



Christian Doppler Labor
Contextual Interfaces

User Experience Design for Vehicles

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1 Introduction

- **Vehicles have become a “temporary” mobile workplace and home-place for both drivers and passengers**
 - interaction with information about one’s own identity
 - entertainment
 - relationship-building/maintenance (e.g., communication with others)
 - access to information resources (e.g., travel information, references, other databases)
- **Vehicles as communication, entertainment, and information environments**
- **Vehicles as interaction and living context**

[Boehm-Davis et al (2003)]

1 Introduction

- Definitions
- Contextual User Experience (UX)
- UX Factors
- UX in the Car
- Example UX studies



| 2 UX Definition

- Up to now UX “is associated with **a broad range** of fuzzy and dynamic concepts” [Law et al., 2008]
- There is a broad range of different definitions, e.g.:
 - ISO/DIS 9241-210
 - Nielsen-Norman Group
 - Uxnet (<http://www.uxnet.org>)
 - Sward & MacArthur, 2007
 - Hassenzahl & Tractinsky, 2006
 - Mäkelä & Fulton Suri, 2001
 - Alben, 1996

| 2 UX Definition

- **Non-utilitarian** aspects of interactions
 - shifting to user affect, sensation,
 - shifting to meaning,
 - shifting to values,
 - hedonics, aesthetics and beauty
- Quality of interaction as much **more comprehensive** concept
- Beyond the “traditional” ingredients of quality

| 2 UX-Definition [Alben, 1996]

- *All the aspects of how people use an interactive product: the way **it feels** in their hands, how well they **understand how** it works, how they **feel about it** while they are using it, how well it **serves their purposes**, and how well it **fits into the entire context** in which they are using it*

2 UX-Definition [Hassenzahl & Tractinsky, 2006]

- UX is a consequence of
 - a **user's internal state** (predispositions, expectations, needs, motivation, mood, etc.),
 - the **characteristics of the designed system** (e.g. complexity, purpose, usability, functionality, etc.) and
 - the **context** (or the environment) within which the interaction occurs (e.g. organisational/social setting, meaningfulness of the activity, voluntariness of use, etc.)

2 UX Definition [Hekkert, 2006]

- (...) *the entire set of **effects that are elicited** by the interaction between a user and a product, including the degree to which **all our senses** are gratified (aesthetic experience), the **meanings we attach** to the product (experience of meaning), and the feelings and emotions that are elicited (emotional experience).*

2 Our UX Definition

(Instant) User Experience is defined as the user's sensory, emotional and reflective response to the interaction with a system in a context.

User: Someone who uses or employs something, i.e. the role of a user is defined by the process of interacting with a system.

System (Product/Service): A group of devices or artificial objects that are organized for a purpose.

Context: Context refers to the interrelated conditions in which something exists or occurs.

Interaction: A chain of interdependent actions and reactions between a user and a system.

| 2 UX Definition

[Oppelaar 2008]:

