Chapter 5: Qualitative Research Approach

5.1 Chapter Objectives

According to the research design, the overall aim of this chapter is to develop concepts that are involved in the individual belief formation towards the use of Advanced Driver-Assistance Systems. These concepts constitute the basis for the construction of a quantitative questionnaire; thus, they should be:

- As complete as possible, covering all sorts of affective and cognitive, conscious and unconscious, favourable and unfavourable beliefs towards ADAS technology;
- Clearly described, mutually exclusive and exhaustive, with as little overlap as possible;
- Directly based on the interview response with a clear and reproducible reference.

It is clearly not the objective of this particular chapter to report on the significance and impact of these concepts or on their potential interrelation and cause-and-effect relationship. Rather, this chapter aims at a holistic collection of potential individual beliefs towards the acceptance decision, which can at a later stage be used in order to construct an explanative model based on representative empirical results.

5.2 Interview Types

The general aim of an interview is to reconstruct subjective theories, or in other words, to elicit the complex stock of knowledge an individual has about the topic under study (Flick, 2010, p.156). Unlike standardised surveys, which generate quantitative, measurable results, interviews generally deliver an extensive amount of verbal data or transcribed text. Another distinctive feature of interviews is that they have to be conducted in person, usually in a one-to-one setting. According to Webb (2002, p.71) interviews can be classified by their degree of structure and directness. Structure represents the amount of freedom that the interviewer has to change the content or order of questions, while directness refers to the amount of awareness the respondent has about the nature and purpose of the study. Completely structured or completely unstructured interviews are rather rare; most interviews involve some kind of structure around which the

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interviewer has considerable freedom to follow the thoughts of the interviewee (Robson, 2009, p.279).

Qualitative research has developed a number of specialised interview types, each with different characteristics and objectives. In research scenarios that focus on specialist knowledge, the *Expert Interview* is used to develop insights on a specific topic. In research scenarios interested in biographic aspects, the *Narrative Interview*, developed by Schütze (1983), is used to motivate the respondent to explain his or her thoughts in a storytelling form. The *Problem Centred Interview*, developed by Witzel (1982), combines a relatively strict contextual focus with a relatively open questioning approach. An overview of the different characteristics of interview types can be found in Table 12.

Table 12: Characteristics of interview types, Source: Based on Flick (2010, p.212)

Criteria	**Standardised Interview**	**Semi-Standardised Interview**	**Expert Interview**	**Narrative Interview**	**Problem-Centred Interview**
Openness to the interviewee's subjective view by:	Structured questions	Open questions	Limited because only interested in the expert, not the person	Non-influencing of narratives once started	Object and process orientation, room for narratives
Structuring (e.g. deepening) the issue by:	Structured questions	Hypothesis-directed questions, Confrontational questions	Interview guide as instrument for structuring	Generative narrative questions, Narrative questioning at the end	Interview guide as basis for turns and ending unproductive presentations
Domain of application	Confirming hypotheses	Reconstruction of subjective theories	Expert knowledge in institutions	Biographical courses	Socially or biographically relevant problems
Problems in conducting the method	Missing the subjective view of participants	Extensive methodological input, problems of interpretations	Role diffusion of the interviewee, blocking by the expert	Unilateral interview situation, problematic to develop pressure	Unsystematic change from narrative to question-answer schema
Limitations of the method	Assumption of knowing objective features of the object is questionable	Introducing structure, need to adopt the method to the issue and the interviewee	Interpretability of expert knowledge	Assumed analogy of experience and narrative, reducing the object to what can be recounted	Problem orientation, unsystematic combination of most diverse partial elements

Generally, the most appropriate way to choose an interview type for a given research topic is to start with the research objectives and develop an interview

form that enables the researcher to fulfil these objectives most efficiently (Flick, 2010, p.211).

5.3 Decision on Interview Type

One of the aims in this part of the qualitative research is to collect salient beliefs pertaining to the use of ADAS technology. Literature research indicates that some questions will be necessary to elicit readily accessible beliefs towards a technology (Keeling, 1999, p.16). Thus, a completely unstructured interview will not be applicable in this case. At the same time, it is expected that the acceptance or resistance decision towards ADAS technology involves multiple complex and interconnected aspects of subjective and emotional elements. Consequently, the respondents as well as the interviewer should be as free as possible to follow their thoughts. An open discussion increases the possibility of revealing subliminal and subconscious beliefs, which respondents might not have been aware of beforehand.

Based on the literature review the author concludes that semi-structured interviews provide the best research solution for the given research objectives, leaving it to the interviewer to elaborate the respondent's answers and to vary the sequence of questions. In terms of directness, the interviews will honestly convey the main purpose of the research in advance, thus being rather direct by openly approaching the research topic. Chart 22 shows the two-dimensional characteristics-model of interviewing and classifies the chosen interview-type.

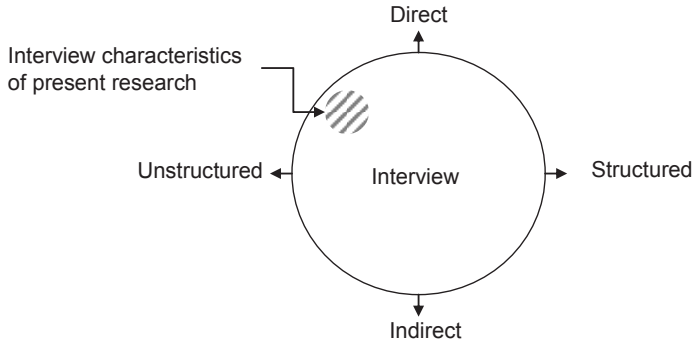

Chart 22: Interview characteristics, Source: Own drawing, based on Flick (2010, p.156)

This interview type will provide the following advantages in regard to the research objectives for the present study:

- Rather open questions concerning the advantages and disadvantages associated with ADAS technology will lead to a mutual discussion that helps to elicit subconscious beliefs
- The possibility of rephrasing and asking follow-up questions on a response will help the interviewer to focus on the relevant topics in relation to the research objectives
- By applying prompts and other techniques of active listening, the interviewer can assist the interviewees to fully develop their own trains of thought (Flick, 2010, p.172).
- By establishing an open dialogue, the interviewer creates mutual trust and thus the interviewee is expected to answer more openly, honestly and precisely than on a standard interview scheme (Mayring, 2002b, p.69).

5.4 Interview Design

In general, interviews should not be conducted with an *a priori* theoretical schema in mind. Hirschman (1986) argues that the researcher should be "interested in learning the group's construction of reality and how possessions, purchasing, apparel, automobiles and leisure time activities fit into that reality". The interviewer has to be aware that in a mutual interactive interview the values and beliefs of the interviewer may be projected on the respondent. Thus, when designing semi-structured interviews, it is important to concentrate on the research objectives and how these objectives can be achieved, avoiding any researcher bias.

According to Robson (2009, p.274) the basic contents of an interview are a set of items (usually questions), often with alternative subsequent items depending on the responses obtained. Furthermore, an interview design should contain a proposed sequence for the questions (which in a semi-structured interview may be subject to change) and suggestions for so-called probes and prompts. A probe is a method to get interviewees to expand on a response where the interviewer beliefs that they have more to say. There are various techniques for constructing probes. Mostly applied are short periods of silence or a short “mmhhmm” to stimulate another response. Alternatively, the interviewer might be prepared with probe sentences in advance (Zikmund and Babin, 2007, p.354).

As a starting point, it is important to make a short self-introduction. As a warm-up and motivator for the following interview, the interviewer should tell the respondent something about himself – his background and the reason for his interest in the area of enquiry. Flick remarks that it is essential to create a good atmosphere in this early phase of the interview and to give room to allow the interviewees to open up (Flick, 2010, p.172). According to Robson (2009, p.279) the interviewer should further use the introduction phase to:

- Explain the purpose and nature of the research
- Explain why the interviewee was selected for the interview
- Give the interviewee assurance the all responses will remain anonymous.

Following this initial phase, the topic is usually introduced by an open question followed by more theory-driven, hypotheses-directed questions (Flick, 2010, p.157). These questions are aimed at making the interviewer's implicit knowledge (derived from scientific literature about the research subject) more explicit by testing assumptions. In semi-structured interviews, "interviewers have their shopping list of topics and want to get responses to them, but they have considerable freedom in the sequence of questions, in their exact wording, and in the amount of time and attention given to different topics"(Robson, 2009, p.279). Researchers have the possibility to deepen their understanding of interesting aspects and develop a certain structure around their research problem. By responding to thoughts, emotions and beliefs, the interviewer also creates empathy with the interviewee, which helps to maintain an open and honest atmosphere during the interview (Mayring, 2002a, p.69).

It is common to have some more structured parts, for example to obtain some standard factual biographical material at the beginning or at the end of the interview. A strategy suggested by Robson (2009, p.279) was followed by providing the interviewer with a series of cards, each with another topic and the associated questions to it. Responses to all questions were immediately judged by the interviewer for being sufficiently elaborate and the interviewer deepened his understanding by asking follow-up questions as needed. It is important, however, that these questions do not unintentionally lead the interviewee in a certain direction but only give the interviewee the chance to follow his or her thoughts. Generally, theoretical concepts should not be developed during the interview;

instead, the interviewer should discover the life world of the interviewee (Flick, 2010, p.172).

5.5 Development of the Interviewer Questions

For the purpose of the present research, the interviews were aimed at eliciting pre-existing evaluations and beliefs that are persistent in the interviewee's subconscious decision-making process towards the acceptance of ADAS. The simplest and most direct procedure to achieve this goal is by asking respondents to name the advantages and disadvantages they associate with the technology in question. The first five to nine beliefs disclosed are readily accessible in memory and are therefore likely to serve as the primary determinants of attitudes towards the behaviour under investigation (Fishbein and Ajzen, 2010, p.100). In a second step, the interviewers prepared a list of more specific questions, each aimed at a feature of Driver Assistance-Systems, such as Lane-Keeping or Automated Cruise Control. These questions were asked if the conversation has not touched this topic so far during the interview (alternative subsequent items). Finally, as recommended by Flick (2010, p.157), the interview ended up with confrontational questions, each centred at the interviewee's reaction to the possibility of completely autonomous driving or legislative enforcement of ADAS usage. Autonomous driving represents an extreme form of a driver-assistance system. Thus it is expected that the prospect of giving up complete control raises extreme reactions, which might inspire further discussion. Also the prospect of legislative enforcement of ADAS usage might raise scepticism about the usefulness of driver assistance systems, especially for those respondents who indicated that they would not consider buying such a system.

Even though the exact formulation of questions might be subject to change in semi-structured interviews, some important aspects concerning the question quality have to be considered beforehand. First of all, it is important that the requirements imposed by each question must be in accordance to the respondent's capabilities (Zikmund and Babin, 2007, p.353). Any form of imposition and stress can negatively influence the interview atmosphere and thus can decrease the respondent's motivation. Moreover, the interviewer must be aware of the effects of choosing the right question wording. Generally, questions should be asked using everyday language and formulations that are not too complex (Faulbaum, Prüfer and Rexroth, 2009, pp.58–63).

