



Strategic customer foresight: From research to strategic decision-making using the example of highly automated vehicles

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ABSTRACT

Understanding changing consumer needs is crucial for a company's survival. Particularly in the context of vehicle autonomy, customer insights lay a significant foundation for strategic decision-making of organizations in the automotive industry. This paper outlines how a German car manufacturer explored customer needs in the context of highly automated vehicles (AVs)¹ by implementing corporate foresight research with visionary customers and how the findings supported the strategic decision-making process of the firm.

A qualitative pilot study with 29 visionary, trend-receiving customers from Germany, the USA and China identified three innovative use cases for premium highly AVs. A subsequent quantitative online survey with 733 participants from the same three markets confirms the relevance of the use cases for mainstream and innovative consumers. The findings underline that highly AVs are a game changer, transforming future cars into extended living and office spaces, with several implications for practitioners. The findings helped to adapt the organization's business model and branding strategy, provided valuable insights for follow-up studies and shaped corporate communication.

The contribution of the paper is threefold: It introduces the concept of strategic customer foresight, outlines specifically how organizations can implement customer foresight research as well as how such research benefits the decision-making process of companies. Further, the paper discloses future customer needs in the context of premium highly AVs.

1. Introduction

According to the INRIX 2017 Global Traffic Scorecard, commuters living in Los Angeles spent on average over 100 h in traffic jams in 2017 alone. This number equals to 2.5 work weeks per year of poorly invested time. Automated vehicles will allow drivers a more productive and pleasant way of spending time in the car (Becker and Axhausen, 2017; Gruel and Stanford, 2016). Even highly automated vehicles (AVs) with conditional automation will already be able to take over the complete driving task for a specific period of time (Gasser et al., 2012), for example, on the highway, thereby enabling drivers to engage in non-driving related activities. Looking at new secondary activities, preliminary results indicate a higher value of riding in highly and fully AVs compared to vehicles without automation or other modes of transport (Steck et al., 2017; Wadud and Huda, 2018).

Understanding consumer needs with the advent of AVs is

fundamental to the survival of established car manufacturers. In particular, the anticipated changes in market structure stemming from the disruptive nature of highly and fully AVs (Schuelke-Leech, 2017), with competent new players like Google's Waymo or Chinese start-ups such as NIO entering the industry, leave the future of the automotive market highly uncertain (Zmud et al., 2016). Traditional players need to identify signals of change in the industry ecosystem as well as in consumer behavior, in order to answer strategic questions concerning the future of autonomous driving and to realize their role in it (Bernhart and Winterhoff, 2016).

Corporate foresight, “an emerging field with a rich tradition” (Rohrbeck et al., 2015, p. 1) can support organizations in anticipating what might drive the industry and consumers in the next decades. It does so by helping companies to maintain strategic agility, that is, to identify trends and dangers and to respond to them appropriately (Vecchiato, 2015). Corporate foresight also allows organizations to

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¹ Highly automated vehicles (SAE level 3) = highly AVs.

develop new business models, products, and service innovations that are likely to be relevant to customers (Heger and Rohrbeck, 2012; Hofmann, 2015; Rohrbeck and Gemünden, 2011; Ruff, 2015).

The methodological approach of corporate foresight often differs from traditional research (Iden et al., 2017). Traditional research investigates phenomena observable in the *present*, applying established methods such as experiments, ethnography, or surveys. With the help of methods like scenario planning (e.g., Schoemaker, 1995), or technology roadmapping (Petrick and Echols, 2004; Phaal et al., 2004), corporate foresight generates value through perceiving, interpreting and responding to changes in the *future*, for example, to trigger innovation initiatives or to challenge innovation development. However, surprisingly few foresight studies integrate consumers when addressing new consumption behavior (for exceptions see: Hoffman et al., 2010; Hofmann, 2015; Ruff, 2015). In particular, qualitative studies within foresight activities oftentimes rely on expert rather than customer opinions (e.g., Bloem da Silveira Junior et al., 2018), despite the goal of identifying consumer needs, motives and attitudes (Hengstler et al., 2016).

Using the example of the automotive industry, we introduce the concept of strategic customer foresight. We define strategic customer foresight as an approach to improve organizations' strategic decision-making processes through corporate foresight research with customers. Cooperation with our project partner Audi allows us to describe in this paper how organizations can implement customer foresight research and how to embed those insights in a firm's strategic decisions.

This article contributes to the corporate foresight literature as it describes how visionary customers can be involved in corporate foresight, how such research can be distributed within and outside the company, and how data about emerging needs is applied in systematic thinking about corporate strategy. The paper also contributes to research on AVs and answers a call to investigate new mobility options (Kun et al., 2016).

The remainder of the paper is organized as follows: We discuss the potential of customer foresight for optimizing strategic decision-making and the anticipated automotive disruption caused by AVs. Based on interviews and workshops with an international sample of visionary customers of premium vehicles, we introduce new use cases in the context of premium highly AVs, verify the use cases' relevance with a quantitative online survey, and show how the insights were integrated in the organization's communication and strategic decision-making process. We conclude by summarizing how to implement and integrate customer foresight within companies and sketch avenues for future research.

2. Theoretical background

2.1. Embedding corporate foresight and customer insights in strategic decision-making

2.1.1. Corporate foresight

According to Rohrbeck, Battistella, and Huizingh (2015, p. 1), corporate foresight is defined as “a practice that permits an organization to lay the foundation for a future competitive advantage” and helps managers to identify, observe and interpret trends and signals of change, in order to decide on organization-specific implications and actions. Essentially, corporate foresight enables organizations to anticipate what may happen in the future, to gather necessary resources on time, to challenge conventional ideas in order to adapt company culture to changes, and, in line with the latter, to successfully maneuver an organization through change (Rohrbeck et al., 2015; Wright et al., 2013). Especially in times of high uncertainty, such as when an entire industry is disrupted by a new technology, corporate foresight can fundamentally contribute to an organization's survival (Rohrbeck et al., 2015; Tapinos, 2012; Vecchiato and Roveda, 2010). Many enterprises have therefore established corporate foresight units to tackle different

strategic issues, such as trend research for innovative products, anticipating the value of projected innovations, or the identification of new business models (Coates et al., 2010; Daheim and Uerz, 2008; Hofmann, 2015; Rohrbeck and Gemünden, 2011; Ruff, 2015).