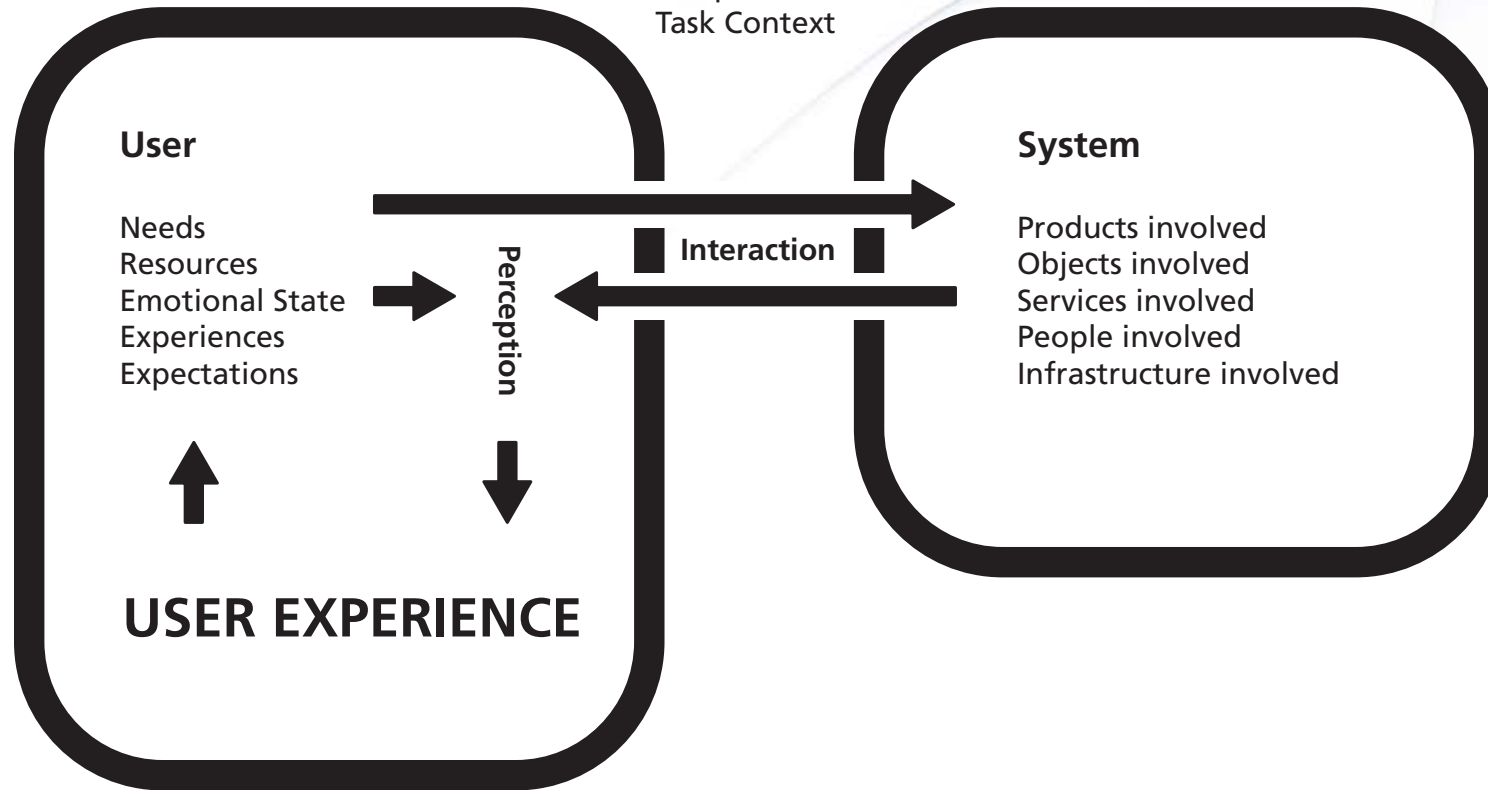
- Experience goes beyond the artefact
- Experience goes behind the actual use
- Experience is a momentum
- Analysis of experience requires multidisciplinary viewpoints
- Experience has a timeframe