Chart 23 gives an overview of the final interview design that was followed in the curse of the present research:

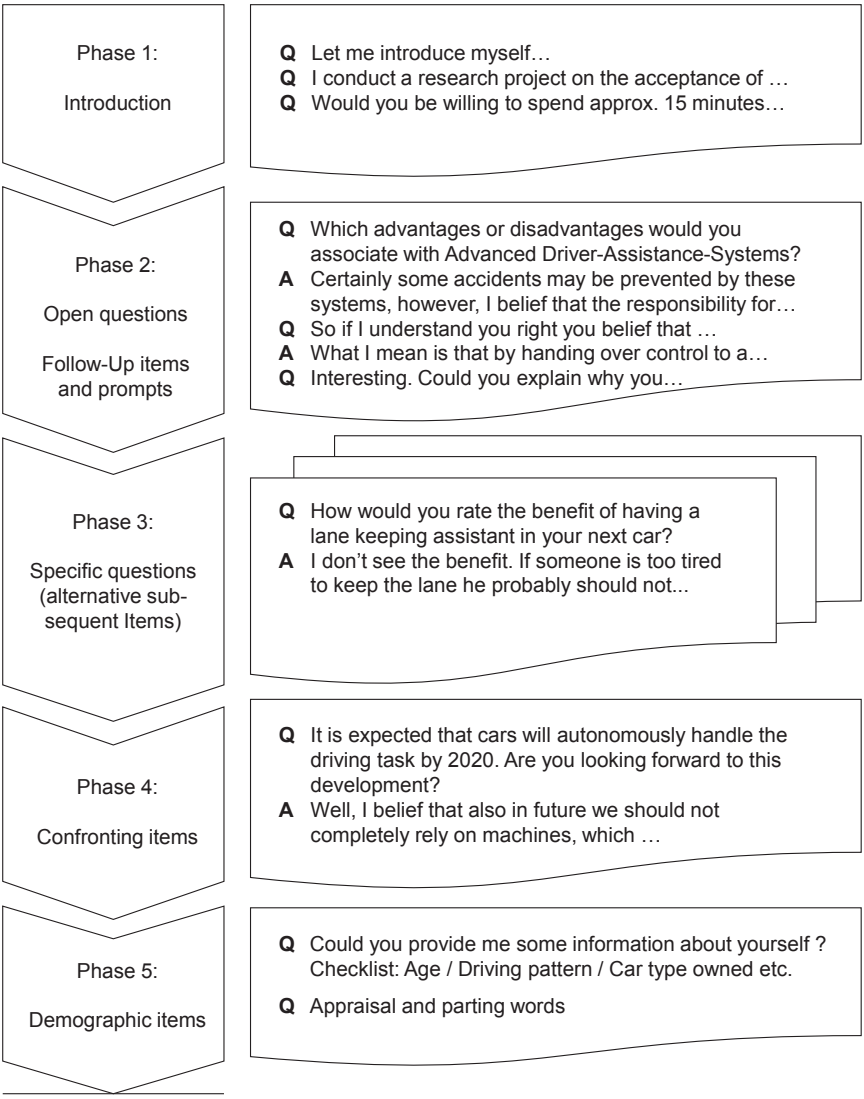

Chart 23: Interview Design Phase Model, Source: Own drawing

The given interview design was pre-tested in interview situations with a group of students. The advantage of pre-testing is that the interview process and content can be elaborated in a more relaxed atmosphere and the interviewers can become accustomed to the situation (Chenail, 2011, p.257). The final interviews were conducted independently by the author and two research assistants in June 2011. Flick (2010, p.391) argues that by having different interviewers conducting the same interview scheme, objectivity can be increased and potential interviewer bias can be reduced.

5.6 Development of the Interviewer Guide

Especially when having different interviewers, a standardised interviewer guide has to be developed in order to ensure a consistent administration of the interviews in any case. Even though standardised, an interviewer guide for semi-structured interviews is "much less specific than the notion of a structured interview schedule" (Bryman and Bell, 2007, p.482). Instead it is usually a list of memory prompts or areas to be covered, giving the interviewer the maximum possibility to follow the participant's thoughts, while offering enough structure to guide the interviewers along the topics that have to be addressed. Based on this, an interviewer guide was developed containing the relevant lead questions and items, the question objectives and their references. The complete interviewer guide can be found in Table 13.

Table 13: Interview guide

Category/ Item	Objective	Reference
1 Introduction		
• Explaining the background of the present research project	Connecting to the interviewee. Creating awareness and attention. Creating the necessary empathy for conducting the interview	Flick, 2010, p.172; Mayring, 2002a, p.69.
• Explaining the reason for the present interview and the approximate required interview duration – 15 minutes	Clarification of interview objectives	Lamnek and Krell, 2010, p.307
• Explaining information on consent form, especially: o participation is voluntary o the interview can be stopped at any time o all personal information will be kept confidential o the interview will be taped and later transcribed o the transcript will remain anonymous o The results of this interview will be published as part of a PhD thesis	Compliance with the ethical standards of scientific research	Robson, 2009, p.279
• Asking for consent to conduct the interview	Approval for conducting the interview	
• Explaining what Advanced Driver-Assistance Systems (ADAS) are, naming some examples, such as Lane Departure Assistance, Automatic Cruise Control or Blind Spot Monitoring.	Assuring that the respondent is aware of what the interviewer wants to ask him about (Corresponding to the Problem-Centered Interview).	Flick, 2010, p.161
• Asking for the level of experience with Driver-Assistance Systems. Have these systems already been purchased or experienced on other cars (rental car etc.)? Are these systems known from advertising or other information sources?	Elicit the individual's status in Rogers' phase model of innovation acceptance (1) Knowledge, (2) Persuasion, (3) Decision, (4) Implementation, (5) Confirmation.	Rogers, 2003, p.170
2 Open questions		
• Please list advantages and/or disadvantages of Driver-Assistance Systems in your opinion?	Elicit the readily accessible beliefs regarding Advanced Driver-Assistance Systems. The respondent should have sufficient time to deeply reflect on this question. If necessary, prompts should be applied to further elaborate on this question until all potential beliefs are elicited.	Fishbein and Ajzen, 2010, pp.96–97
• What are your expectations concerning the functionality of these systems?	Additional question to further reflect about the advantages of ADAS	Fishbein and Ajzen, 2010, p.289; Rogers, 2003, p.15
• Do you see risks using these systems?	Additional question to further reflect about the disadvantages of ADAS	
If the respondent has already used these systems: • Have your expectations concerning ADAS been fulfilled in the past? • Have you made positive and / or negative experiences with Driver-Assistance Systems in the past?	The influence of past experiences on the acceptance of this technology	Sattabusaya, 2008, p.58

3 Specific questions		
• Which Driver-Assistance System would you consider to buy next and why?	Basis for the following question-sequence.	
The following question-sequence should be applied for each assistance system the respondent has named so far.	Deepen the understanding of one specific assistance-system	
• Which specific advantages do you see in using this system?	Elicit the individual beliefs towards the specific system	
• Would you pay a price premium for having this system in your next car?	Elicit the relevance of costs of the acceptance decision	
• In which situations would you expect this system to be beneficial for you?	Reflection on the perceived usefulness of Advanced Driver-Assistance Systems in different driving situations.	Davis, Bagozzi and Warshaw, 1989, p.320
• How would you feel driving with this system?	Elicit affective responses in relation to Advanced Driver-Assistance System usage	Chtourou and Souiden, 2010, p.340
• Would you drive differently when this system is activated?	Influence of Advanced Driver-Assistance Systems on driving behaviour	
4 Confronting questions		Flick, 2010, p.157
• It is expected that cars will autonomously handle the driving task by 2020. Are you looking forward to this development?	Autonomous driving represents an extreme form of driver-assistance system development. It is expected that the prospect of giving up complete control will raise extreme reactions, which might inspire a further discussion	
• Since 2012, Electronic Stability Program (ESP) is mandatory for all new cars in the EU. Other assistance systems may become mandatory soon, too. What do you think of this development?	The prospect of legislative enforcement might raise scepticism about the usefulness of driver assistance systems, especially for respondents who would not consider buying such a system. Thus this question might also inspire a further discussion on the usefulness of ADAS.	
• Studies confirm that more than 50 percent of all accidents could be prevented with ADAS. Don't you believe that this could be a beneficial development for the society?	This question confronts the respondent with the moral concern of creating a benefit for the common public by using these systems. Thus it is expected that the respondent will reflect on whether or not he or she sees a moral obligation to use such a system.	
5 Demographic items		
Questions: • Type of car • Used/ New-car customer • Car age • Annual distance travelled by car Documentation: • Date of interview • Place of interview • Participant gender		
6 Appraisal for participation		

5.7 Defining a Recording Concept

Since the given interview design was expected to result in a considerable amount of verbal content, the need for an efficient documentation system has emerged. The interview responses have to be recorded in a way that enables the researcher to analyse the content at any later point of the project without any loss of meaning (Flick, 2010, p.294). Consequently the author decided to use an audio-taping system, digitally recording the interview discussion and allowing for a loss-free reproduction of the interview audio track at any time. The author consciously refrained from taping any visual data, since literature suggests that compared to audio taping, video taping has an irritating effect on respondents and thus might impede them from opening up (Lamnek, 2005, p.393). An additional protocol was kept for the documentation of observed behavioural changes and emphases made and for remembering the main topics discussed so far in order to choose the right subsequent questions.

5.8 Defining a Sample Size

According to Marshall (1996, p.523) "an appropriate sample size for a qualitative study is one that adequately answers the research questions". In principle there are different ways of deriving a group of interview participants. In statistical or probability sampling, individuals are put together according to certain (e.g. demographic) criteria in order to arrive at a sample that represents the research object's typicality as well as possible (Flick, 2010, p.117). In contemporary qualitative research, nonprobability sampling, however, has become more and more common. In theoretical sampling, the most common form of nonprobability sampling, decisions about choosing and putting research objects together are made in the process of collecting and interpreting data. The process of data collection is controlled by the emerging theory (Patton and Patton, 2002, p.230). Usually certain individuals are selected according to their expected level of new insights for the developing theory (Flick, 2010, p.118). The qualitative literature recognizes that some respondents are richer informants than others and that these people are more likely to provide an insight and an understanding for the researcher (Marshall, 1996, p.523). The criteria that define a valuable participant from the perspective of the research objectives have to be estimated *a priori*, based on the literature, and are refined in the course of the ongoing interviews.

The overall size of the sample is also defined by criteria in relation to the emerging theory. An *a priori* estimation of the number of participants needed to reach saturation in a qualitative study is almost impossible, since it depends on various factors such as the scope of the study, the nature of the topic, the quality of the data and the research method (Robson, 2009, p.199). Usually the key question is how promising the next case is and how relevant it might be for developing the theory. Based on Glaser and Strauss (1967, p.45) this criterion is named "theoretical saturation". According to this theory, the number of participants needed for interviews usually becomes evident as the study progresses, as new beliefs, categories and values stop emerging and thus data saturation is achieved (Robson, 2009, p.199). This requires a flexible research design and an iterative approach to sampling. In general, the qualitative literature suggests that the sample variation is more important than the overall sample size (Kleining, 2007, p.200). Consequently, a small well-chosen sample might be more appropriate than large-scale random sampling for the purpose of the present study at this point of the research.

5.9 Interview Participants

In order to find individuals providing an insight and an understanding for the research objectives, the author decided to visit automobile dealerships of different car brands in different cities. This approach provides the advantage that mainly car drivers, who are in the decision phase towards the purchase of a new automobile, will be part of the sample. It is expected that new car shoppers will have more elaborated beliefs towards the potential equipment of their next car and thus are more valuable as interview partners. It is further expected that these individuals are more open to give their opinions on ADAS technology in the atmosphere of an automobile dealership. Moreover, waiting times are quite common in this environment, so it was expected that respondents would have the necessary time to take part in the interviews.