Several studies have been published on the positive influence achieved by companies' strategic foresight activities on specific corporate outcomes (Coates et al., 2010; Heger and Rohrbeck, 2012; Rhisiart et al., 2015). For example, previous research has highlighted the value of corporate foresight in vision finding, long-term decision making and brand, product and service development in the automotive sector (Hofmann, 2015) as well as in improving product innovation in consultancies (Andriopoulos and Gotsi, 2006). For this study, a consumer-centric multiple methods approach was chosen that combined qualitative data generation with a quantitative online survey. At the next stage, we analyze why the integration of customers into foresight research is valuable when exploring future customer needs and for informing organizations' strategic decisions (Hofmann, 2015; Ruff, 2015).

2.1.2. Strategic customer foresight

Previous research points out that even the best technical innovations fail if they do not adapt adequately to the customer (Kleijnen et al., 2009). Consumer-centricity and a balance between technology push and market pull are thus important factors for understanding future customer needs and for developing brand and product portfolios that are attractive to consumers, especially in the resource-intensive automotive sector (Ruff, 2015). Companies need to integrate such insights into a consumer-based strategy (Hamilton, 2016) in order to give consumers a voice.

Based on Hamilton (2016) and Iden et al. (2017), who describe how corporate strategy can be informed by consumer or future-oriented research as well as based on the case study described in this article, we suggest the concept of strategic customer foresight. Strategic customer foresight fulfills a dual-purpose task as it aims at capturing how customer needs and behavior might change in the future and subsequently develops an appropriate organizational strategy based on those customer insights. The concept of strategic customer foresight differs from the one of consumer-based strategy introduced by Hamilton (2016), as the former addresses *future* behavior of specific *customer* groups, as opposed to *present* behavior of the common *consumer*. It is also more specific than the concept of strategic foresight described by Iden et al. (2017) as strategic customer foresight focuses on insights generated with customers as opposed to general future-oriented insights. Importantly, strategic customer foresight demands that, in the development of an organizational strategy, future desires and needs of customers are being taken into account.

By understanding adoption and consumer lifestyle changes, and sources of growth for technology development, strategic customer foresight supports enterprises in planning, and decision-making, lifting customer satisfaction and gaining competitive advantage (Coates, 1985; Hofmann, 2015; Kleijnen et al., 2009; Linstone, 2011; Nieuwenhuijsen et al., 2018; Ruff, 2015; Slaughter and Slaughter, 1999). Particularly in times of uncertainty, as in the case of the future of mobility, inviting customers to partake in corporate foresight research increases the validity of projecting future consumer lifestyles and makes it easier to react to them. Research that can be grouped under strategic customer foresight has gained considerable push in recent years (Hoffman et al., 2010; Hofmann, 2010; Hofmann, 2015; Ruff, 2015). Below, we outline, how different research groups have implemented customer foresight research.

2.1.3. Implementing customer foresight research

Over 30 different foresight methods have been developed, ranging from quantitative to qualitative and semi-quantitative methods, which are often triangulated (Popper et al., 2008). Among the more popular forecasting methods are scenario planning (e.g., Schoemaker, 1995), the Delphi method (e.g., Linstone and Turoff, 1975), technology

roadmapping (Petrick and Echols, 2004; Phaal et al., 2004), patent analysis (e.g., Daim et al., 2006), or a combination of different methods (e.g., Hussain et al., 2017). Articles focusing on foresight methods often rely on different variants of scenario planning methodology or surveys with industry experts. On the other hand, articles drawing a link between strategic decision-making and foresight methods often rely on case studies (Iden et al., 2017). Documented cases of customer integration in forecasting activity are scant. Even for research questions targeted at the end consumer, expert panels are often preferred over customer research (Hengstler et al., 2016).

A consumer-centric method that has been applied with growing frequency in corporate settings since its first publication in 2010 is the trend receiver approach (Hofmann, 2010; Hofmann, 2015). Trend Receivers (TRs) are consumers “who perceive changes and potentials of the new in a specific domain in a highly sensitive and differentiated way.” (Hofmann, 2015, p. 92). TR studies invite trend-receiving customers to discuss future trends, signals of change, potentials of the new, and emerging consumer needs from a customer perspective. The TR method contributes to a firm's vision finding, long-term decision-making, and brand, product and service development. It does so by combining both customer insights and foresight elements. TRs are best described by the following search criteria: TRs have a deep understanding of the context in question as well as the motives and values of the consumers interacting with it. They have a well-grounded and concrete usage experience with the product or service under investigation, resulting in concrete projections of future everyday life realities. Furthermore, TRs are very interested in consumer lifestyles and different perspectives. While using their preferences and emotions as a point of reference, TRs have the ability to abstract from themselves and to understand other consumers' needs. They have learned to deal with and to understand consumer paradoxes without lapsing into relativism. Moreover, TRs have a strong desire to understand causes and interdependencies, and they are very curious and open-minded. They have a sharpened understanding of weak signals as well as dynamics of change. In addition, TRs have a good ability to filter and to perceive which structures, motives and values remain stable and the extent to which new behaviors might emerge. Essentially, TRs have the ability to recognize paradigms and to combine them with new impulses and dynamics of change. These characteristics enable them to project realistic opportunities and to detect and describe potentials of the new for future everyday life.

Via pyramiding, “a search process based upon the idea that people with a strong interest in a topic or field tend to know people more expert than themselves” (Von Hippel et al., 2009, p. 1397), TRs are recruited for new research according to specific search criteria. Different corporate organizations have successfully implemented the TR approach in over 50 industry projects (for further description of the TR approach, TR characteristics, differentiation from other concepts and for example studies, please read Hofmann, 2015).

While qualitative research contextualizes human behavior, quantitative research provides objective, statistical analyses about the “what” of human behavior. A quantitative approach including visionary consumers that share characteristics with TRs is the concept of emerging-nature consumers introduced by Hoffman et al. (2010). Studies show that ideas from emerging nature consumers (ENCs) are highly innovative, yet they result in a high “reality fit” and appreciation from the “common” consumer. Participants with emerging nature characteristics can be integrated in concept testing by evaluating their responses to product ideas with concept testing surveys, in order to trial ideas before bringing them to the market. This proactive strategy helps save time and money across all marketing projects. Both Trend Receivers and emerging nature consumers were invited to participate in this research to inform Audi about changing consumer needs in a landscape of future mobility concepts.