2 UX Definition

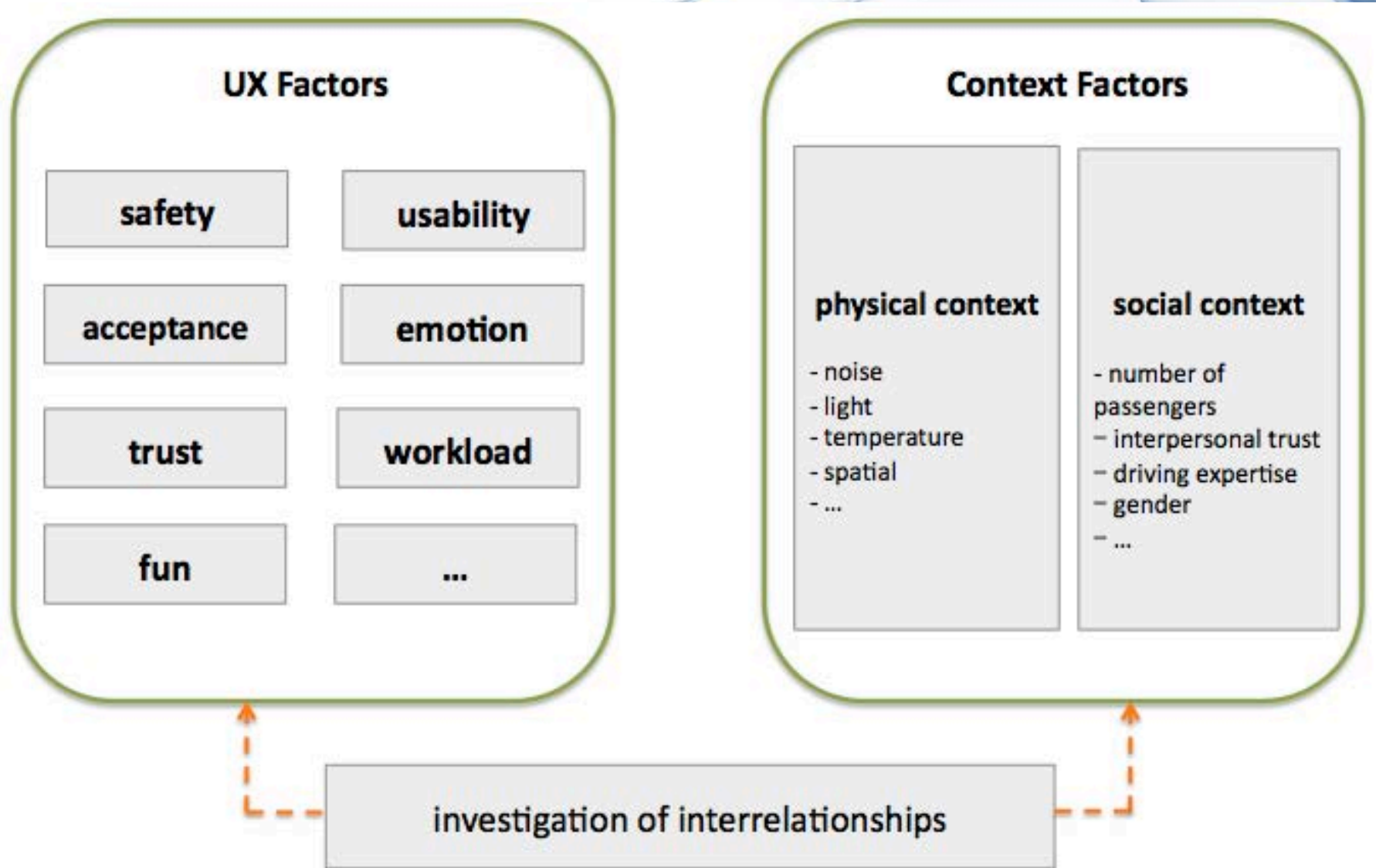
Roto 2006

Context