In order to increase the sample heterogeneity, different car dealerships in different cities were selected and interviews were conducted at different times of the day. It was expected that customers of car brands that already offer a wide range of ADAS equipment have already formed more beliefs about this technology. Thus, following a market analysis, dealerships of the brands Mercedes-Benz, Audi, Volkswagen and BMW were chosen as interview spots. Most of these dealerships, however, also offered lower priced brands such as Smart, Mini or

Skoda, whose customers were consequently also part of the research. The local dealership management of these branches supported the research by offering office space for the interviews. Consequently it was possible to conduct the interviews in office spaces usually dedicated to sales conversations and thereby generate an atmosphere as close as possible to the situation when a new car is sold. It was expected that this atmosphere would help the interviewees to most openly reflect on the possibility of having driver assistance systems as extra equipment in their next car. In order to further increase the heterogeneity of the sample, some interviews were also conducted on a university campus. Students are expected to have less experience with ADAS technology but are generally expected to have a higher level of affinity towards innovations (Waycotta et al., 2010, p.1208). Thus their individual beliefs might be valuable for the later stages of the present research.

All interviewees were asked to consent to a fifteen-minute interview, which was an estimated average duration. One of the shortcomings of non-standardised interviews is that an *a priori* estimation of the overall interview duration is not possible. Literature suggests an average duration of approximately twenty minutes, which might change considerably depending on the context and interview setting (Lamnek and Krell, 2010, p.307). In the course of the present research project the interview duration was tested during the pilot phase and the result – between fifteen and twenty minutes – was used for the final consent information for all respondents. In sum, thirty-two interviews were conducted, nine of which took place at a Mercedes-Benz and Smart dealership, eight at a BMW and Mini dealership, seven at a VW and Skoda dealership and, finally, eight at the Pforzheim University campus. There were no further selection criteria on gender, age or social status of the participants. It turned out, however, that males were over-represented with a three to one ratio, which is attributed to the fact that two-thirds of car owners in Germany are male (ACE, 2010). The distribution of car segments among the interviewees (categorized into small-, medium- and large-sized cars) was equally balanced in the sample. Chart 24 shows the distribution of selected demographic variables within the chosen interview sample.

Selected demographic variables of interview participants

Interview Location:	Interview Participants	Sample Percentage
Mercedes-Benz and Smart dealership	9	28%
BMW and Mini dealership	8	25%
Volkswagen and Skoda dealership	7	22%
Pforzheim University Campus	8	25%

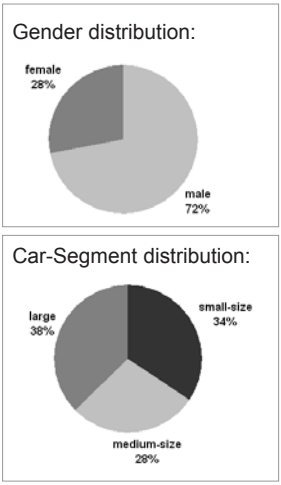

Chart 24: Demographic distribution of interview participants, Source: Own drawing.

It has to be acknowledged that the theoretical sampling approach applied in the present research also conveys some risks. Generally, this approach has the limitation that the sample might be biased due to the pre-selection of participants. In order to minimise this threat, the author visited different car dealerships, in different locations, at different times and chose participants within the selected location at random.

5.10 Transcription

Transcription means the conversion of spoken material into textual data, which in general implies a reduction of audio/visual data into a written form (Höld, 2009, p.657; Mayring, 2002a, p.89). This process is necessary for virtually all analysis techniques in qualitative research and lays the foundation for the further elaboration of the material (Kowal and O´Connell, 2009, p.438). A transcript enables the researcher to develop a reproducible interpretation which is later available for critical appraisal and thus offers a high level of methodical validity (Lamnek and Krell, 2010, p.356). Even though there are no widely accepted standards for transcription, certain general rules have emerged persistently in the literature (Robson, 2009, p.456). In general, transcription aims at the maximum exactness in classifying and presenting statements. In qualitative research, however, the question of appropriateness for the given research process has become

more important. In order to judge the appropriateness of a transcription method, a variety of criteria were developed, such as manageability, readability, learnability and interpretability. Some of the most important general guidelines for generating transcriptions include leaving enough space in the left and right margins for notes, using line numbers for reference and employing standardised conventions for the whole text (Flick, 2010, pp.300–305). Consequently, ample space was left in the margins to permit the author to annotate the transcripts.

For the purpose of the present research, the interviews were first recorded on tape, and along with field notes made during the interview, were later transcribed into written verbal data. Nonverbal aspects, such as pauses, pitch or facial expressions, were neglected for the transcription, since this surplus of information was judged as not appropriate for the later analysis in regard to the research objectives. Moreover, the interviews were transcribed in German standard orthography, meaning that verbal colloquial expressions were transformed into written standard German expressions. The sequence of dialogue items was transcribed line-by-line in descending order, representing the chronology of the interview. The change of speaker from interviewer to interviewee was clearly marked and transcribed into a new passage. In sum, the resulting transcription convention is in line with Flick, who denotes that “a transcription system should be easy to write, easy to read, easy to learn and easy to search“ (Flick, 2010, p.300).
The amount of verbal data produced in this way is expected to be substantial, thus methods of reduction will be necessary. The first step for simplification of material or data is to select the part of data that covers the topic relevant for the research objective. Thus, for most interviews, the author reduced Phase 1 (Introduction) from the transcript if it was not directly directed at the research objectives. Also, any off-topic conversation, not related to ADAS usage, was reduced, leaving a richer content for further analysis.

Using these techniques, the overall volume of transcripts can be reduced without changing the underlying meaning of the text. It has to be acknowledged, however, that any reduction of the volume of text affects what finally constitutes data for the purpose of the research and thus may have an influence on the research findings (Dey, 1998, p.16).

5.11 Qualitative Data Analysis

The aim of qualitative data analysis is to describe the world as it is perceived by different observers (Dey, 1998, p.36). Robson (2009, p.456) remarks that "there is no clear and accepted single set of conventions for analysis [of qualitative data] corresponding to those observed with quantitative data". However, there are ways in which qualitative data can be dealt with systematically.

Three basic methodologies of content analysis are suggested by the literature, which have to be regarded as supplementary rather than competing strategies:

Summarizing Content Analysis
In Summarizing Content Analysis, the text is paraphrased and less relevant passages and paraphrases with the same meaning are skipped (first reduction). Then similar paraphrases are grouped and summarized (second reduction). The result of this content analysis is a text on a higher level of abstraction.

Explicative Content Analysis
Explicative Content Analysis is aimed at clarifying unclear, diffuse or ambiguous passages by involving text from either inside the text (narrow context analysis) or from external material (wide context analysis). On this basis, explicating paraphrases are formulated and tested,

Structuring Content Analysis
Finally, the paraphrased text can be restructured in such a way that the internal structure of the text helps in explaining the phenomenon under study (Flick, 2010, p.326).

Since the first reduction as part of the Summarizing Content Analysis had already been performed during the transcription process, the analysis continues with the second part, the grouping and summarizing of similar paraphrases. After a first familiarization with the text, the main task is to translate the key ideas into more abstract concepts, which will become the labels for the underlying phenomena in the text. This process is known as open coding – the categories are allowed to emerge from the detailed analysis of the text (Flick, 2010, p.307). In a second step, the distinct categories will be tested for any logical connection using mind-map techniques, which is known as axial coding (Flick, 2010, p.310).

The procedure of coding in the context of Grounded Theory was developed by Glaser and Strauss (1967) in order to integrate data collection and sampling into the data interpretation phase. In general, coding leads to the development of theories through a process of abstraction. Even though there are different approaches to coding, such as “open coding”, “axial coding” and “selective coding”, in practice there are no clear distinctions between these methods. Basically coding approaches can be seen as different ways of handling textual material between which the research may move back and forth if necessary and which can be combined (Flick, 2010, p.307). In general, the process of text interpretation begins with open coding, whereas the need for axial and selective coding emerges during the procedure.

Open Coding

In open coding, codes are developed and attached to parts of the texts or to single words in a first step. These codes can either be formulated as closely as possible to the text or, if possible, based on relevant literature on the topic. Codes that are rephrasing parts of the text are called *in-vivo codes*, while codes based on literature are called *constructed codes* (Flick, 2010, p.309). In a second step, codes are categorized by grouping them around phenomena discovered in the data. The resulting categories are again linked to codes, which are now more abstract than those in the first step. The result of open coding should be a list of the codes and categories attached to the text (Flick, 2010, p.308).

Axial Coding

After identifying a number of relevant categories and codes, the next step is to develop a differentiated picture of their relation to the research topic. In general, axial coding is aimed at revealing the relations and dependability between categories and codes (Strauss and Corbin, 1998, p.127). The key question here is which category or code causes a phenomenon and which category or code is the consequence of a phenomenon. The result of axial coding is a structure of the hierarchy and relations of the categories relevant to the research question (Flick, 2010, p.311).

Selective Coding

In a third step, selective coding continues axial coding on a higher level of abstraction. This step focuses on potential core concepts or core variables and

compares and contrasts these to other groups and foci. The result of selective coding should be one central category and one central phenomenon. This core category is developed in its dimensions and features and should then be linked to all other categories. Finally, the theory is developed in more detail and checked against the data (Flick, 2010, p.310).

According to Dey (1998, p.30), qualitative data analysis is a circular process. Description lays the basis for analysis, but analysis in turn lays the basis for further description. From initial description, the process continuous with breaking down and classifying the data and then aims to connect the concepts developed so far in order to provide a basis for a new description. The process of coding should then continue until theoretical saturation occurs, meaning that further coding, enrichment of categories etc. no longer promise any new insights into the topic (Flick, 2010, p.312).

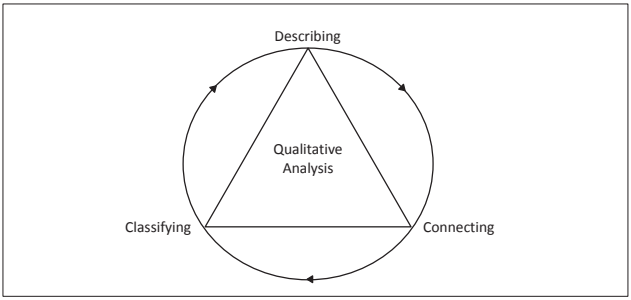

Chart 25: Circular process of data analysis in qualitative research, Source: Own Drawing based on Dey (1998, p.31)

5.12 Content Analysis of the Interview Transcripts

Following the process described by Dey (1998), data analysis of the present material started with an initial familiarization of the text. During this first reading the author marked any relevant parts of the text with regard to ADAS acceptance by underlining them. In a second step, initial *in vivo* codes were developed from the underlined parts, directly based on the content. Since the interviews were conducted in German, these initial *in vivo* codes were also based on German standard expressions. In a second step, the author had to transfer these *in vivo* codes into constructed codes in English, consciously bringing the results to a slightly higher level of abstraction. Since these codes had to be clearly distinguishable and differentiated from each other, they were

constantly developed further during the process of analysis. Existing code groups had to be extended or completely changed, while new ones had to be created in the course of this process. In order to have a clear reference, an ascending number was assigned to each code in a side column. Table 14 gives an example of the data analysing process.

Interview transcript:	**In Vivo Code**	**Constructed Code**	**Code #**
What are the disadvantages of Advanced Driver-Assistance Systems in your opinion?			
The additional costs are certainly an issue here. Malfunctions are another topic; however, I have to admit that in my experience I have not yet had any trouble with that so far.	Additional costs	Price	4
	Malfunctions	Risk of Failure	11
	My Experiences	Past Experiences	1

Table 14: Example of initial data analysis

Since the development of constructed codes is based on the interpretive understanding of the written transcripts, it is generally influenced by the researcher's position towards the research object. In order to increase the objectivity of the interpretation, the development of codes was conducted independently by the author and two research assistants following the open coding method outlined before. As expected, the resulting constructed codes from the interview transcripts varied slightly in quantity and wording. In a first step, codes with similar meaning but divergent wording were grouped and the most unambiguous wording was chosen as the final code label. In the second step, each of the remaining codes, resulting from only one of the two analyses, was included in order to derive the most comprehensive code list of the transcripts. In sum, 54 codes emerged from the process of open coding which consequently formed the basis for the further analysis.