2.2. Case study: disruption through (highly) automated vehicles

2.2.1. Disruption in the context of (highly) automated vehicles

Six levels of driving automation have been defined by the SAE international's J3016, ranging from manual to fully automated driving. A significant change in terms of human-car interaction occurs at SAE level 3, conditional automation. Conditional automation implies that, in certain situations, the automated driving system is able to perform the entire dynamic driving task autonomously without human interference (SAE International, 2014, please see Appendix A for an overview of the different levels). With the advent of Level 3 automation, the role of the human operator changes from an active controller, that is, someone who manually controls machines, to a supervisory controller, that is, someone who supervises the functioning of automated technological processes (Lee and Moray, 1994). Vehicles with conditional or high automation (i.e., vehicles with Level 3 and 4, respectively), and especially fully automated vehicles (i.e., Level 5) can be considered a radical innovation (Chandy and Tellis, 1998, 2000) as they challenge the entire transport ecosystem, fundamentally reorder well-established patterns (Schuelke-Leech, 2017; Sprei, 2018; Van de Ven et al., 1999, p. 171) and will likely induce massive paradigm changes (Tushman and Anderson, 1986). Discontinuities on a macro and micro level through AVs seem foreseeable (Garcia and Calantone, 2002). Research shows that this new technology will heavily impact cities (Zakharenko, 2016), consumer behavior (Gruel and Stanford, 2016; Harper et al., 2016), and safety (Fagnant and Kockelman, 2015) as well as travel and energy demand and resulting greenhouse gas emissions (Wadud et al., 2016). As is typical for radical innovations, vehicles with conditional to full automation are anticipated to create new markets relating to hard- and software and to initiate fundamentally new product applications (Herbig, 1994; Meyer et al., 1990; VDA, 2015). Further, automation in cars is an innovation driver, with car manufacturers, automotive suppliers and new IT-players investing billions in research and development of autonomous and connected vehicles. Research on consumer needs in the context of this radical technology can ensure that investments make sense and strategic decisions turn out successfully. While fully AVs are most disruptive, leading to a wide range of everyday applications and tremendous economic potential, the mainstream usage of highly AVs is closer to today's traffic reality. Moreover, highly AVs are the indispensable next phase on the road to fully AVs. Research on the future of highly automated driving allows a close look at an OEM's results transfer to different stakeholders and results application in corporate practice, which is why highly AVs are the focus of this manuscript. Next, we will review previous research on consumer acceptance of AVs and emerging consumer mobility needs.

2.2.2. Consumer research on AVs

Previous academic and market research on consumers' acceptance of autonomous vehicles points out ambivalent public opinions (e.g., Kyriakidis et al., 2015; Payre et al., 2014; Power, 2012; Zmud et al., 2016). Early global surveys carried out by Schoettle and Sivak (2014a, 2014b) showed that the majority of respondents expressed positive opinions, yet high levels of concern about riding in an autonomous car. A global survey by Kyriakidis et al. (2015) reported consumers' fear of software hacking/misuse, legal issues, and the cars' safety. An online survey with a sample from Austin, Texas followed by qualitative interviews also reported that half of participants were likely and half were unlikely to use autonomous vehicles (Zmud et al., 2016). More recent research by Haboucha et al. (2017) conducted in Israel and North America points out that early AV adopters are likely to “be young, students, more educated, and spend more time in vehicles”, and in line with this, Owens et al. (2015) also demonstrated that younger generations are more open to the technology than older generations. Studies investigating perceived consequences of automation for driving behavior show that the public regards the loss of driving fun as a major downside associated with autonomous cars (EY, 2013). Through

participation in a wide array of new tasks while the vehicle takes over the driving task, drivers might find new pleasure in “driving” (Le Vine et al., 2015). Drivers seem open to engaging in secondary tasks such as sleeping, watching movies/TV, using virtual reality (VR) and driving while intoxicated/using drugs (Noblet et al., 2018), watching the roadway or working (Wadud and Huda, 2018). Studies in the driving simulator (Jamson et al., 2013) as well as a field study show that drivers who are familiar with driving assistance systems seem inclined to participate in secondary tasks when the vehicle takes over the driving task (Naujoks et al., 2016). So far, however, detailed use cases and descriptions of how exactly consumers want to spend their time in AVs are lacking. Previous research on the influence of secondary activities on vehicle attractiveness could demonstrate that drivers might explore new uses that will positively influence vehicle attractiveness, travel time and travel distance (Gruel and Stanford, 2016). However, other results show a lower perceived value of time spent in automated as compared to conventional vehicles, indicating that drivers do not yet perceive an advantage in engaging in secondary tasks in AVs (Yap et al., 2016).

Summarizing, consumer research undertaken in the context of AVs underpins the complexity of consumer behavior and the need for further studies, especially on how consumers want to spend their time in the car, to ensure drivers' acceptance of this technology.

2.3. Overview of studies

In order to manage possible weaknesses of different methods in identifying future customer needs, an iterative, multiple methods approach was implemented. The triangulation of qualitative methods with a quantitative survey design helped to increase the results' validity (Bloem da Silveira Junior et al., 2018; Campbell and Fiske, 1959; Flick, 2017), by capturing a more holistic picture of the research question and by ruling out biases inherent in the different methods (Creswell, 2003). Based on an exploratory qualitative pilot study, new use cases for and secondary activities within highly AVs were developed with the help of visionary customers of premium vehicles. Subsequently, the main use cases and activities were introduced to a broader sample of innovative and common consumers within a quantitative online survey to estimate their relevance for a broader consumer group. A detailed study outline follows below.

3. Qualitative pilot study

The qualitative pilot study aimed to better comprehend customers' perception, needs, and motives concerning highly AVs while building the qualitative foundation for the iterative development of new use cases in the context of premium highly AVs. Based on this, purposeful measures for a subsequent quantitative survey could be created.