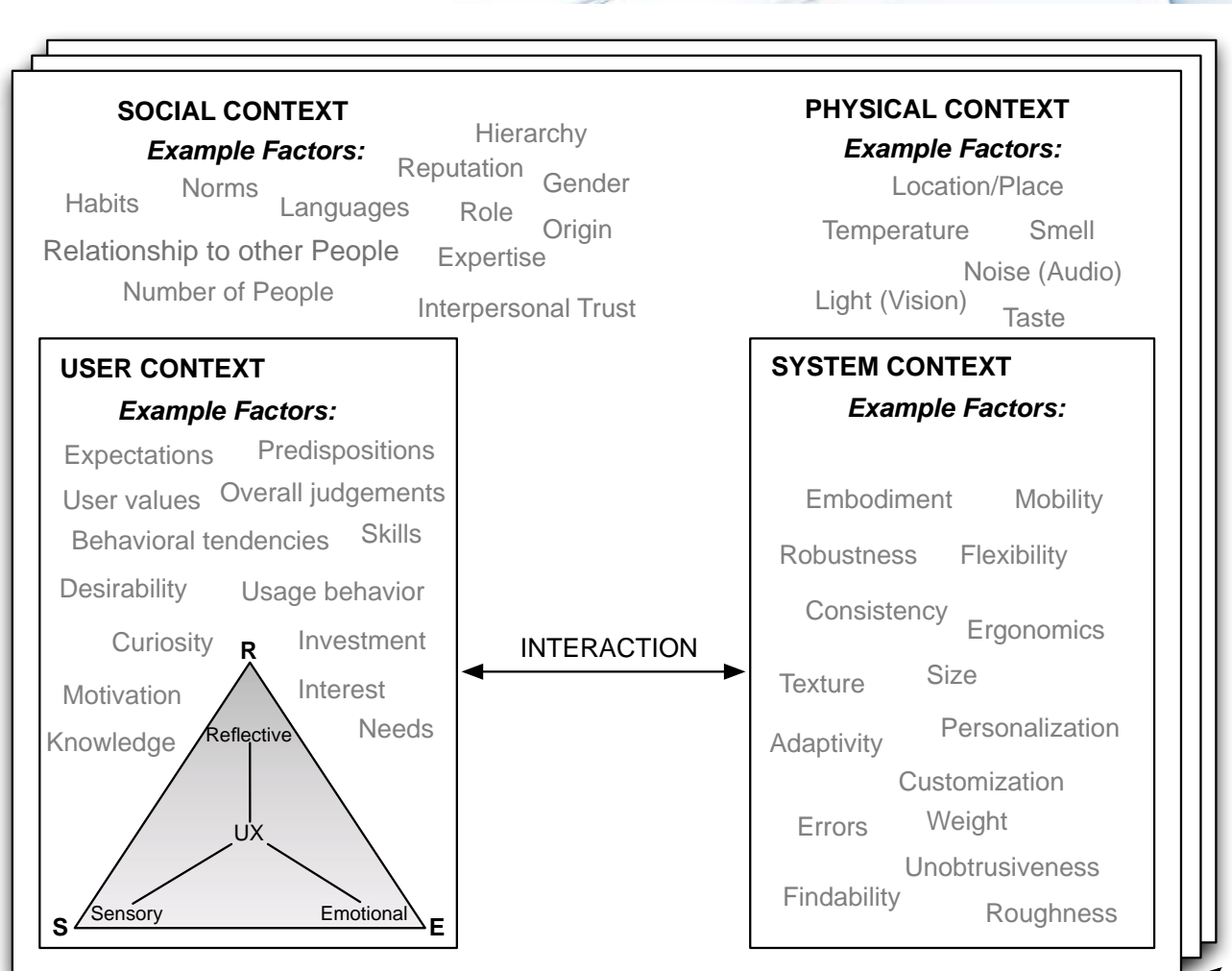
- Physical Context
- Social Context
- Temporal Context
- Task Context