There is no clear agreed approach as to how to present the results of coding and the structure of volumes of non-standard data derived from qualitative research (Easterby-Smith, Thorpe and Jackson, 2008, p.175). For the present research, a model developed by Miles and Huberman (2009) is applied, which is aimed at

capturing the complexity of all sorts of qualitative data in a wide variety of circumstances. The core element of this approach is a matrix format, which displays the constructs (i.e. the beliefs derived from content analyses) on one axis and the responses on the other. The characteristics of responses displayed on the second axis depend on the research question, and thus have to be developed beforehand. The main advantage of this model is the clear visualisation of results, which can lead beyond a simple configuration to sort data into an understanding of causal linkages. In conclusion, a matrix was developed showing the codes on the first row and their mentioning in each interview on the following rows. The interview numbers appear column by column, while the code appearance in each interview was noted line by line. As noted above, each code was allocated an ascending number (#1,#2,#3 etc.) as a clear reference. The author decided to use Microsoft Excel database software, which fulfils all requirements of this part of the analysis. Due to the predefined reference for each code and each interview, the allocation of codes in the matrix can easily be traced to the relevant interview passages. Table 15 gives an example of the raw database matrix.

Code	Code #	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	…
Perceived Usefulness	7												
Risk of Failure	11												
Trust in Technology	21												
Safety Benefit	17												
Comfort Benefit	19												

Table 15: Example Raw Data Matrix

In the next step, axial and selective coding was applied to check for any hierarchical structure within the extrapolated codes. Similar codes were grouped into logical entities. For instance, the codes Good Feeling, Unsafe Feeling, Uneasy Feeling and Coolness were grouped into one unit, since all of these concepts include some affective elements referring to feelings and emotions. In the next step, a higher-level code was developed, referring to the mutual meaning of the group of codes. This was either one of the codes itself, meaning that there was already a superior code within the group that represented a category, or alternatively a new, higher-ranked code had to be developed, which completely covers the meaning of the group's codes. In the example mentioned above, a new code

"Emotions" was defined to cover the implicit meaning of all four codes in the group. Table 16 shows the example Group "Emotions".

Category	Code	#	I1	I2	I3	I4	I5	I6	I7	I8	
Emotions	Good Feeling	23									
	Unsafe Feeling	47									
	Uneasy Feeling	41									
	Coolness	56									

Table 16: Example Category Grouping Matrix

The process of grouping was applied until all codes that had been developed from the data were allocated to a logical concept category. The final category system consists of ten higher ranked categories and fifty-four secondary codes. Chart 26 gives an overview of the process steps involved in the development of the category system.

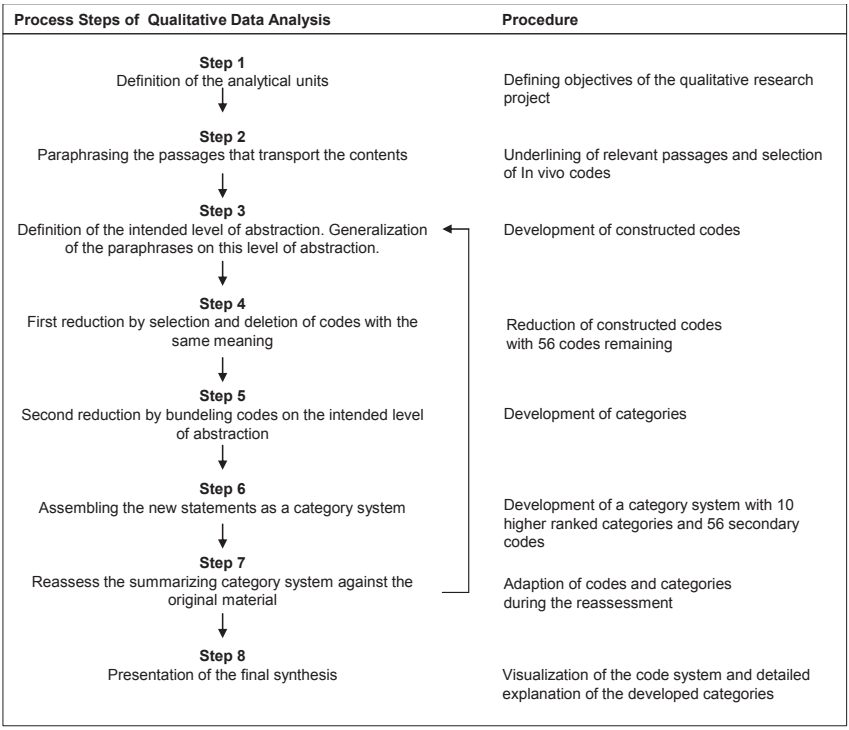

Chart 26: Data analysis process, Source: Own drawing based on Flick (2010, p.326)

5.13 Content Analysis Results

The results were finally visualised in matrix form with the resulting categories in the first row, the codes and code numbers in the second and third rows and the interview results in the subsequent rows. The interview results represent the number of code appearances in each interview. Instead of numeric results, the author decided to use symbols, which simplify the matrix and increases readability and interpretability. Every mentioning of a code in the given interview is represented by a filled slot. Since no individual code was mentioned more than four times in any interview, four empty slots are provided for each code/ interview combination. Four empty slots represents no mentioning of the code in the given interview, one coloured slot means that the concept was addressed once, two slots filled means the concept came up twice, three slots filled means the concept was brought up three times and four slots filled, finally, means that the concept has been mentioned four times during the interview.

This visualisation approach enables the researcher to get a general idea of the interview results and to develop hypotheses about the potential impacts and the potential interrelation of different codes and categories. Table 17 shows the complete result matrix and the symbolic representation of the results.

Category	Code	Code ID	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14	I15	I16	I17	I18	I19	I20	I21	I22	I23	I24	I25	I26	I27	I28	I29	I30	I31	I32
Emotions	Good Feeling	#23		■								■	■	■	■		■					■	■	■	■		■			■				
	Unsafe Feeling	#47																	■				■		■	■									
	Uneasy Feeling	#41										■						■	■																
	Coolness	#39																							■										
Enjoyment of Driving	Enjoyment of Driving	#27				■	■	■			■	■			■	■	■	■		■			■	■		■	■	■			■	■			■
	Conformity with Driving Style	#25			■	■			■																			■							
Loss of Control	Loss of Control	#6	■	■							■	■	■			■	■		■	■	■			■	■			■			■	■			
	Irreplaceability of Human Driver	#13	■	■		■	■	■	■	■					■		■	■						■	■						■			■	
	Technological Paternalism	#34						■																		■		■	■			■			■
	Dependency on Systems	#49																		■															
Past Experiences	Past Experiences	#1	■		■	■		■		■	■				■	■		■	■		■	■		■	■	■		■	■	■			■	■	
	Familiarisation with Technology	#24		■						■																									
	Lack of Knowledge	#38										■	■	■		■				■															
Perceived Ease of Use	Ease of Use	#42										■			■			■				■											■		
	Customisation with System	#53																						■			■								
Perceived Risks	Risk of Failure	#11	■	■	■	■		■	■	■		■	■	■		■	■		■	■			■	■	■	■	■				■	■		■
	Technical Immaturity	#10	■			■	■	■	■	■			■		■		■	■		■	■		■	■	■	■	■					■	■	■	
	Fear of Excessive Warnings	#32					■	■	■	■			■		■		■	■	■						■								■	■	
	Responsibility	#5	■	■		■			■	■		■														■						■		■	
	Artificial Feeling of Being Protected	#28			■	■			■			■								■			■	■	■	■									
	Risk of Decreased Driving Skills	#29			■							■					■	■														■			
	Risk of Distraction	#48																		■	■	■			■	■	■								■
	Uncertainty in Driving Situations	#26		■						■														■	■		■				■				
	Risk of Becoming Careless	#12	■					■	■	■							■							■											
	Reliability	#22		■	■											■					■							■				■			
	Increased Driving Complexity	#31				■				■	■									■															■
	Risk of Wrong Operation of System	#52																					■												
Perceived Usefulness	Comfort Benefit	#19	■			■	■			■		■	■	■	■	■	■	■				■		■		■	■	■	■	■		■		■	
	Reduction of Driving Strain	#35								■															■		■			■	■	■	■	■	
	Perceived Usefulness	#7	■	■	■	■	■	■	■	■		■		■		■	■	■		■			■		■	■				■		■		■
	Technical Gadget	#9	■		■		■	■	■			■													■	■						■			
	Ability to Support Driving	#15	■						■		■						■	■	■		■		■		■				■						
	Technological Proliferation	#20	■	■			■				■	■		■												■									
	Safety Benefit	#17	■	■				■		■			■	■	■	■	■		■		■		■	■	■	■	■	■			■	■	■	■	■
	Support for Highway Driving	#40										■										■				■	■			■					
	Support for Elderly	#50																				■			■			■			■		■	■	
	Support for City Driving	#45																	■	■					■										
	Increased Traffic Law Conformity	#46																											■	■					
	Support for Handicapped Persons	#44																										■					■		
	Possibility of Drunk- or Tired-Driving	#54																					■												
	Risk of Human Error	#16	■	■	■			■			■											■		■	■	■		■		■		■		■	
	Usefulness for Job-related Driving	#2																						■											
Resources	Price	#4	■	■	■	■	■	■		■		■					■						■	■	■	■	■					■	■		
	Value for Money	#18	■		■	■	■			■																									
	Limited Availability	#3	■						■								■																		
	Risk of Increased Repair Costs	#36									■																						■		
Subjective Norms	Subjective Technological Standard	#37															■	■	■		■												■		
	Social Obligation	#8	■				■			■																									
	Social Influence	#33					■																												
	Societal Need due to Increase in Traffic	#51																				■													
Trust	Trust in Technology	#21	■		■	■	■	■				■				■	■	■		■	■	■	■	■	■	■	■	■		■	■	■			■
	Trust in Own Driving Skills	#43			■								■							■	■					■									
	Trust in Computer	#14	■		■																												■		
	Trust in Brands	#30				■																			■										

Symbol explanations: No mentioning of the Code in this interview; Code was mentioned once during this interview; Code was mentioned twice during this interview; Code was mentioned three times during this interview; Code was mentioned four times during this interview

Table 17: Content Analysis Results Matrix

The visualisation scheme makes it apparent that some of the codes appeared constantly in almost every interview, while others only came up once or twice. The codes that were mentioned in more than half of the interviews are: Enjoy-

ment of Driving, Loss of Control, Past Experiences, Risk of Failure, Technical Immaturity, Comfort Benefit, Perceived Usefulness, Safety Benefit and Trust in Technology. In sum, these nine codes represent more than half of all mentioned concepts. Eight codes, on the other hand, were only brought up once.
It has to be acknowledged, however, that conclusions from the relative frequency of occurrences cannot be drawn from this qualitative analysis alone. Rather, according to the chapter objectives, this study is aimed at eliciting prevalent beliefs towards the acceptance of ADAS, which can later be used to construct a standardised survey. Consequently, it is necessary to evaluate whether the concepts developed so far are satisfying the requirements to be used in this regard.