3.1. Method

3.1.1. Sample

The sample was selected based on a purposive sampling strategy for trend receiving customers of premium vehicles (Hofmann, 2015; Schweitzer et al., 2015; Spiggle, 1994). TRs were recruited for this study due to their visionary competence in anticipating future consumer needs, as demonstrated in previous foresight research (Hofmann, 2015). In total, 29 TRs from Germany (GER; $n = 14$), the USA, and China (CHN) were suggested via a pyramiding process ($n_{GER} = 14$, $n_{USA} = 7$, $n_{China} = 8$; see Appendix B for an overview of the TR sample). All TRs had considerable experience with or were owners of premium vehicles acquired within the past five years at the time of the interviews. This selection criterion ensured expertise with premium automobiles as a basis for envisioning future concepts of premium highly AVs. Further, as indicated by prior studies, higher-income groups living

in urban areas show the greatest interest in autonomous vehicles (Bansal et al., 2016) and benefit most from the technology due to their higher driving distances and higher in-vehicle productivity enabled by automation which leads to a higher perceived value of time (Wadud, 2017). Therefore, all TRs were of higher income groups. Lastly, Germany, the USA and China were selected as markets for the study since they are among the four biggest automotive markets worldwide (Statista, 2016) and represent the most important customer segments for the automotive industry. Furthermore, prior studies have indicated differences in preferences between drivers from developed and emerging countries (Kyriakidis et al., 2015; Schoettle and Sivak, 2014b), highlighting the need for comparisons between different markets.

3.1.2. Interviews

Based on extensive desk research, a semi-structured interview guide was developed including open questions to explore how intentions, motives, and behavior regarding highly AVs might change up to 2025. This is an established way of generating primary data in foresight research (Magruk, 2011; Porter et al., 2004), and has previously been applied to different research questions in corporate foresight studies (Hofmann, 2015; Moradi and Vagnoni, 2018; Spiess et al., 2015). The interviewer started by asking grand-tour questions about the interviewees' current mobility behavior and continued with the interviewees' perception and idea of highly automated driving as well as preferred in-vehicle time usage. The interviewer probed when it was thought relevant. All interviews were conducted by two interviewers in winter 2014/15, were recorded verbatim and lasted on average 110 min each. Content and structure of the interview guide were continuously and iteratively adapted between interviews (Spiggle, 1994). The iterative process helped with induction, that is, with developing concepts from the data, as well as with deduction, thus refining these concepts and inferring theoretical and practical implications. The interview phase was ended when saturation was reached and no new insights were gained through additional data (Morse, 1995).

All interviews were transcribed, coded, and analyzed via qualitative content analysis, an empirically grounded methodology that helps to draw replicable and valid inferences from the participants' interviews (Krippendorff, 2012; Lincoln and Guba, 1985; Spiggle, 1994). The interview data was coded for benefits of highly AVs and preferred in-vehicle time usage. Through structured coding (i.e. open, selective and axial coding, Glaser and Strauss, 1967) the results obtained were aggregated into use cases which emerged from the data, e.g. the car as entertainment space, as well as general secondary activities, e.g. watching television, and use case-specific secondary activities.

The use cases were visualized by professional graphic designers, as visualizations trigger an authentic experience of future scenarios and facilitate insight generation, new perspectives and the integration of implicit knowledge (Eppler and Platts, 2009; Müller and Shwarz, 2016; Schweitzer, 2017).

3.1.3. Workshops

Following the interviews, two consecutive workshops (each lasting 6 h) allowed for an open discussion of the use cases, further knowledge creation (Dufva and Ahlqvist, 2015; Spiess et al., 2015), and reflection and projection. The workshops were held with German TRs who had participated in the previous interviews ($n_1 = 6$ and $n_2 = 8$, see Appendix B for sample description). During the workshops, the visualized use cases were systematically structured, discussed, discarded, extended and fine-tuned by means of individual and group work as well as plenum discussions.

3.2. Results

The interviews and workshops revealed that TRs imagine innovative use cases for premium highly AVs. Three main use cases as well as



Fig. 1. Visualizations of the final three use cases in the context of highly AVs (a. entertainment, b. work, c. communication and relaxation). The use cases were established on basis of a qualitative pilot study with 29 trend receivers from Germany, the USA, and China.

Source: Audi Trend Research, use cases and illustrations developed in cooperation with Hyve AG.

attractive secondary activities were identified on the basis of the qualitative interviews and workshops. The most relevant activities described by the participants are those which can still be undertaken in the classical driving position and which can be interrupted if the driver's attention to the traffic is required. The visualizations and descriptions of the final three use cases for highly AVs served as stimuli in the subsequent quantitative online survey (see Fig. 1 for visualizations).

3.2.1. Entertainment

TRs envisioned highly AVs that offer entertainment in form of a cinema-like experience. While the vehicle is in control of driving, TRs imagined watching movies or TV, playing games (analog or digital) or listening to and/or exploring music and audio books in an easy-going yet private atmosphere. Furthermore, TRs could imagine using the car for entertaining family time, for example, watching a movie together with their kids.

3.2.2. Work

The second use case is linked to professional life. TRs described highly AVs as typical office spaces in which they can work on new concepts and ideas, write reports, create presentations, talk to colleagues or business partners via (video) telephone, write emails or network. TRs appreciate a private and silent atmosphere, unlike in a train or plane, and the facilitation of working tasks by adaptation of the cars' interior design to their needs. In line with this idea, TRs imagined having a table to work at, an integrated video phone or the option to have meetings with colleagues inside the car.

3.2.3. Communication and relaxation

The third use case is again connected to private life and results from TRs envisioning the car as a relaxation retreat in which to calm down, relax and escape from everyday life. This use case also includes the possibility for communication with friends or family, either personally or via (video) phone, as well as the pursuit of personal interests, like browsing the internet as well as enjoying the ride with some snacks and drinks.

4. Quantitative online survey

Qualitative data collection was followed by a quantitative online survey, which consisted of closed and open questions and was also implemented in Germany, the USA, and China. The survey allowed us to evaluate the relevance and consumers' acceptance of the visualized use cases and secondary activities in premium highly AVs as identified in the qualitative pilot study.

4.1. Method

4.1.1. Sample

Participants were recruited from a participant pool provided by an external agency. In total, 733 participants aged from 25 to 65 took part in the online survey ($n_{GER} = 284$, $n_{USA} = 230$, $n_{China} = 219$, $M_{age} = 42.5$ years, 46% females, see Appendix C for country-specific demographics). Participants all held a university degree, household net income was EUR 3000 per month or higher and respondents were owners of a new premium car acquired within last five years in order to represent the premium car segment and thereby maximize external validity in identifying attractive use cases for premium highly AVs (Singleton and Straits, 2005). Due to their higher interest in autonomous vehicles and their predicted early adoption pattern (Haboucha et al., 2017; Owens et al., 2015), around one fourth of participants (27.8%) were screened to be digital natives, who are individuals born later than 1979. In order to allow for more innovative ideas concerning secondary activities in highly AVs in response to the open questions (see description below), a third of participants were screened to be high in emergent nature (i.e., to obtain a mean score of 6.0 or higher on the 7-point ENC Likert scale; Hoffman et al., 2010).

