible applications of the individual subject areas towards the automotive theme, the emphasis of the multimodal interaction depicts another interdisciplinary field of topic. Multimodality connotes the involvement of several perceptual channels. While disciplines like industrial design or architecture conceive mostly visual and haptic perceptions on products, media design engages into mostly visual but also more and more haptic information interaction (see fig.: 1).

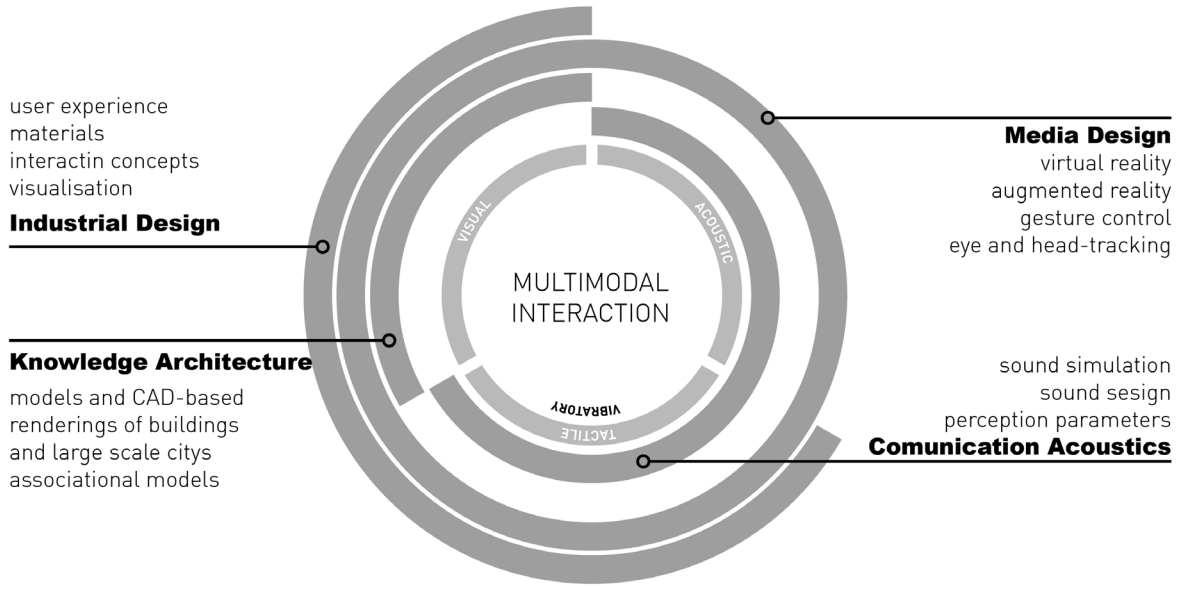

Figure 1. Input of the evolved disciplines for a multimodal approach

The variety of perceptual channels is supplemented by the communication acoustics, which examines auditory signals alongside with vibratory influences. The focus on the multimodal interactions is promoted by the more complex and bigger information structures of today's systems [3].

4 COLLABORATIVE GROUP BASED WORKING

Pivotal topic of the project on our side was to align and contrast the subject specific procedures and methods. Therefore, we prepared a timetable and a project structure in cooperation with every chair involved in this project. Our thoughts also include several tools that in our opinion are essential for a cross-discipline exchange as we expect it from this project. Depending on the phase of the project, we included sessions using paper prototyping [4] or full-scale tape renderings (see fig. 2).

First, the students individually research peripheral sections and inherent problems of the task according to their field of study. The outcome contains a very wide but also quite deep analysis of current trends from the familiar fields of research. The group building based on the request for mixed teams of participants from every discipline and considering the individual interests. In the end six groups were built, from which four had representatives of all four active enlisted departments, one with students of the departments architecture, design and media design and one with three participants each of the subject areas design and media design.

During the next step, the groups collaboratively developed several holistic approaches on what they want to aim for in their project. These Approaches containing design ideas as well as also technical ones and those for interaction. For the depiction and presentation of the ideas sketches, renderings, simple CAD-models and 1:1 tape were used. The final design concepts joined the disciplinary separate ideas to a consistent approach.