5.14 Quality Criteria of Qualitative Research

In order to evaluate the level of confidence that may be associated with the present research results, a set of quality criteria have to be established beforehand. Increasingly popular among social science researchers, qualitative research has been heavily criticised for not being assessable by standardised, external means. Quality criteria are well known and widely agreed in quantitative research. For qualitative research, however, that is not yet the case (Bryman, Becker and Sempik, 2008, p.262). Recognizing the very wide range of methods that this term covers, Dale (2006, p.79) argues that it might not be possible to establish comparable fixed sets of criteria that can be universally employed in every type of qualitative research. Yet, developing quality criteria for qualitative research has become increasingly popular in recent years. Criteriology, a designated research area aimed at developing criteria for judging the quality of qualitative research studies, has generated a number of publications proposing divergent evaluation criteria (Seale, 2002, p.102). Most authors start by outlining conceptions of validity and reliability in the quantitative tradition, transferring some fundamental aspects to the field of qualitative research (see Golafshani, 2003 as an example). The central conceptions of quality, generally discussed as validity and reliability, are transferred into the field of qualitative research by generating aspects that establish the trustworthiness of a research report. Reliability is translated into dependability, which can be achieved via an auditing procedure, involving the researchers' documentation of data, methods and decision-making during a project, as well as its end product (Flick, 2010, p.396). Internal validity is transferred to neutrality, and is achieved by basing the findings on the subjects and conditions of the inquiry, rather than on the eventually biased researcher perception. Additionally, researchers should aim to maximize

the truth value, accomplishable by "prolonged engagement in the field, persistent observation and triangulation exercises, as well as exposure of the research report to criticism by a disinterested peer reviewer" (Seale, 2002, p.104). External validity, finally, translates into applicability. Providing a detailed, rich description of the study, the author should give readers sufficient information to be able to judge the applicability of findings to other settings (Seale, 2002, pp.104–105). Consequently, based on Lincoln and Guba (2007, p.290), five basic requirements have to be fulfilled by qualitative research reports:

1. ***Trustworthiness/Credibility:*** How can one establish confidence in the truth of the findings resulting from a particular inquiry?

2. ***Applicability:*** Are the findings of a particular survey applicable in other contexts or with other subjects?

3. ***Consistency:*** Would the findings be repeated if the inquiry were replicated with the same (or similar) subjects in the same (or similar) context?

4. ***Neutrality:*** Are the findings of a survey determined by the subjects and conditions of the inquiry or rather by the biases, motivations, interests or perspectives of the inquirer?

5. ***Transparency:*** Are the research methods, procedures and actions described in a way that enables an external auditor to assess the work?

Trustworthiness/Credibility

As noted by (Seale, 2002), prolonged engagement in the field and persistent observation of subjects in the research area can foster the trustworthiness of qualitative research reports. The author of the present study has spent more than five years in the automobile industry, constantly being exposed to car customers as part of his daily work. Conducting hundreds of interviews on customer satisfaction, the author has gained confidence in interviewing techniques as well as experience in data analysis. The research results will be discussed in the course of several research conferences and a synthesis of this chapter will be published as a part of a book on entrepreneurial communication (see publication list), allowing for an open discussion of the findings.

Applicability
The development of concepts and categories is described in detail and enables the reader to judge whether or not a particular concept might be transferable to another context. Furthermore, the results of the present study are comparable to the results from other inquiries in different areas of technological product innovation. Consequently, knowledge from this study can be transferred and checked against results from other fields of acceptance behaviour.

Consistency
Consistency is obtained if any repetition of the qualitative interviews in a similar setting with similar participants leads to similar findings. In order to ensure this, the author aimed for maximum sample heterogeneity within the chosen interview participants by interviewing different car drivers at different dealerships at different times. In sum, it is thus expected that an acceptable level of consistency was obtained by the present interview methodology.

Neutrality
In order to increase neutrality, the author decided to carry out the qualitative phase together with two research assistants from Pforzheim University. The interviews were each conducted either by one of the research assistants or by the author himself. Comparability of interview administration was ensured by using a predefined interviewer's guide and by having a mutual pre-testing phase of the interviews. Data analysis was conducted by the research assistants and the author independently, but applying a similar methodology. By comparing the results from both analyses (the research assistants performed their analysis together) the author could use triangulation to ensure that the results are free from researcher bias.

Transparency
Transparency is one fundamental aspect that is involved in any kind of quality criteria. Without transparency, quality assessment would be not possible. Transparency is a crucial requirement at a number of different points during the research process: not only when keeping respondents informed about the research objectives but also at the end, when reporting the full details of how the study was conducted and the data was analysed (Dale, 2006, p.79). In order to increase the transparency of the present research, the author thus specified and

documented the multiple processes from data gathering to data presentation at a very detailed level, ensuring a clear and comprehensible thread for the reader.

Conclusion
In the absence of standardised, objective quality criteria, trustworthiness of the present research was evaluated by assessing the research report's level of Credibility, Applicability, Consistency, Neutrality and Transparency. The author used different techniques to ensure that the research methodology applied met these criteria, such as using different interviewers and documenting the data analysis process to a very detailed level. Based on this evaluation, the present qualitative study can be regarded as a credible source of knowledge, acknowledging some minor tentative assumptions in the field of consistency.

5.15 Implications from Qualitative Research

The implications from this part of the research are substantial from the viewpoint that they allow for an insight in the manifold and complex constitution of conscious and subconscious beliefs influencing the acceptance decision towards ADAS technology. In sum, ten clearly defined categories have emerged from the interview transcript as the result of content analysis. These categories and their subordinate concepts are supposed to serve as the main determinants for the acceptance decision of individuals towards ADAS technology. Thus a further elaboration of these categories delivers a meaningful contribution for the explanation of acceptance behaviour in this context.

Emotions
During the interviews it became apparent that ADAS technology causes affective responses, which arise intuitively without an immediate rational explanation. It is important to acknowledge that these affective responses expressed positive as well as negative feelings or emotions. Interviewees reported that they expect a "good feeling" (code #23) when driving with ADAS, while others reported that they expect an "unsafe feeling" (code #47) or an "uneasy feeling" (code #41). Two respondents expressed positive as well as negative emotions during the same interview, a paradox that occurs because in some situations (e.g. parking) these systems might create a good feeling, while in others (e.g. highway driving), these systems are perceived as "spooky" (code #47 in interview 23). In conclusion, emotions have repeatedly emerged as an important

affective concept from the interviews, which can have a positive and/or negative impact on the innovation acceptance decision of ADAS.

Enjoyment of Driving

An aspect mentioned by more than half of all respondents is "perceived enjoyment of driving an automobile" (Code #27). Enjoyment in this context refers to various personal motives other than transportation, such as sensory stimulation, excitement or self-expression. Advanced Driver-Assistance Systems are perceived as supplanting manual driving tasks that respondents prefer to fulfil themselves. In most cases respondents commented that they "enjoy driving too much to use these assistance systems" (Code #27 in interview 16). It also became evident that individuals want to preserve their own driving style, which they suspect ADAS not to be compatible with: "especially for sportive drivers, ADAS might not be especially useful" (Code #25 in interview 4). In conclusion, the perceived enjoyment of driving has occurred as one of the major reasons for resistance towards ADAS in this interview phase.

Loss of Control

Respondents reported very directly that with the usage of ADAS they "fear losing control over the vehicle" (Code #6 in interview 17). More than half of all interviewees expressed this fear, which is motivated by the belief that such systems are "taking away personal freedom" (Code #34 in interview 29) and thus creating a form of technological paternalism. Moreover, respondents remarked that assistance systems "cannot replace the human driver" (Code #13 in interview 23) and expressed the wish to remain in control of the automobile in any situation. In conclusion, the prospect of handing over control to an assistance system has consistently emerged as a major reason for resistance towards ADAS.

Past Experiences

During the interviews it became apparent that drivers with no knowledge and no experience of ADAS were more sceptical towards this technology, while drivers who already had first experiences with these systems had a more positive attitude towards them. It is not particularly surprising that past experiences with a technology strongly impact the attitude towards this technology. Additionally, however, it also became apparent that personal experiences have a significant impact on the acceptance decision. Multiple respondents remarked that they had

experienced critical driving situations in the past: “it happened to me that I went off the lane after a long drive […] so I would definitely pay a price premium to have a Lane-Assistance System in my next car ” (Code #1 in interview 22). These critical experiences influenced the perceived need for driving assistance, thus leading to a more positive attitude towards ADAS. In conclusion, past experiences are expected to have a significant impact on the decision as to whether or not to use a new technology.

Perceived Ease of Use

The expected cognitive expenses necessary to use a driver assistance-system were mainly brought up by respondents who already had first experiences with ADAS. They remarked that they liked the easy operation of these systems: “You just switch it on and nothing else – I like the usability” (Code #42 in interview 1). Respondents with little or no experience rather remarked that they expected to be able to use these systems with little strain after a short period of customisation: “At first I might be irritated but I believe that’s a matter of becoming accustomed to it” (Code #53 in interview 22). In conclusion, Perceived Ease of Use was brought up rather seldom by respondents and if so, the interviewees consistently reported that they had experienced or expected a rather easy usage of these systems.

Perceived Risks

Throughout the interviews, almost every respondent remarked that he or she expected risks associated with ADAS. The most common risk mentioned by the interviewees was a critical system failure leading to a hazardous situation: “I believe that these systems will malfunction one day or do not work the way they should” (Code #11 in interview 21). This perception was intensified by the belief that these systems are technologically immature or not yet safe enough: “These systems are marketed too early: [they] should be tested more thoroughly” (Code #10 in interview 24). Alongside this, respondents feared distraction by excessive warning noises and flashing signals (Code #32) and increased driving strain (Code #31). Another serious concern expressed by the interviewees was that these systems create an artificial feeling of being protected. This can be attributed to the fact that using ADAS might lead to the belief that driver attention is no longer necessary: “If the car is doing too much automatically, the driver might fall asleep sometime” (Code #28 in interview 21).

Further to this, respondents expressed the fear of diminishing driving skills due to the use of ADAS: "The disadvantage of parking assistance is that you unlearn how to park by yourself" (Code #29 in interview 15). In conclusion, there is a multitude of anticipated risks that are involved in the belief formation towards the acceptance of ADAS technology. Taken together, these risks are expected to serve as a major reason for resistance towards this innovation.

Perceived Usefulness

The usefulness of ADAS technology was discussed in every interview conducted. Most respondents named specific product features, such as lane keeping or automatic parking, which they considered useful: "Traffic signs are recognised automatically. That's useful" (Code #7 in interview 21). Perceived Usefulness in this regard mainly refers to an expected benefit towards an individual goal. The interviews revealed that in the context of ADAS this benefit could be a:

- Comfort Benefit (Code #19), which was mainly associated with a reduction in driving strain: "Using parking assistance, I don't have to wrench my head anymore" (Code #19 in interview 15)
- Safety Benefit (Code #17), which mainly refers to the perceived increase in driving safety: "Using blind spot monitoring, I can probably realize dangerous situations much faster" (Code #17 in interview 31).

Safety Benefit was frequently linked to the belief that human errors do occur and could possible be prevented by these systems: "On a long drive it can always happen that you become inattentive […]" (Code #16 in interview 25). Additionally respondents saw specific benefits for different target groups, such as:

- elderly (Code #50),
- handicapped (Code #44),
- professional drivers (Code #2) or
- drunk drivers (Code #54).

A minority of respondents reported that they did not see a benefit in at least some of these systems: "Lane keeping is a feature which I rather regard as a technical gadget" (Code #9 in interview 5). In conclusion, the perceived usefulness of ADAS strongly depends on the personal motives and goals, generally either related to increased comfort, increased safety or both. In sum, this concept

is expected to be a major determinant for innovation acceptance in the context of ADAS.