4.1.2. Measures and survey

After being informed of the expected time for completion, respondents were screened according to the predefined criteria listed under "sample". The survey was structured hierarchically, moving from abstract to more specific usage situations and features in the context of highly AVs. At first, subjects read a description of highly AVs in order to

align the subjects' concept of the technology (see Appendix D; Hohenberger et al., 2017). Then, subjects were asked to imagine a fictional 120-minute drive on a highway in a highly AV. Within the scenario, the car was described as taking over driving for 120 min and subjects were told that time could be invested in secondary activities outside the driving task. While imagining this situation, participants had to choose their preferred use case during the ride. Use cases were represented by visualizations obtained in the qualitative study (Fig. 1) and were additionally described in written form to facilitate participants' imagination of the use case as well as to ensure that participants understood the differences between the use cases (please see written description in Appendix E). The three use cases were listed in random order.

Afterwards, participants were asked to allocate 120 min in a highly AV to a list of secondary activities according to individual preference. The secondary activities were also derived from the qualitative data and formulated in detail in three discussion rounds with three consumer behavior researchers and two automotive experts (see Appendix F for the list of secondary activities). Subsequently, the sample was randomly distributed among the three main use cases and aimed to dive deeper into one specific use case with the help of open questions such as "What is good entertainment/work/relaxation for you? How do you imagine entertainment/work/relaxation in a highly automated car? Think of activities, atmosphere, interior, technology, software and interfaces". In order to prevent fatigue, subjects were asked to imagine and describe only one use case at this stage of the survey. In a last step, participants rated the perceived relevance of different secondary activities that also emerged from the qualitative data and expert discussion rounds on a 7-point Likert scale. Those more concrete activities (e.g., watch TV) were relevant mostly for one specific use case but might also play a role in the other use cases (i.e., especially listening to music which is nowadays a very common activity in the driving context and one that oftentimes accompanies different activities in everyday life, such as relaxing or working). The authors wanted to get a first impression of the relevance of different specific activities, aware of the fact that there might be some overlap between use cases. We believe, that a potential overlap in secondary activities does not vitiate the results concerning the choice of the favorite use case. The visual representations of the use cases developed in the qualitative pilot study were accompanied by descriptive text to clarify what participants should expect from each use case and to describe their main purpose. A potential overlap between use cases might, later on, be solved by producing a car providing individual solutions to allow drivers to engage in various activities simultaneously or successively.

4.1.3. Data analysis

The authors performed descriptive analyses and significance tests to quantify and estimate the relevance of the three main use cases and secondary activities. Due to research pointing at country- and gender-specific differences (Hohenberger et al., 2017; Kyriakidis et al., 2015; Schoettle and Sivak, 2014a, 2014b), different customer segments defined by sociodemographic variables (i.e., country and gender) were compared to assess the use cases' and activities' relevance for specific customer segments. Similar to the qualitative pilot study, the open questions were coded and analyzed via qualitative content analysis (Krippendorff, 2012; Lincoln and Guba, 1985; Spiggle, 1994).

4.2. Results

4.2.1. Choice of preferred use case

A chi-square test examining differences in consumer preference for the three use cases was found to be significant ($\chi^2(2, N = 661^3) = 63.13, p = 0.001$). Results indicate that participants' top preference was for the use case "communication and relaxation" in a highly AV, with almost half of the sample (47.8%) voting for this option. The difference between the use cases for entertainment (27.5%)

and work (24.7%) was small. The overall high frequencies of votes for all use cases point towards their general relevance for participants.²

4.2.2. Country-specific differences

A chi-square test investigating the relationship between use cases and countries points out significant differences between Germany, the USA and China ($\chi^2(4, N = 661^3) = 19.05, p = 0.001$). A comparison of column properties with Bonferroni-adjusted p -values revealed that the Chinese sample selected the use case "work" significantly less often and the use case "communication and relaxation" significantly more often than German and US-American subjects. Within-country comparisons show that also the difference between the use cases "work" and "communication and relaxation" were significant for the Chinese sample.

4.2.3. Gender-specific differences

The observed results for gender also differed significantly from what would be expected if female and male participants were drawn from the same distribution ($\chi^2(2, N = 661^3) = 14.63, p = 0.001$). A comparison of column properties indicated that women expressed a significantly stronger preference for the use case "entertainment" in comparison to men. Men, on the other hand, chose significantly more often to work in the car. The observed counts for "entertainment" and "work" also differed significantly within both groups.

Please see Figs. 2 and 3 for the results of the overall sample and group comparisons. Appendices G and H show detailed cross tabulations for use case * country and use case * gender.

4.3. Time investment in secondary activities

The distribution of minutes onto secondary activities is in line with the dominance of the use case "communication and relaxation". Participants would like to invest most of their time in recharging energy (i.e., snoozing, relaxing, enjoying the landscape, eating, drinking, $M = 21.75$) and listening to music or audio books ($M = 20.45$). Participants also allocated over 10 min per activity to the other tasks, pointing to their general relevance, with the exception of gaming.

4.3.1. Country-specific differences

A significant result of a Levene's tests for homogeneity of variances indicated that variances of the secondary activities were not equal for the three countries. In order to account for the inhomogeneity of variances, Welch ANOVAs were conducted to compare the effect of country on the allocation of minutes. Significant effects of country were found for most of the activities presented (i.e., for "watching TV" ($F(2, 730) = 6.32, p = 0.002$), "gaming" ($F(2, 730) = 18.64, p < 0.001$), "developing ideas and concepts" ($F(2, 730) = 6.37, p = 0.002$), "organizing and implementing projects" ($F(2, 730) = 7.62, p = 0.001$), "networking" ($F(2, 730) = 6.09, p = 0.002$), and "pursuing personal interests" ($F(2, 730) = 28.00, p < 0.001$). Post-hoc comparisons applying Games-Howell tests revealed that the Chinese sample distributed significantly more minutes onto the activity "gaming" ($M_{GER} = 3.97, SD_{GER} = 7.88, M_{USA} = 5.43, SD_{USA} = 10.25, M_{CHN} = 9.70, SD_{CHN} = 12.04$), and significantly less minutes onto "pursuing personal interests" ($M_{GER} = 20.68, SD_{GER} = 19.08, M_{USA} = 22.86, SD_{USA} = 20.52, M_{CHN} = 13.21, SD_{CHN} = 10.75$) in comparison to the other two countries. German subjects, on the other hand, preferred to distribute more time to work-related activities than the other two country samples (e.g. "developing ideas and concepts": $M_{GER} = 15.20, SD_{GER} = 17.53, M_{USA} = 10.42, SD_{USA} = 15.46, M_{CHN} = 11.23, SD_{CHN} = 11.97$) and were significantly less interested in watching television in the car ($M_{GER} = 12.02, SD_{GER} = 17.03, M_{USA} = 17.70,$

²No significant differences were found in the choice of use case between consumers high and low in emergent nature (Hoffman et al., 2010).