The developing and realizing of these concepts in technical and functional aspects as well as the ones of styling and interaction happened by defining partial tasks and responsibilities inside the groups. Dynamic and iterative change of interdisciplinary pairing characterizes the work of the students considering the specializations und different reviewing methods the disciplines provides. This was complimented by the use of visualizations, animations, digital and physical prototypes as well as regular presentation rounds aiming for an integrative workflow. The illustration below (fig.:2) shows in which phases the groups worked in close discussion about the topics and in which they split the work regarding their individual expertise.

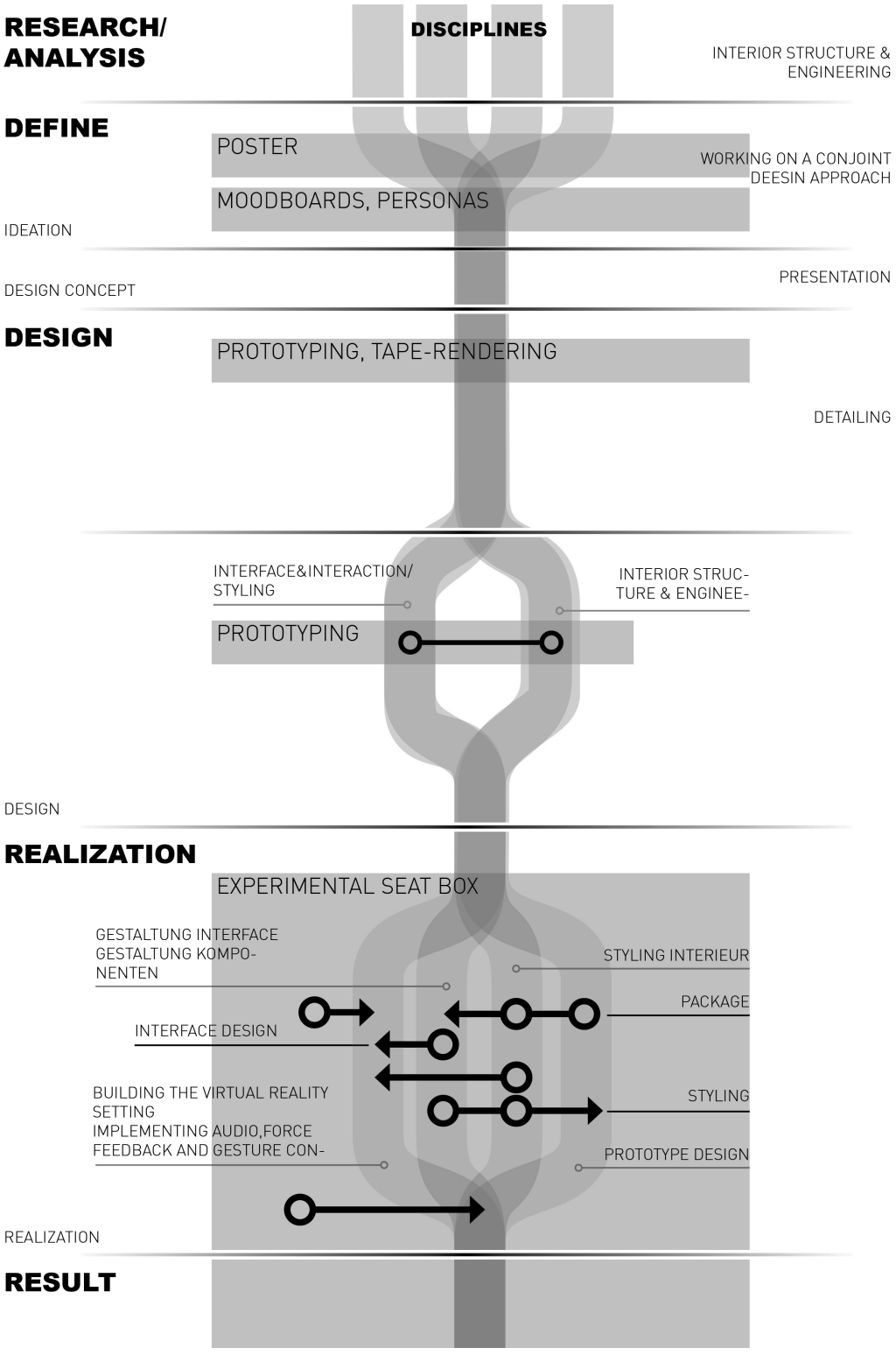

Figure 2. The projects interdisciplinary workflow

5 MODELLING AND PROTOTYPING

As mentioned in the beginning, the inclusion of the working models in all periods of the project express an important topic. With tools like paper prototyping, simple models made of Kapa and laser cut wood structures, printed models out of synthetic material or milled foam bodies, the whole process and the respective available data was covered and converted in physical objects. In addition, we use projectors, data glasses, gesture recognition devices and speakers to enhance these objects with digital data. The tool diversity allows the representation of many kinds of information to facilitate an interdisciplinary workflow and design process [4]. It also enabled the students to build most of the prototypes in full-scale. That is essential for a close to reality experience and to ensure a better estimation [5].

The students had access to the "Makerspace" of the Staats- und Landesbibliothek (SLuB) Dresden, which moreover was the main workplace. For the final implementation of the ideas, the Fraunhofer Institute for Machine Tools and Forming Technology supported the students with extensive knowledge in the department of smart materials to develop properly functioning demonstrators and really implement those.

This happened mainly within the scope of the "Werkstoffwoche" a materials trade fair, which took place in September 2015 in Germany. The working right in between the booths brought the students close to the current scientific discussions, technical challenges and approaches from scientific community and the industry. Next to the input, the workgroup enriched the fair concept by an active and applied project workshop, which led to brisk discussions.

The early and over the whole process consistent inclusion of models and prototypes proved to be a good working tool for the exchange among the students, the advisors and the colleagues from industry. Further, they allowed an experience dimension, which would not have been achievable just with graphic resources. Both the change between and the pairing of digital and physical models and surroundings depicted an interface between the disciplines. This way the usage of a real automotive seat together with a force feedback steering wheel and a projection generated a real scenario by bringing the students' ideas together (Fig. 3, 4).

Figure 3. seat box "immersive dynamics" with force-feedback seat, VR glasses and corresponding projection wall

Figure 4. iconic seat concept "holistic interaction" using the Oculus Rift VR glasses

6 RESULT