Resources

Another important aspect elicited from the interviews is the perceived expectation of resources necessary to obtain and use Advanced Driver-Assistance Systems. The additional price for such systems was mentioned by almost half of the interviewees as a reason for non-adoption of this technology: "These systems are probably very expensive" (Code #4 in interview 22). It is remarkable that respondents often did not know the exact costs of these systems but instead anticipated an additional cost, based on their expectations. The non-availability of these material resources then acts as a reason for resistance: "I have no money for this" (Code #4 in interview 21). Additionally, two respondents anticipated high repair and maintenance costs for these systems (Code #36). Perceived non-availability of these systems also occurred because respondents believed that they are either not offered in their car category or not offered by their car brand: "I drive old cars – for those you cannot get these systems" (Code #3 in interview 8). In conclusion, the perceived requirements of material- and non-material resources acts as a motive for resistance towards the acceptance of ADAS for at least half of the individuals interviewed at this stage.

Subjective Norms

Subjective Norms have a manifold influence on human behaviour and on the acceptance of innovation in particular. On the one hand, respondents remarked that they perceived ADAS to be a common technological standard with which they wanted to comply: "these systems are standard equipment already. I wouldn't buy a car without them" (Code #37 in interview S15). The perceived installed customer base acts as a descriptive norm in this case, meaning that individuals want to comply with what they perceive the public is considering reasonable. On the other hand, some respondents perceived a moral obligation to use ADAS: "Personally I don't see the benefit. If the accident rates are lowered by these systems, however, everybody would benefit" (Code #8 in interview 1). If ADAS is perceived as serving the common good, this belief can establish a moral norm, which respondents want to comply with. Direct influence of a peer group or individuals, which the literature refers to as injunctive norms, was only reported by one interviewee: "I have been told that these sys-

tems are too sensitive in every usage […]" (Code #33 in interview 5). It is remarkable that injunctive norms, even though widely recognized in the literature, played only a minor role in this interview phase. Either the influence of peer groups is rather low in the context of ADAS, or respondents were influenced by these norms on a subconscious level, which could not be revealed in the course of these interviews.

Trust in New Technologies / Trust in Own Driving Skills

The interviews revealed that trust is an important, although ambivalent, influence factor for innovation acceptance. On the one hand, trust in technology serves as a major motive for the acceptance of ADAS: "I trust in these systems because I feel confident that they work" (Code #21 in interview 26). On the other hand, the absence of trust in technology serves as a major motive for resistance: "I don't believe you should rely on technology too much" (Code #21 in interview 18). Since ADAS is aimed at substituting manual driving tasks, respondents weighed the level of trust in technology against the level of trust in their own driving skills: "I trust my own eyes more than this computer screen […]" (Code #43 in interview 3). In order to recognise these two aspects, the author decided to split this concept into *Trust in Own Driving Skills* and *Trust in New Technologies*. *Trust in New Technologies* is a factor considered in most innovation acceptance studies as *General Innovativeness*. The author will consequently use this wording for the concept.

5.16 Summary of Results

Ten core concepts have been developed from this qualitative phase as potential influence factors for acceptance behaviour in the context of ADAS. Based on the interview results, the factors that are expected to constitute the main reasons for resistance towards ADAS are *Enjoyment of Driving*, *Loss of Control* and *Perceived Risks*. *Perceived Usefulness*, on the other hand, has emerged as the strongest factor supporting the acceptance of this technology. Finally, *Past Experiences* and *Trust* were also found to be important influence factors for the acceptance of ADAS, albeit with ambiguous effects.

Recapitulating the chapter objectives, these concepts are clearly described, mutually exclusive, exhaustive and directly based on the interview responses with a clear and reproducible reference. Even though it is not the objective of this chapter to report on the significance and impact of these concepts, initial hypotheses can be developed from the present interviews. The significance of

these concepts for the respondents can be estimated based on the number of occurrences during the interview phase (see Table 17). Additionally the interview results allow for an evaluation of whether the concepts tend to support acceptance, resistance or both in the context of ADAS. Table 18 shows the acceptance factors, their significance and their effect on the acceptance decision.

Table 18: Acceptance factors derived from qualitative interviews

Concept (alphabetic order)	**Short description**	**Importance of the concept** (Based on the frequency of occurrences in the interviews)		**Effect of the concept** (Whether the concept tends to lead towards acceptance or towards resistance of ADAS)		**Typical quotations**	**Reference**
Emotions	Affective responses, referring to feelings and emotions which come up intuitively without an immediate rational explanation.	Average	Slightly less than half of all respondents expressed emotions or feelings in relation to ADAS during the interview.	Acceptance and/or resistance	The affective responses expressed positive as well as negative feelings towards ADAS. Positive emotions are, however, predominating.	"I feel much better and safer with these systems" "As a passenger I would clearly feel much more unsafe […]"	Code #23, interview 12 Code #47, interview 24
Enjoyment of Driving	Enjoyment refers to various personal motives other than transportation (non-functional motives), such as sensory stimulation, excitement or self-expression.	High	This concept was mentioned by more than half of all respondents.	Resistance	Advanced Driver-Assistance Systems are perceived as supplanting manual driving tasks, which respondents prefer to fulfil themselves.	"I enjoy driving too much to use these assistance systems"	Code #27, interview 16
Loss of Control	Loss of Control expresses the belief that ADAS is taking away personal freedom and thus creating a form of technological paternalism.	High	This concept was mentioned by about two thirds of the respondents, some of whom brought it up multiple times.	Resistance	The prospect of handing over control to an assistance system has consistently emerged as a major reason for resistance towards ADAS.	"Fear of losing control over the vehicle" "Taking away personal freedom"	Code #6, interview 17 Code #34, interview 29
Past Experien-ces	Past Experiences refers to experiences with ADAS technology as well as to personal experiences for instance in critical driving situations.	High	Past Experiences were found to have a significant impact on the decision as to whether or not to use ADAS technology.	Acceptance and/or resistance	Generally, having first experiences with ADAS increases the acceptance of this technology and vice versa. Additionally, having experienced critical driving situations in the past was found to support the acceptance of ADAS.	"I have ACC on my car and I don't want to miss this anymore" "	Code #1, Interview 6 Code #1, interview 22

Perceived Ease of Use	Expected cognitive expenses necessary to use a driver- assistance system.	Low	Perceived Ease of Use was brought up rather seldom by respondents and if so, the interviewees consistently reported that they had experienced or expected a rather easy usage of these systems.	Acceptance	Respondents who already had first experiences with ADAS remarked that they liked the easy operation of these systems.	"You just switch it on and nothing else – I like the usability"	Code #42, interview 10
Perceived Risks	Anticipated negative consequences of adopting ADAS. Most commonly: Critical system failure, distraction, diminishing driving skills and the artificial feeling of being protected.	High	Almost every respondent remarked that he or she expected risks associated with ADAS throughout the interviews: thus the influence of this factor is expected to be rather high.	Resistance	The multitude of anticipated risks associated with ADAS serve as a major barrier for the acceptance of this technology.	"I believe that these systems malfunction one day" "If the car is doing too much automatically, the driver might fall asleep some time."	Code #11, interview 21 Code #28, interview 21
Perceived Usefulness	Anticipated positive consequences of adopting ADAS. Most commonly: Comfort and safety benefit.	High	The usefulness of ADAS technology was discussed in every interview: thus, the influence of this factor is expected to be rather high.	Acceptance	Perceived usefulness of ADAS strongly depends on the personal motives and goals, usually either related to increased comfort, increased safety or both. These motives were found to be in line with ADAS features for most respondents.	"Traffic signs are recognized automatically. That's useful." "Using blind spot monitoring I can probably realize dangerous situations much faster"	Code #7, interview 21 Code #17, interview 31
Resources	Perceived expectation of resources necessary to obtain and use Advanced Driver-Assistance Systems.	Average	The resources needed to obtain and use ADAS were mentioned by about half of the individuals interviewed.	Resistance	The perceived requirement of material- and non-material resources acts as a motive for resistance towards the usage of ADAS.	"These systems are probably very expensive" "I drive old cars – for those you cannot get these systems."	Code #4, interview 22 Code #3, interview 8
Subjective Norms	Perceived social pressure to adopt or not to adopt a certain innovation.	Low	The perceived installed customer base (descriptive norm) and direct social pressure (injunctive norm) have played only a minor role in this interview phase.	Acceptance and/or resistance	If respondents perceive ADAS to be a common technological standard, they want to comply with it (descriptive norm). Direct influence of a peer group can lead to either acceptance or rejection (injunctive norm).	"These systems are standard equipment already. I wouldn't buy a car without them" "I have been told that these systems are too sensitive in every usage […]"	Code #37, interview 15 Code #33, interview 5

Trust in own driving skills	The reasonable expectation (confidence) of the respondents to posses the necessary driving skills.	Low	Even though it was only mentioned by six respondents *Trust in own driving skills* could be an important subconscious influence factor of ADAS acceptance	Resistance	Trust in own driving skills has led to resistance towards ADAS technology	"I trust my own eyes more than this computer screen [..]"	Code #43, interview 3
Trust in New Technologies	The reasonable expectation (confidence) of the respondents that new technology will be beneficial.	High	Trust in New Technologies has emerged as an important factor mentioned by almost two thirds of the respondents.	Acceptance	Trust in technology serves as a major motive for the acceptance of ADAS. The absence of trust, on the other hand, serves as a major motive for resistance	"I trust in these systems because I feel confident that they work" "I don't believe you should rely on technology too much"	Code #21, interview 26 Code #21, interview 18

5.17 Visualisation of Results

In the next step, the results presented so far are visualized by employing *concept mapping*, a tool increasingly employed in qualitative research in order to develop and to clarify theory (Maxwell, 2009, p.47). Originally developed by Miles and Huberman (2009), concept mapping has been developed to fit different purposes and is used by social science researchers in different contextual areas. The common idea is to develop a map-like pattern by "arranging and connecting a set of ideas that is relevant to the research topic" (Hesse-Biber and Leavy, 2011, p.188). For the purpose of the present research, categories are expressed with circles, which are arranged around the main research objective, the intention to use ADAS. The circle size depends on the estimated significance of the particular concept developed from the number of occurrences during the interviews (see Table 18). Lines connecting the circles represent hypotheses for potential causal relationships. Finally, positive and/or negative symbols illustrate whether concepts were found to support or impede the acceptance of ADAS. A "+" symbol indicates that the concept is expected to support the acceptance of ADAS, while a "-" symbol indicates that the concept is expected to lead to resistance towards ADAS. The combination "+/-" indicates that the concept was found to have ambiguous effects on the acceptance decision. The codes, which were developed from the interview transcripts, are attached to their respective concept category. In conclusion, this visualisation scheme provides a comprehensive, yet perspicuous overview of the research results obtained by the qualitative interviews.