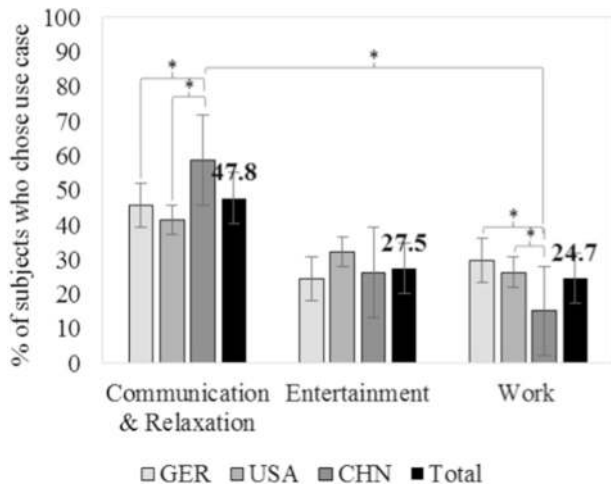


Fig. 2. Choice of preferred use case for the overall sample and according to country in percentage, n = 661.¹ In this and subsequent figures, error bars indicate the standard error and *: Asymp. Sig. (2-sided), p-value ≤ 0.05, **: Asymp. Sig. (2-sided), p-value ≤ 0.01. GER = Germany, CHN = China.
¹Participants who chose more than one use case were excluded from the analysis.

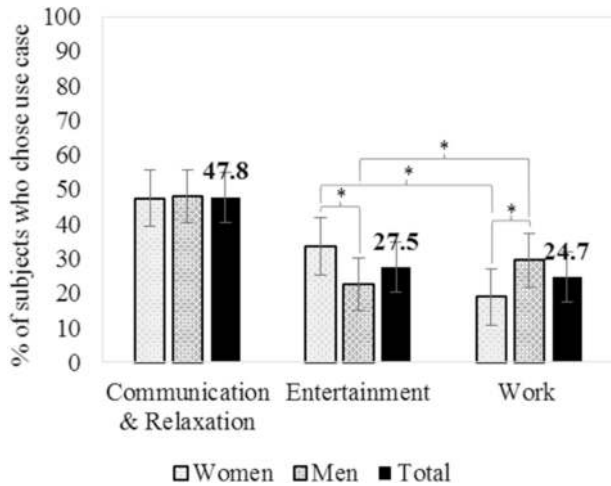


Fig. 3. Choice of preferred use case for the overall sample and according to gender in percentage, n = 661.¹
¹Participants who chose more than one use case were excluded from the analysis.

SD_{USA} = 22.40, M_{CHN} = 15.97, SD_{CHN} = 15.15). Please see Fig. 4 for a depiction of mean minutes allocated for the overall sample and country comparisons.

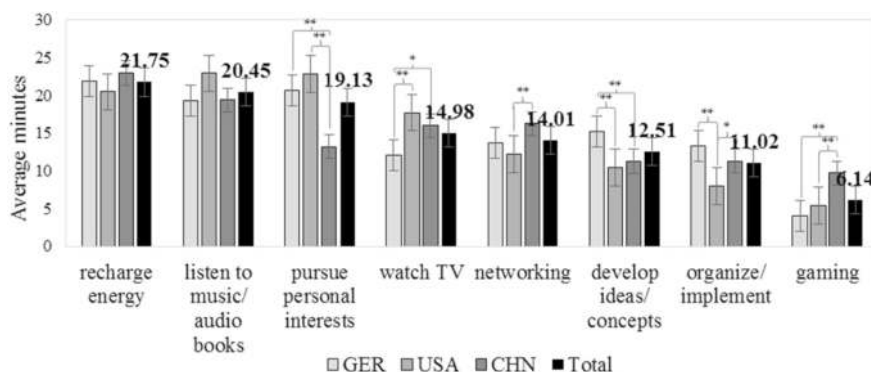


Fig. 4. Distribution of minutes to secondary activities for the overall sample and by country, n = 733. Displayed means reflect the overall sample.

4.3.2. Gender-specific differences

In line with their pronounced interest in the use case “entertainment”, women allocated more time to hedonistic activities like listening to music and audio books ($t(731) = 2.68, p = 0.007$), and pursuing personal interests ($t(637.33) = 2.49, p = 0.013$). Male subjects distributed significantly more minutes to organizing and implementing projects ($t(730.92) = -3.172, p = 0.002$) as well as networking with business partners ($t(731) = -2.754, p = 0.006$), underlining their interest in the use case “work”.

4.4. Use case-specific secondary activities

4.4.1. Entertainment

A descriptive analysis of the relevance of specific secondary activities within the use case “entertainment” revealed that new entertainment possibilities, like watching TV and movies, were perceived as relevant for highly AVs (Appendix I). The analysis of the open questions showed that the German and Chinese samples more often mentioned an entertainment experience in solitude, while American subjects could rather imagine sharing the experience with friends or family. In general, the atmosphere was described as relaxed, quiet, comfortable and cheerful. German and American subjects listed (HD) TV screens and a Dolby surround sound system as desirable features to support a perfect in-vehicle entertainment experience. The Chinese sample expressed a desire for stable Wi-Fi and, in less concrete terms, a first-class, intelligent entertainment system for an optimal entertainment experience.

4.4.2. Work

In the context of work in a highly AV, typical office activities such as doing online or offline research for projects, planning to-do lists, having contact with colleagues and coordinating tasks, were perceived as particularly relevant (please see Appendix J). The open questions revealed that, across countries, participants preferred to work alone and undisturbed in a highly AV. The atmosphere was described as private and tranquil. German and American subjects in particular envisioned the highly AV as an extended office in order to work effectively, including a classical office setup with stable and fast internet, a telephone and monitor as well as storage areas. Chinese participants mentioned a comfortable, soundproof interior, Wi-Fi connection and intelligent technologies to establish an optimal work atmosphere.