3 Contextual UX

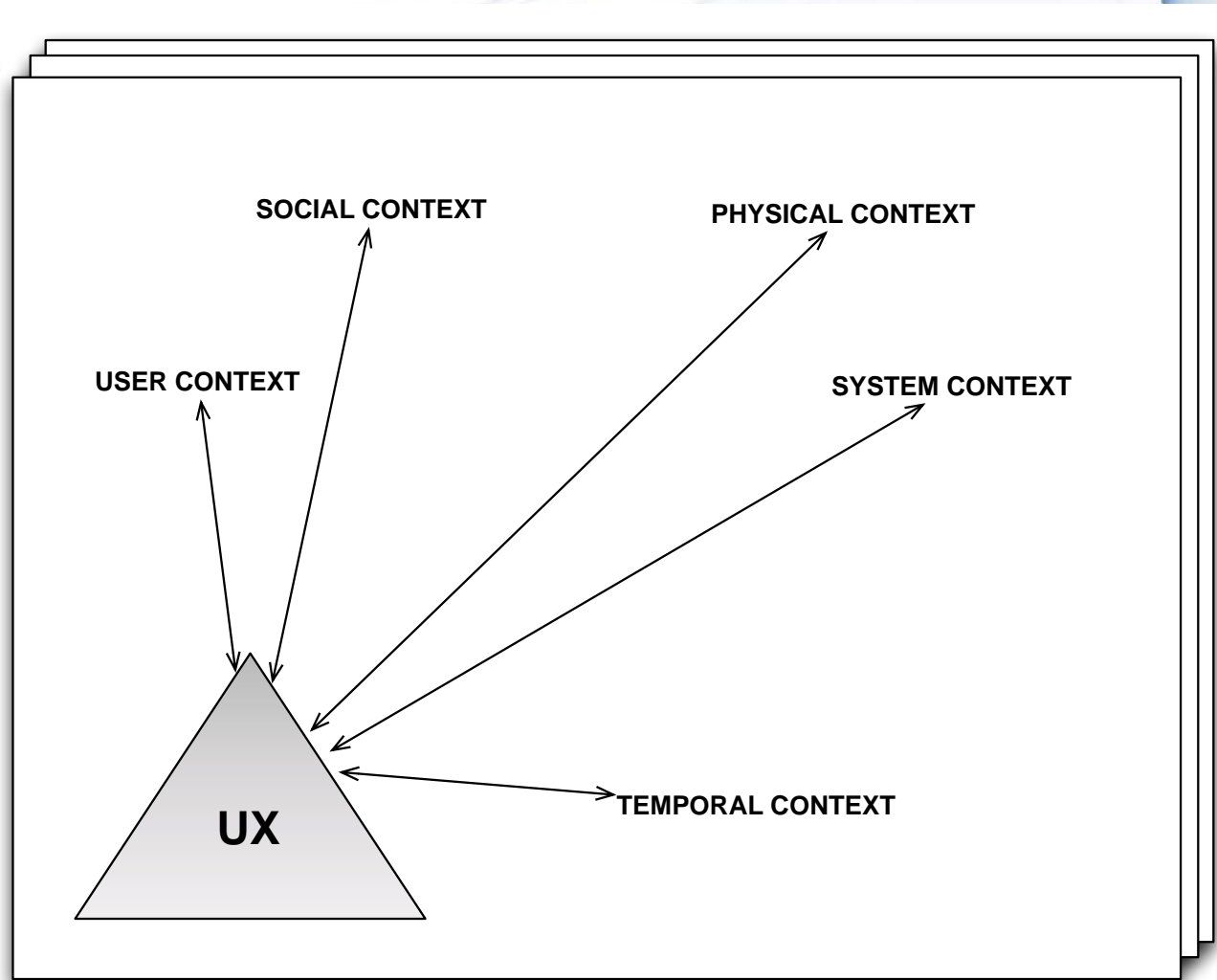


3 Contextual UX



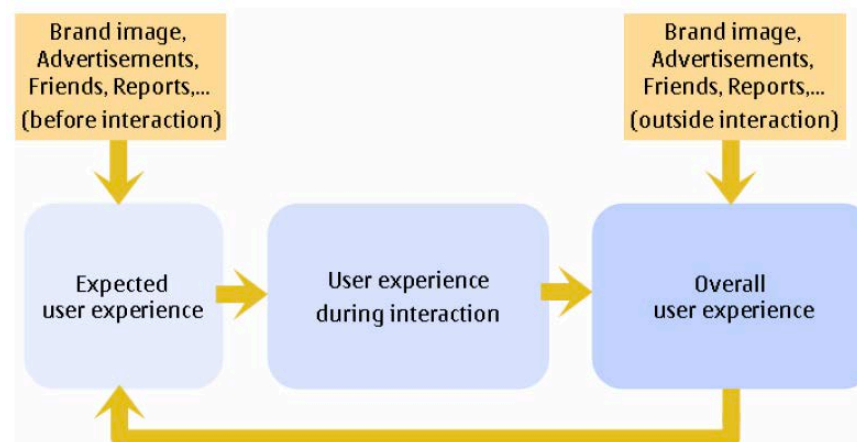
TEMPORAL CONTEXT

3 Contextual UX



4 Temporality of UX

“User experience is the complete experience of a user **before, during** or **after** the use of a product or service, directly caused or changed by this product or service. There are many aspects influencing the user experience, e.g. fulfillment of user needs and desires, usability aspects, emotional aspects of product usage.” [Eggenkamp, 2006]



User Experience Phases
[Roto, 2007]



5 UX Factors

- **Trust**
 - **Sensoric Attitudes / Aesthetics**
 - **Perceived Workload / Stress**
 - **Fun/Enjoyment**
 - **Usability**
 - **User Acceptance**
 - **Co-Experience**
 - **Perceived Safety**
 - **Emotion**
-

5 UX Factors



| 5 Trust

- *Trust is a basic organizing principle of interpersonal exchange relations. It can be described as the problem of **acting without knowing the reaction** of the exchange partner in advance [Leimeister et al (2005)]*
- *Trust is one of the most important social concept that helps human agents to cope with their social environment and is present in all human interaction [Gambetta, 1990]*

5 Trust

Trust exists between a trusting party (**trustor**) and a party to be trusted (**trustee**). The development of trust depends on the ability of the trustee to act in the best interest of the trustor and the degree of trust that the trustor places on the trustee.



| 5 Sensoric Attitudes / Aesthetics

- Everything humans perceive must enter their minds through their senses. Designing for smell, taste, touch, sound and sight is combined in the **term sensorial design** [Shedroff, 2001]
- A deeper **understanding of sensorial attitudes** can result in more intuitive and easy to grasp interfaces by interacting with users in an innovative way
- Parts of the **car as design material**