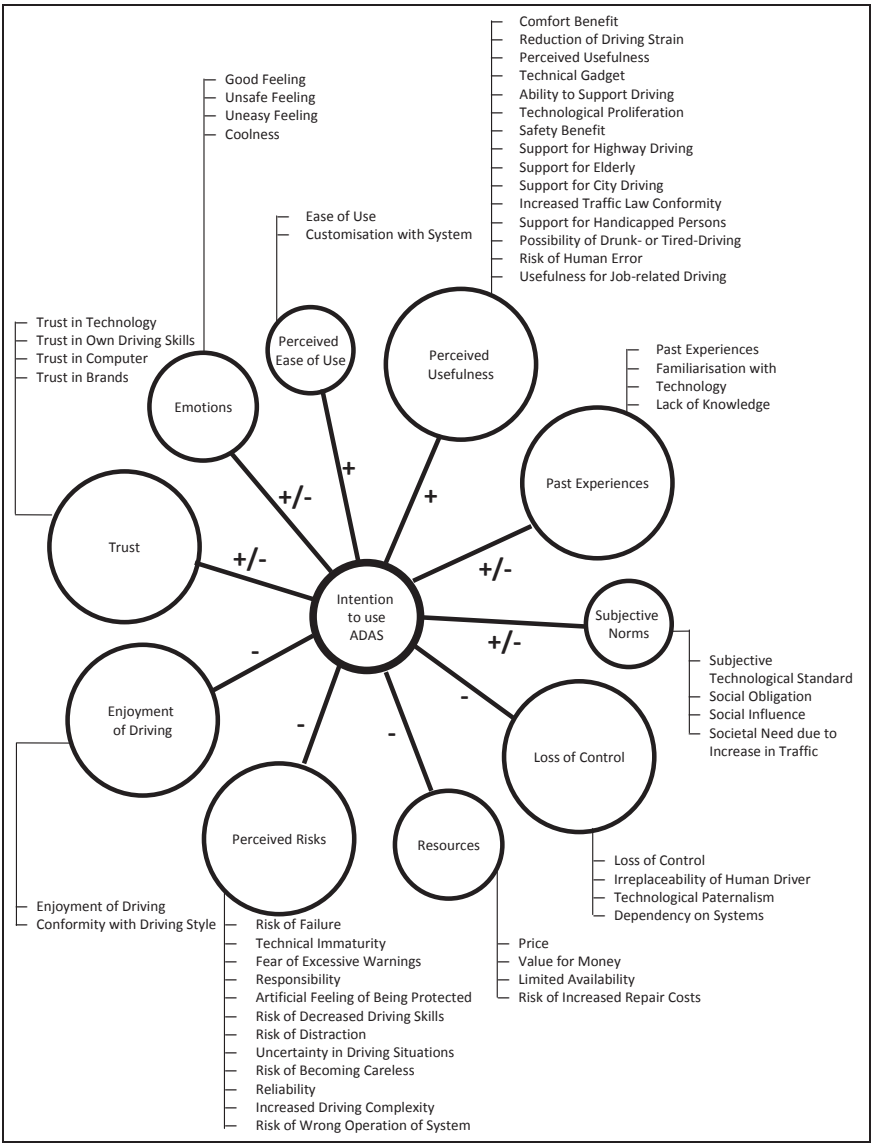

Chart 27: Visualisation of qualitative research results, Source: Own Drawing

5.18 Comparison of Results with Previous Empirical Studies

Comparing the findings of this qualitative stage to the results derived from literature review (see Chapter 3), it becomes apparent that considerable differences exist between what has been found in this study and what was found in previous innovation acceptance studies. An analysis of overlaps and differences between this qualitative study and the results from literature review will thus help to draw conclusions on the relevant factors that should consequently be used in the quantitative phase.

A direct comparison of the concept list from interview data and the concept list from the literature review shows that five out of the ten concepts from the interview analysis directly match the findings from literature research and will consequently be used to develop hypotheses for the further research steps. These concepts are: *Enjoyment of Driving, Loss of Control*, *Perceived Risks*, *Perceived Usefulness* and *Trust*.

Despite these similarities, the results from the qualitative research and the results from the literature review revealed some fundamental differences. *Subjective Norms* were mentioned only rarely during the interviews, while this factor was found to be a major determinant for innovation acceptance behaviour in the literature. Due to the possibility that *Subjective Norms* influence behaviour on a strongly subconscious level, which the interviews might not have been able to reveal, the author decided to use this concept in the quantitative stage, despite the low occurrences during the interviews.

Emotions were brought up relativly frequently by respondents during the interviews, while most empirical research has not included affective responses as causes of action. This is, most possibly, due to the fact that the majority of empirical studies is based on the on the Theory of Reasoned Action (TRA). This psychological model is founded on Ajzen and Fishbein's (2010) paradigm, which suggests that human behaviour is based on beliefs, which are developed over time, rather than on affective impulses. In this regard, affective responses are a result rather than a cause of behaviour. Based on the massive empirical evidence for this paradigm, the author decided that affective responses would be dismissed for hypothesis development.

Perceived Ease of Use was brought up rather infrequently by respondents, while virtually all empirical studies applying the TAM model report that this concept has a significant influence on acceptance behaviour (see Chapter 3). To explain this paradox, it is necessary to have a closer look at the few interview responses that were received on this topic in the course of the interviews. Respondents consistently reported that they had experienced or expected rather easy usage of ADAS. Thus, it can be concluded that the extent to which *Perceived Ease of Use* impacts acceptance behaviour is strongly dependent on the technology or product category in question. In the case of ADAS, inferences about potential learning expenditures were found to be almost nonexistent. Consequently, *Perceived Ease of Use* is expected to have only a minor influence on the acceptance of ADAS. This factor was accordingly omitted from the hypothesis development.

Resources, most importantly price, were brought up in a fraction of the interviews as a factor impeding acceptance. Empirical studies, however, have generally found no proof for a causal relationship between the availability of resources and the intention to accept an innovation. Even though the availability of resources is part of the TPB model (as part of a concept called *Perceived Behavioural Control*), its ability to explain the acceptance behaviour has been found to be insignificant in most empirical studies (see Chapter 3). Consequently, this factor will be dismissed for hypothesis development.

Finally, *Past Experience* was derived from the literature as well as from the interview data as an influence factor of innovation acceptance. However, the author decided to dismiss this concept, since most empirical work indicates that Past Experience is not a predictor of acceptance behaviour but should rather be treated as a background factor. People having experience with an innovation generally have a stronger intention to use this innovation, since they are situated further on the Rogers (2003) acceptance process model (usually they have already accepted the innovation). Thus, including *Past Experience* into the hypotheses will not add to the explanative power of the final model. Consequently, Past Experience is omitted from the hypotheses model and will be treated as an ancillary background factor.
Table 19 shows the comparison of concepts derived from the qualitative interviews and those elicited from the literature review and the resulting decision on the further process.

Table 19: Comparison of results from interviews with results from literature research

Concept (alphabetical order)	**Short description**	**Significance of the concept derived from interviews** (Based on the frequency of occurrences in the interviews)		**Significance of the concept derived from literature review** (Based on applications of the concept in literature and the explained variance in innovation acceptance behaviour that was attributed to the concept in the reviewed studies)		**Decision on the concept** (whether or not the concept will be subsequently used to develop hypothesis for quantitative research)	
Emotions	Affective responses, referring to feelings and emotions which come up intuitively without an immediate rational explanation	Average	Slightly less than half of all respondents expressed emotions or feelings in relation to ADAS during the interview	Low	Most empirical research is based on the Theory of Reasoned Action, which does not include affective responses as causes of action. Emotional involvement with a product category, however, was found to support the acceptance decision	Dismiss	Even though *Affective Responses* were brought up during the interviews, the author follows the reasoning of Ajzen and Fishbein (2010), who emphasize that human behaviour is based on beliefs, which are developed over time, rather than on affective impulses. In this view, affective responses are rather a result than a cause of behaviour. Consequently, affective responses are dismissed for hypothesis development.
Enjoyment of Driving	Enjoyment refers to various personal motives other than transportation (non-functional motives), such as sensory stimulation, excitement or self-expression	High	This concept was mentioned by more than half of all respondents	High	Non-functional motives, such as enjoyment of driving, were generally found to be important in research on consumer product acceptance	Continue	*Enjoyment of Driving* was brought up regularly during the interviews. Empirical research in the field of consumer products confirms that non-functional motives are important in virtually any consumer related product category. Consequently, this concept will be included in the quantitative stage.
Control	Control expresses the belief that ADAS is taking away personal freedom and thus creating a form of technological paternalism	High	This concept was mentioned by about two thirds of the respondents, some of whom brought it up multiple times	Context-Specific	This factor was only applied in the area of technological innovations that are aimed at substituting manual tasks. In these cases, however, the concept was found to be significant	Continue	*Control* was found to be an important factor in both interviews and empirical research in the field of technological innovations. Consequently, this concept will be included in the quantitative stage.
Past Experiences	Past Experiences refers to experiences with ADAS technology as well as to personal experiences for instance in critical driving situations	High	Past Experiences were found to have a significant impact on the decision as to whether or not to use ADAS technology	Moderate	This concept was found to be a significant factor for acceptance in some studies, others could not report any impact	Dismiss	Experience with the product category or the technology of interest was found to be an important determinant in literature as well as during the interviews. This causal relationship, however, is almost tautological and is also confirmed by Roger's Innovation Acceptance Process. Thus, the concept was dismissed for hypothesis development.

Concept (alphabetical order)	**Short description**	**Significance of the concept derived from interviews** (Based on the frequency of occurrences in the interviews)		**Significance of the concept derived from literature review** (Based on applications of the concept in literature and the explained variance in innovation acceptance behaviour that was attributed to the concept in the reviewed studies)		**Decision on the concept** (whether or not the concept will be subsequently used to develop hypothesis for quantitative research)	
Perceived Ease of Use	Expected cognitive expenses necessary to use a driver assistance-system	Low	Perceived Ease of Use was brought up rather seldom by respondents and if so, the interviewees consistently reported that they had experienced or expected a rather easy usage of these systems	High	Virtually all studies applying the TAM model report that this concept has a significant influence on attitude, which in turn significantly influences the acceptance of innovations	Dismiss	*Perceived Ease of Use* was found to be a relevant factor for many technological innovations in empirical studies. The interviews revealed, however, that in the case of ADAS learning efforts are generally not regarded to be relevant. Consequently, this concept will be dismissed for hypothesis development.
Perceived Risks	Anticipated negative consequences of adopting ADAS. Most commonly: Critical system failure, distraction, diminishing driving skills and the artificial feeling of being protected	High	Almost every respondent remarked that he or she expected risks associated with ADAS throughout the interviews: thus, the influence of this factor is expected to be rather high	Context-Specific	This concept has only been reported to be significant for some technological innovations like mobile banking: thus, its significance is likely to be context dependent	Continue	*Perceived Risks* were found to be an important factor in both, interviews and empirical research in the field of technological innovations. Consequently, this concept will be included in the quantitative stage.
Perceived Usefulness	Anticipated positive consequences of adopting ADAS. Most commonly: Comfort and safety benefits	High	The usefulness of ADAS technology was discussed in every interview: thus, the influence of this factor is expected to be rather high	High	Virtually all studies applying the TAM model report that this concept has a significant influence on attitude, which in turn significantly influences the acceptance of innovations	Continue	*Perceived Usefulness* was found to be an important factor in both interviews and empirical research. Consequently, this concept will be included in the quantitative stage.
Resources	Perceived expectation of resources necessary to obtain and use Advanced Driver-Assistance Systems	Average	The resources needed to obtain and use ADAS were mentioned by about half of the individuals interviewed	Low	Even though the availability of resources necessary to adopt an innovation are part of the TPB model, its ability to explain the acceptance behaviour was in most cases found to be insignificant	Continue	*Resources*, most importantly price, were brought up during the interviews as a factor impeding acceptance. Empirical studies, however, have generally found no proof for this relationship (see Table 7). It can be concluded that cost may only play a role for the acceptance of some particular innovations. Since costs were mentioned during the interviews on ADAS technology, costs will be included for the present hypothesis model.