4.4.3. Communication and relaxation

All activities within the context of communication and relaxation were rated rather high in perceived relevance, which underlines the strong preference for this use case (please see Appendix K). According to the open questions analysis, the subjects could envisage a communication and relaxation experience either alone or with others. The atmosphere within this use case was described as calm and easy-going. Across countries, participants desired stable Wi-Fi access and high

comfort. German and American respondents in particular addressed specific features, such as a good sound system, high resolution displays and comfortable seats. The Chinese sample expressed interest in in-vehicle game consoles.

The moderate to high relevance ratings and answers to the open questions demonstrate participants' acceptance of new secondary activities in highly AVs. Whereas Chinese and female participants indicated more interest in hedonic activities inside the car, German and male respondents showed a higher preference for work tasks. Please read [Appendices I–K](#) for detailed statistical analyses and depictions of use case-specific secondary activities.

5. Discussion of case study

This consumer-based corporate foresight research conducted in three developing and developed markets explored changing customer needs and the relevance of new use cases in the context of premium highly AVs. Based on interviews and workshops three main use cases were identified, which were subsequently validated, reviewed, and fine-tuned with the help of a quantitative online survey. Visionary customers (i.e., trend receivers as described by [Hofmann, 2015](#)), and emergent nature consumers (as described by [Hoffman et al., 2010](#)), were invited for both studies. This customer foresight research helped to inform the strategic decision-making process of Audi as well as corporate communication.

5.1. A new purpose for the automobile

In line with [Noblet et al. \(2018\)](#) and [Wadud and Huda \(2018\)](#), but contrary to [Kyriakidis et al. \(2015\)](#) and [Schoettle and Sivak \(2014b\)](#), the results of the qualitative and quantitative studies indicate an open-mindedness of customers towards new secondary activities in highly AVs. For example, visionary and common customers of premium vehicles accept and appreciate the analogy to specific rooms, such as a cinema-like experience for entertainment, a space for relaxation, or a moving office. However, individual preferences of subgroups exist with respect to use cases and specific secondary activities. The results denote that customers expect premium highly AVs to transform from pure mobility providers into extended living and working spaces with new functionalities in order to guarantee a good in-vehicle experience.

In comparison to current mobility services which already offer different activities, such as trains or planes, privately-owned highly AVs in particular offer the benefit of allowing people to engage in meaningful activities in a more individual, private setting. For example, the option to use the vehicle for leisure and relaxation is reminiscent of a living room in which to enjoy personal activities and might fuel an ongoing interest in the purchase of private vehicles ([Steck et al., 2017](#)). As indicated by preliminary studies, privately owned highly AVs might indeed be valued more highly than shared experiences with other customers.

The use cases for premium highly AVs identified here highlight the role of these vehicles in a new smart model of mobility, with value in mobility being derived from how much the traveler spends on vehicle ownership, services, apps, and potentially on travel tickets ([Docherty et al., 2018](#); [Fagnant and Kockelman, 2015](#)). Highly AVs' increasingly user-centric nature, offering a spectrum of secondary activities outside the driving task as well as potentially innovative and personalized services ([Heitanen, 2014](#)), will allow this means of transport to better address individual customer needs, improve the quality of hours spent in traffic and commercialize such activities. Especially for commuters, these new possibilities seem to positively influence the attractiveness of travel-time in AVs ([Hensher, 2011](#); [Steck et al., 2017](#)), with high income commuters benefitting most from automation, due to a more productive use of time inside AVs ([Wadud, 2017](#)). A higher appreciation of travel time in highly AVs might not only result in new revenue streams for manufacturers and service providers, but might also have a

profound impact on the amount of travel time spent and distance travelled in future automated cars ([Gruel and Stanford, 2016](#)). The latter might potentially lead to more vehicles on the road, including all the forecasted positive (e.g., higher safety, less congestion, greater efficiency) and negative (e.g., higher system costs, information asymmetries due to data misuse) externalities ([Docherty et al., 2018](#); [Fagnant and Kockelman, 2015](#); [Gruel and Stanford, 2016](#)).

5.2. Implications for manufacturer and suppliers

Major implications of vehicle automation for practitioners like Audi that follow from the results are the need for fundamentally new product applications ([Herbig, 1994](#); [Meyer et al., 1990](#); [VDA, 2015](#)) as well as the formation of new markets and partnerships surrounding hard- and software. For example, the use cases for premium highly AVs described here suggest that the cars' interior design, systems and services should enable flexible ways of using space and time, with the car's interior adapting to new secondary activities with movable chairs, displays, and table areas. Additionally, personalized digital services and their integration into premium highly AVs might be necessary to attract premium customers and provide compensation in the form of the new degrees of freedom and usage of time.

The new requirements and consumer needs following vehicle automation challenge existing functionalities and pave the way for alliances and strategic partnerships with other players ([Docherty et al., 2018](#)). For example, new partners specialized in the interior architecture of offices and private spaces might support the design of innovative interior concepts for highly AVs, while large technology enterprises are already helping with establishing the IT infrastructure needed for autonomous driving and developing new digital services together with partners from the automotive industry ([Cohan, 2017](#); [Kröger, 2017](#)).

5.3. Integration of results in Audi's strategic decision-making

Audi merged the generated research results into a business report. Further, visualized scenarios, including short film clips, were developed based on the data. The report and visualized scenarios facilitated the synthesis of customer insights and allowed for better understanding of the challenging content ([Eppler and Platts, 2009](#)) as well as the transfer of knowledge at many levels, internal and also external to the firm ([Müller and Schwarz, 2016](#)). In particular, the use of inspiring visualizations involved stakeholders on an emotional level and enabled the buy-in of recipients ([Bezold, 2010](#); [Eppler and Platts, 2009](#); [Müller and Schwarz, 2016](#)).