5 Perceived Workload / Stress

- The **effort invested as a response to a demand** placed on humans, physical and/or mental in nature
- Limited processing capacity theory: human mental **resources are limited** and that their deployment is under voluntary control. The higher the demand, the more resources have to be invested in order to keep the performance stable
- Cause is both **external** (task demand) and **internal** (person specific demand)

5 Fun / Enjoyment

- *Things are fun when they **attract, capture, and hold our attention** by provoking **new or unusual** perceptions, arousing emotions in contexts that typically arouse none, or arousing emotions not typically aroused in a given context. Things are fun when they **surprise** us; when they **don't feel like they look**, when they don't sound like they feel. Things are fun when they present **challenges or puzzles** to us as we try to make sense and construct interpretations [Carroll, 2004].*
- [Brandtzæg et al. (2003)] present three main design implications for designing enjoyable technologies
 1. *User control and participation, with appropriate challenge*
 2. *Variation and multiple opportunities*
 3. *Social opportunities in terms of co- activity and social cohesion*

5 Usability

- ISO 9241-11 (1998) specifies usability as: *The extent to which a product can be used by specified users to achieve specified goals with **effectiveness**, **efficiency** and **satisfaction** in a specified context of use.*
- Therefore it is interesting to find out, for example:
 - Is the system easy to use?
 - Can users quickly learn to use this system?
 - How confident does the user feel while using the system?

5 User Acceptance

- User Acceptance can be defined as “the **demonstrable willingness** within a user group to employ technology for the tasks it is designed to support” [Dillion, 2001]
- Technology Acceptance Model (TAM) [Davis 1989]
 - **Perceived Usefulness**: *the extent to which the individual believes that using a system will enhance his/her job performance*
 - **Perceived Ease of Use**: *the extent to which an individual believes using a system will be free of effort*
 - **Behavioral Intention of Use**: *The intent of the user to use the technology once it is made available*

5 Co-Experience

- *Co-experience is about user experience in **social contexts***
- *Co-experience takes place as experiences are created **together**, or shared with others*
- *Co-experience reveals how the experiences an individual has and the interpretations that are made of them are **influenced by the physical or virtual presence of others***

[Forlizzi & Battarbee, 2004]

5 Perceived Safety

- The perception of humans to what extent one is **safe**; the **perceived level of danger** while using an interactive system
- Design and behaviour of a system can positively influence the perceived safety
- A high level of perceived safety might be desirable in some areas but can also lead to negative effects such as users stop paying sufficient attention when handling dangerous tasks
- Make user aware of the **difference of perceived safety and objective safety** when designing interactive systems

5 Emotion

- The driver's emotional state is an important issue for automotive safety.
- Since emotions **affect perception and action**, they are relevant for traffic participation. A number of driving behaviors are negatively affected by emotions, linking anger or aggression to accidents (see e.g. [Lajunen & Parker, 2001]).
- Relevant emotional states during driving are e.g.,
 - Aggressiveness & Anger
 - Stress
 - Anxiety
 - Sadness
 - Happiness

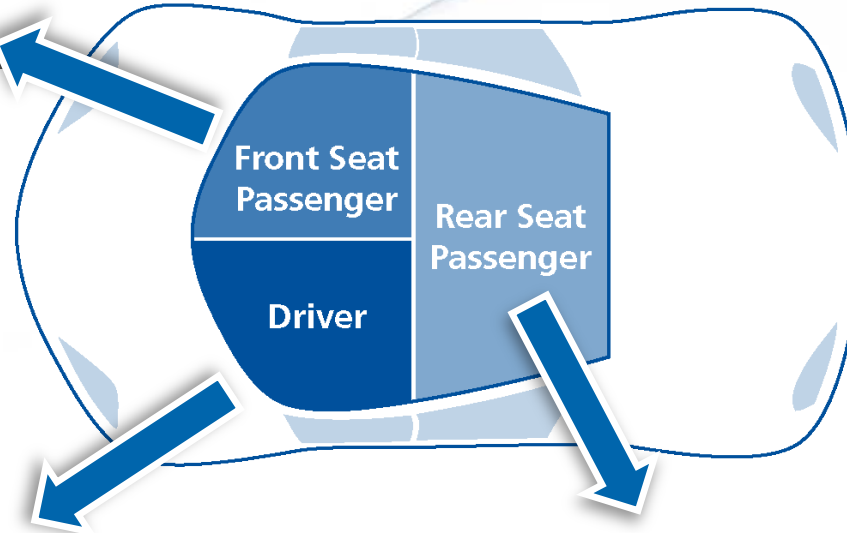
| 6 User Experience in the Car

- Apart from Usability & Usefulness, the Drivers' Experience needs to get into the focus on a more **comprehensive** level
- Focus: How to design cars & in-car systems that provide **positive and desirable experiences** to drivers and passengers?