The presented result of the project showed two interactive seat boxes (Fig. 3, 4). These combine next to the abstract illustration of the interior with a seat the most different interaction and visualization elements and create rooms for experiences, which not only reflect alternative mobility scenarios, but many modalities for the design of the user experience. The first one shows a vibratory animated seat and using speakers and a force feedback steering wheel to interact with a dynamic VR-surrounding. In addition, it comes with a prototype of a steering wheel with tactile interaction elements, which allows the driver to interact with the car in a completely new way. The second creates an immersive scenario around a seat using a wall projected surrounding which can be navigated by hand gestures. It is likewise equipped with a directional speaker facing the driving seat enriching it with an audio component. A function demonstrator clarifies the concept of an assistive force feedback glove. The presentation for Audi within the scope of a large project presentation together with other universities represented the conclusion of this project. In comparison to the physical design models of the other student projects, the possibility of interaction and the interdisciplinary thoughts behind the concepts attracted a high amount of enthusiasm and attention.

7 DISCUSSION

The interdisciplinary composition of the teams allowed a very broad, yet deep discussion of the asked topic. As a matter of fact, the approaches presented by the students were much more differentiated. A major issue in advancing the ideas was the process of joining the different ideas which often represented a quite isolated view based on the own discipline of the individual group members. The constant exchange with the students showed that the design students did much better in an integrative thinking. This could be caused by the experience our students have, since industrial design projects often calls for integrating different disciplines and have a strong conceptual content. In addition, the task was a typical "design problem". In the beginning of the development of the concepts, the students had problems to understand their role and to allocate tasks.

All disciplines also provided important and professional input during the whole process. The use of personas, mood boards and scenarios within the concept creation phase was new for many of the non-design participants but facilitated their access to a user-centred approach. After fixing the design concepts and features, the students succeeded much better to distribute tasks and merge the results again. Here, the students were able to rely on their experience and learned processes. Due to a constant discussion between the students and a continuous discussion of the contributions, many synergies could be used.

The fact remains that for an interdisciplinary project in a solution development in the conceptual area a good guide for the consolidation is recommended. Also an assist in the evaluation of the results, the students rely on transparent input. Clear communication of the drain and the challenges ahead can better prepare the students on the tasks to be performed and cooperation. The results show the potential of its high integration of various areas of expertise in a consistent implementation.

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