Concept (alphabetical order)	**Short description**	**Significance of the concept derived from interviews** (Based on the frequency of occurrences in the interviews)		**Significance of the concept derived from literature review** (Based on applications of the concept in literature and the explained variance in innovation acceptance behaviour that was attributed to the concept in the reviewed studies)		**Decision on the concept** (whether or not the concept will be subsequently used to develop hypothesis for quantitative research)	
Subjective Norms	Perceived social pressure to adopt or not to adopt a certain innovation.	Low	The perceived installed customer base (descriptive norm) and direct social pressure (injunctive norm) have played only a minor role in this interview phase	High	A widely applied and integral part of the TPB model, this concept was consistently found to be a significant predictor	Continue	*Subjective Norms* were rarely mentioned during the interviews. In empirical research, however, this factor was found to be a major determinant for the acceptance behaviour. Due to the possibility that *Subjective Norms* influence behaviour on a more subconscious level, which the interviews might not have been able to reveal, the author decided to test this model in the qualitative stage, despite the rather low occurrence in the interview results.
Trust	The reasonable expectation (confidence) of the respondent that the system will behave in a beneficial way	High	Trust has emerged as an important factor mentioned by almost two thirds of the respondents	Context-Specific	This concept has only been reported to be significant for some technological innovations like mobile banking, and thus its significance is likely to be context dependent	Continue	*Trust* was found to be an important factor in both interviews and empirical research in the field of technological innovations. Consequently, this concept will be included in the quantitative stage.

5.19 Integrating Behavioural Models

In order to develop behavioural hypotheses from these concepts, it is necessary to recall the behavioural models reviewed in the literature review (see Chapter 2). From an empirical point of view, it is difficult to judge the efficiency of the different behavioural models as predictive tools for innovation acceptance. Meta-studies which applied the TPB and the TAM model to the same data set have found that the "theory of planned behaviour explains acceptance [..] beyond that which is explained by TAM alone" (Seeman and Gibson, 2009, p.25). However, other meta-studies have revealed a rather similar predictive efficacy of TPB and TAM (Fusilier and Durlabhji, 2005, p.234). From a more theoretical point of view, the models differ mainly in the degree of generality. The TAM uses only two main constructs, *Perceived Ease of Use* and *Perceived Usefulness*, as the core determinants of use decisions. The TPB, on the other hand, employs beliefs that are specific to the very context under investigation.

In contrast to the TAM, which uses the same constructs for each context, the TPB thus requires conducting a pilot study to identify relevant behavioural beliefs, referent groups and control variables in every context and for each study (Hwa, 2006, p.102). Moreover, unlike the TPB, the TAM does not explicitly include any social pressure variable, which, as discussed above, might be an important influential variable in the context of consumer goods. The UTAUT is an attempt to incorporate both models, but has not yet proved to be a predictive model outperforming the singular applications of the TPB and the TAM. Moreover, operationalisation of UTAUT variables is difficult, since the multitude of constructs lack a standard operationalisation-scheme comparable to the original models (Bagozzi, 2007, p.245). In terms of numbers of applications in contemporary innovation acceptance research, the TAM and TPB are employed almost equally, with only a minority of researchers deciding to use the UTAUT model.

In conclusion, Ajzen and Fishbein's TPB model offers the possibility to combine the results from the qualitative research with a quantitative approach and thus best fits within the chosen research approach. In accordance with the research philosophy discussed in the previous chapter, the employment of the TPB model will satisfy a postpositivistic approach and will base the empirical research on a model that is scientifically robust and empirically proven. Thus, the TPB model will be the model of choice for the further hypothesis development.

Ajzen and Fishbein (1980) propose that behaviour is determined by *Intention,* which in turn is determined by two fundamental factors, the *Attitude* towards the behaviour and the *Subjective Norms*. According to Rogers (2003) it is the persuasion stage when the individual forms a favourable or unfavourable attitude towards the innovation. This phase is followed by the decision and, finally, the implementation phase. Both models thus propose that the acceptance of an innovation is preceded by a positive intention to use the technology in question.

Demographic variables such as age and gender are treated as background variables in the TPB model as well as in other behavioural models such as the UTAUT model. Thus, demographic variables can be an explanation for model factors but are not part of the model themselves.

Chart 28 shows the basic behavioural model of ADAS acceptance.

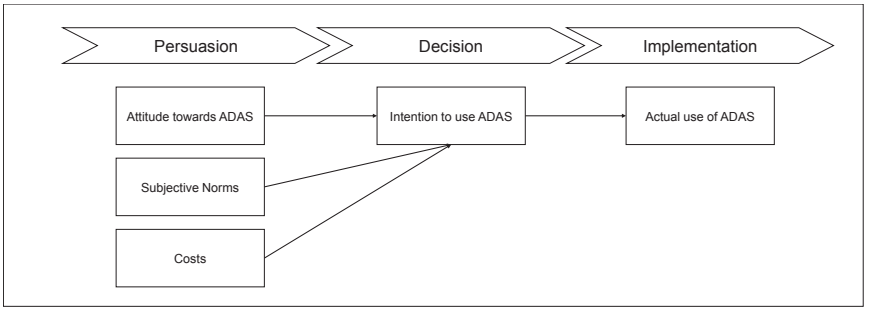

Chart 28: Basic behavioural model, Source: Own drawing based on Rogers (2003) and Fishbein and Ajzen (2010)

As a consequence of this behavioural model, all causal hypotheses will be directed at the *Intention to Use ADA*S, as an affected construct. By determining the intention to use ADAS within the target group, the author will derive at the most exact approximation of the future actual usage of this technology.

5.20 Hypothesis Refinement

Based on the combined analysis of interview data and empirical research, the initial hypotheses, set up before, are now revisited. The analysis resulted in seven core concepts, which are expected to impact the individual acceptance or resistance decision towards Advanced Driver-Assistance Systems. These seven concepts widely confirm the initial hypotheses, but with some minor refinements and supplements.

Initial hypotheses H_{i1} was confirmed, since ancillary driving benefits were found to be a major factor influencing the acceptance of ADAS. The hypothesis, however, will consequently be split into two, with one resulting hypothesis referring to the general enjoyment of driving and one to the desire to exert control. Hypothesis H_{i2} was confirmed by the analysis, as was Hypothesis H_{i3} (both were only slightly reworded, based on the interview results). Three new predictors resulted from the analysis, which were not included in the initial hypotheses, namely *Perceived Usefulness*, *Perceived Installed Customer Base* and *Perceived Costs*. These concepts will consequently be included in the hypotheses model.

The refined hypotheses are as follows:

Enjoyment of Driving
Enjoyment of driving, which refers to various personal motives other than transportation, such as sensory stimulation, excitement, independence or self-expression, was found to be a major reason for resistance towards ADAS. Advanced Driver-Assistance Systems are perceived as supplanting manual driving tasks which respondents prefer to conduct themselves. Thus, it follows that:

H_1: The greater the enjoyment of driving, the lesser the intention to use Advanced Driver Assistance Systems.

Desire to Exert Control
The interviews revealed the concern that ADAS are taking away personal freedom and thus create a form of technological paternalism. Respondents expressed the wish to remain in control of the automobile in any situation. Thus, it follows that:

H_2: The greater the desire to exert control, the lesser the intention to use Advanced Driver Assistance Systems.

Perceived Risks
Throughout the interviews, almost every respondent remarked that he or she expected risks associated with ADAS. The most common risks mentioned by the interviewees were related to safety considerations. Taken together, these risks are expected to serve as a major reason for resistance towards this innovation. Thus, it follows that:

H_3: The greater the perceived risks associated with Advanced Driver Assistance Systems, the lesser the intention to use Advanced Driver Assistance Systems.

Perceived Usefulness
The interviews revealed that the anticipated positive consequences of adopting ADAS, which were mainly attributed to comfort and safety benefits, were the strongest factors supporting the acceptance. Thus, it follows that:

H_4: The greater the perceived usefulness of Advanced Driver Assistance Systems, the stronger the intention to use Advanced Driver Assistance Systems.

Trust in Own Driving Skills
Trust is defined as the reasonable expectation (confidence) of an individual that the adoption of an innovation will be beneficial for him or her. Generally, the literature found empirical evidence that trust in technology supports the acceptance of high-tech innovations. The interviews, however, also revealed that trust is an ambivalent influence factor for innovation acceptance in the case of ADAS. Since ADAS are aimed at substituting manual driving tasks, respondents weighted the level of trust in technology against the level of trust in their own driving skills. To support this thesis, it follows that:

H_5: The greater the confidence in one's own driving capabilities, the lesser the intention to use Advanced Driver Assistance Systems.

General Innovativeness
Even though innovativeness is often regarded as a background factor (such as age or gender), the interviews revealed that the general attitude towards new technologies (or general innovativeness) serves as a major factor influencing the attitude towards ADAS. To support this thesis, it follows that:

H_6: The more individuals trust in new technology, the stronger the intention to use Advanced Driver Assistance Systems.

Perceived Installed Customer Base
Rogers (2003, p.245) argues that individuals do not evaluate an innovation solely on the basis of its performance as judged by objective attributes. Rather, they decide whether or not to adopt the product on the basis of the subjective evaluations of the innovation conveyed to them by others like themselves (peers). During the interviews, respondents remarked that they perceive ADAS

to be a common technological standard. The perceived installed customer base acts as a descriptive norm in this case, meaning that individuals want to comply with what they perceive that the public considers reasonable. Thus, it follows that:

H_7: The greater the perceived installed customer base of Advanced Driver Assistance Systems, the stronger the intention to use these Systems.

Perceived Costs
Costs were found in many interviews as a factor impeding acceptance of ADAS technology. Consequently, it follows that:

H_8: The greater the perceived costs of Advanced Driver Assistance Systems, the lesser the intention to use Advanced Driver Assistance Systems.

In the next chapter, these eight hypotheses will be used as a basis for developing a questionnaire aimed at eliciting the underlying interdependencies between the variables and thus develop a conceptual model towards the acceptance of ADAS.

5.21 Chapter Conclusion

Recapitulating the chapter objectives, the overall aim of this chapter was to develop concepts that are involved in the individual belief formation towards the use of Advanced Driver-Assistance Systems. Based on fifty-four initial codes, which were extracted from the interview transcripts, ten main categories could be developed as potential concepts towards this objective. A combined analysis of the interview results and the results from literature research was conducted in order to increase the validity of the concepts. In sum, eight refined hypotheses were derived as a basis for the next research phase. Chart 29 gives an overview of the model of hypotheses that was developed as the result of this chapter.

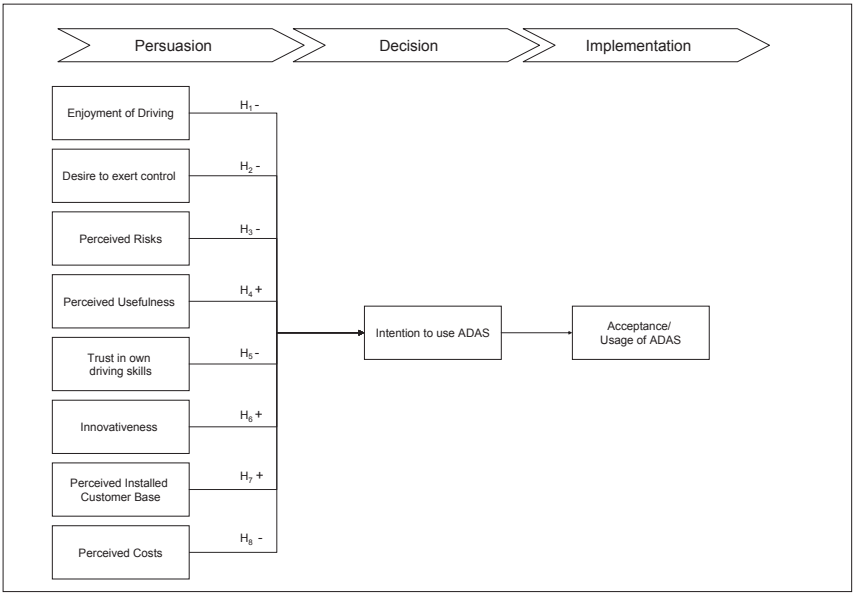

Chart 29: Model of Hypotheses for ADAS acceptance, Source: Own drawing