6 Car Experience Spaces

Front Seat Passenger Experience

„source of both assistance & distraction“



Driver Experience

„area of a variety of safety-critical interactions“

Rear Seat Passenger Experience

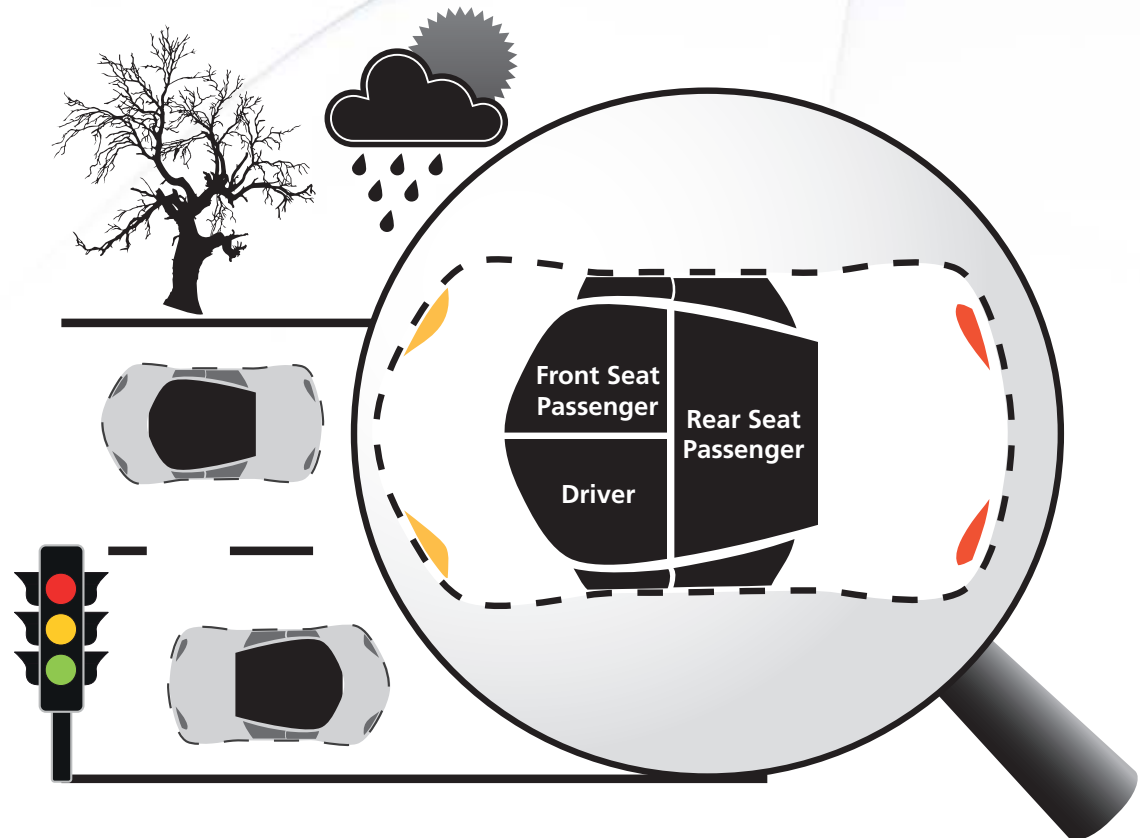
„included towards a holistic picture of the cabin“

6 Car Experience Spaces

Context

Car is highly linked to context around it

Understanding of context factors is important to understand experiences



7 Investigating Car UX

- **Lab Studies**
 - Highly controllable
 - Reduced realism
- **In-Situ Studies**
 - Researcher present (e.g., Ethnography, Contextual Inquiry)
 - High effort, safety issues
 - High realism, natural surrounding
- **Remote In-Situ Studies**
 - Researcher not present (e.g., ESM, Video Ethnography)
 - Mostly technology supported
 - Danger of missing relevant “real” experiences

7 Investigating Car UX

- **The Dangerous Car**
 - How can we avoid that somebody gets harmed during a study?
 - Safe integration of equipment, unobtrusive observation
- **Limited Space**
 - Limited space to include researcher and/or equipment
 - Intrusion into the social space
- **The Moving Car**
 - Changing environmental conditions (light, noise, ...)
 - High effort travelling for researcher



8 Example Studies (1)

- **[Leshed et al (2008)]: In-car gps navigation: engagement with and disengagement from the environment**
- **Ethnographically-informed study with GPS users**
- **Found evidence for practices of disengagement of users with their environment.**
 - **You no longer need to know where you are and where your destination is, attend to physical landmarks along the way, or get assistance from other people in the car and outside of it.**
- **Also found opportunities**
 - **Discovering invisible landmarks, exploring previously unknown areas thanks to a new sense of security**

8 Example Studies (2)

- Automotive HMI Test (under publication): Audi MMI, BMW iDrive, Mercedes COMAND
- Video Summary available online (german): http://www.youtu.be/GqTu1_pDxxs



8 Example Studies (3)

- [Meschtscherjakov et al (2009)]:
Acceptance of future persuasive in-car interfaces towards a more economic driving behavior.
- Evaluate future eco-friendly interfaces towards their user acceptance
- Online Survey based on TAM (+added questions towards disturbance, security risks, suitability)
- Results: Augmentation of existing interfaces was most accepted (e.g. eco speedometer)



8 Example Studies (4)

- [Knobel et al. (2012)]: *Clique Trip*: feeling related in different cars
- **Stress the importance of creating relatedness experiences when travelling in different cars to the same destination**
- **Conducted a case study:**
 - Addressed analysis, design, and evaluation of the experience regarding the Clique Trip prototype
 - Insights were derived from experience reports, implemented in the car and evaluated on the road.
- **Demonstrated how they designed for a positive social experience in the automotive context to evoke a feeling of relatedness and closeness while driving**

8 Example Studies (5)

- [Harris & Nass (2011)]: *Emotion regulation for frustrating driving contexts*
 - Negative emotional states – e.g., through frustrating events – are dangerous during driving
 - Examined effects of cognitively reframing frustrating events
 - Task: navigate a challenging driving course that included frustrating events such as long lights and being cut-off (N=36)
 - 3 conditions:
 - *Reappraisal-down: voice prompts that should deflate negative reactions*
 - *Reappraisal-up: voice prompts that brought attention to the negative actions of vehicles and pedestrians*
 - *Silent: no voice prompts*
 - **Result: Participants in the reappraisal-down condition had better driving behavior and reported less negative emotions**
- Lowering frustration on the road could be done by changing cognitions immediately after frustrating events

8 Example Studies (6)

- [Inbar & Tractinsky (2011)]: *Make a Trip an Experience: Sharing In-Car Information with Passengers*
- **Suggest to involve passengers in the handling of in-vehicle information systems (IVIS)**
 - also consider needs of passengers and their potential contribution as additional information handlers who buffer the driver from information overload
- **Benefits:**
 - For passengers: reduced boredom, increased trust, a sense of inclusion
 - For drivers: less distraction and reduced information load

5 Example Studies (7)

- [Eckoldt et al. (2012)]: *An Experiential Perspective on Advanced Driver Assistance Systems.*
- **Stresses the experiential perspective in the automotive domain**
- **Study on advanced driver assistance systems (ADAS)**
 - **How do ADAS impact people's driving experience?**
 - **Results show that there is a difference in the usage of ADAS with regard to “joy of driving” and “joy while driving”:**
 - ADAS are perceived rather negatively when „joy of driving“ is in the fore, as this is related to a feeling of mastery and control over the car.
 - ADAS are perceived rather positively when „joy while driving“ is in the fore, as this stems from aspects beyond driving, e.g., through a stimulating landscape or through feeling related to others inside or outside the car.

9 Summary

- **User Experience is a comprehensive concept which needs comprehensive consideration**
- **There are relations between factors**
- **There is a temporal dimension**
- **There is a contextual dimension**
- **UX insights in some domains not necessarily hold also in the car context**
- **More studies are needed to get a bigger picture (still fragmented)**

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