The report and visualizations influenced corporate communication and strategy at many levels: Internal and external communication, envisioning of change, inspiration for future product design, and the adaptation of strategies. Firstly, the project's results laid the foundation for internal communication on the intranet trend portal, a website with over 40,000 visits per year, as well as a public Audi website on trend and innovation topics (www.audi.com/air). The final report also stimulated decision-makers to consider the suggested changes and challenged their prevailing mindset. For example, the CEO of the company communicated the project's results to a wide external audience at symposiums and press conferences. The results clearly increased the management's intention to invest into further insights and aligned the mindset towards innovation-driven thinking, especially on more specific aspects regarding autonomous driving and emerging customer needs. Moreover, R&D departments used the project results within the development processes of new design and technology approaches for future car models. Most importantly, the results provided a sound basis for the mid-term corporate and branding strategy. That is, the insights contributed to preparing the company for a business model that includes access-based in addition to pure ownership-based consumption, allowing customers to access different car models for different use cases

without the need to purchase. Based on the insights gathered in this research in addition to other sources, Audi is acting on the assumption that within the next ten years, most customers will still want to possess their vehicle, especially in the premium car market. Despite a likely decrease in market share of car ownership, high marginal costs for access cars during rush hours might motivate most drivers to purchase fully AVs. However, a new market segment of access cars is developing, which allows mobility providers to market mobility-as-a-service (i.e., MaaS), for example, by offering new solutions regarding car sharing or car rental.

In the context of highly and fully AVs, MaaS can be divided into five main levels of added value: 1) the manufacturer of self-driving-systems, enabling the vehicles to operate autonomously, 2) the OEM, producing the vehicles, 3) the fleet provider, which operates the vehicles and is responsible for the maintenance, 4) the mobility provider selling trips to the customer, and 5) additional services like entertainment, snacks, equipment for pets, escorting special travelers (e.g., children traveling alone). Audi's future business model in the era of fully AVs will address MaaS at the level of OEMs, fleet providers, and additional services. In other words, Audi will not only produce vehicles but also sell mobility as well as additional services around the trip. From a brand perspective, the fully AV might increasingly become a commodity, given a much more regulated traffic environment with "same speed for everybody". Thus, the new field of brand differentiation will be the mobility experience for the customer, consisting of the vehicle (especially the interior experience), the planning, booking, and execution of the trip, and the additional services offered. In sum, more than just being a premium car manufacturer, Audi will develop towards a premium mobility provider. Audi will enrich its main competence of building vehicles with mobility services, providing the customer a new mobility experience – traveling in an individual space alone or with friends, family, and colleagues, having the option to work, entertain, relax or dine.

6. General discussion

Corporate foresight is crucial in enabling organizations to imagine and project trends in technology, markets and consumption behavior and to react appropriately to such signals by strategically planning ahead, freeing resources, and preparing the company for change (Rohrbeck et al., 2015; Wright et al., 2013). The present research investigated future consumption behavior in the highly uncertain automotive market, which will be disrupted by AVs providing new concepts for individual mobility. This research contributes to literature on corporate foresight by showing how strategic customer foresight, a concept introduced in this article, can support organizations in understanding changing customer needs and how organizations can embed such insights in corporate communication and strategic decision-making. The results of this multiple methods research further highlight the benefits of triangulating different approaches (Bloem da Silveira Junior et al., 2018; Campbell and Fiske, 1959; Flick, 2017). Moreover, the concrete case study in this article helps organizations within the automotive industry to understand future needs of automotive customers and to anticipate the decision-making processes behind customers' acceptance of and their willingness to use automated driving functions and autonomous cars.

6.1. Customer foresight research with visionary customers

Classical consumer-based market research often lacks vision and innovativeness, especially in the case of radical innovations. On the other hand, research with visionary customers, such as Trend Receivers in qualitative research and emergent nature consumers for quantitative studies, supports organizations in challenging strategic planning and in further developing strategy and execution. It enables researchers, strategists and practitioners to detect new sources of competitive advantage, discover new market segments, and ultimately influence

business model innovations, by envisioning new technologies, reflecting on highly innovative ideas, and enriching concepts. Further, foresight research with visionary customers points decision makers to the steps and resources necessary for change management. Research based on visionary customers offers a methodically elaborated answer to the question of what the future customer is likely to expect from an industry and its firms.

The current article described two different approaches to qualitative and quantitative customer foresight research, respectively: The Trend Receiver method and the inclusion of emergent nature consumers in surveys. Qualitative Trend Receiver research is based on hypotheses about trends, weak signals and new competitors with relevant potentials derived from secondary data based on continuous market observation and market development analysis. With the help of the hypotheses as factual information and stimuli in interviews and workshops, qualitative studies with TRs provide a methodology for exploring the relevance of (weak) signals and trends, new ideas about how product or service offers might evolve from such trends and signals over time, emerging needs, and future consumer behavior. TRs support researchers in conceiving motivations and triggers behind trend data and in understanding possible future market dynamics and changes. They bolster understanding of what major drivers and growth inhibitors exist from a customer perspective, and which technologies might gain traction. In addition, TR research helps to assess competitive structures as well as risks stemming from current competitors, companies that might develop into key players and start-ups or new business concepts that have the potential to disrupt the market. For example, TRs can be invited to discuss strengths and weaknesses with respect to specific market participants or competitors (i.e., incumbents and start-ups alike) or what a new player's product or service needs to offer to motivate the participant to switch brands. In order to collect answers to these questions, interview questions need to address the TRs' personal perspective, such that the participants can reflect on everyday life experiences, their own expectations and personal future needs.

Quantitative surveys, on the other hand, provide numeric weights and comparisons of human behavior and offer the opportunity of objective, statistical analyses. Different scales, such as the Emergent Nature Scale (Hoffman et al., 2010) or the scale on Technologically Reflective Individuals (Schweitzer et al., 2015) support organizations in identifying consumers high in innovativeness, visionary competence and technological reflectiveness. These visionary consumers are better able to assess the potential of new and radical ideas and concepts, and thereby help companies to adapt their strategy to relevant upcoming consumer needs, and to develop future product portfolios accordingly. Depending on the research question and task, different scales should be selected.

Integrated qualitative and quantitative research, as in the present article, provides multifaceted answers to critical business questions about why customers behave in a certain way and what they will do in future, especially in relation to customer-driven brands. Further, a multi-methods design and diverse samples have the benefit of increasing the validity of the results (Bloem da Silveira Junior et al., 2018; Campbell and Fiske, 1959; Flick, 2017). For example, surveys with market-representative consumers help to validate the findings for a broader target group.

6.2. Communicating and embedding insights into strategic decision-making

The findings of customer foresight research need to be synthesized into a report for distribution within firms, including recommendations based on customer insights for business action. The results should be presented both efficiently, using facts and figures, and in an emotional way via visualizations and inspiring and convincing storytelling. Subsequently, insights need to be presented to key decision makers; if possible the board, different company divisions and the responsible technical, market and organization-related specialists. Influencing

senior leadership is necessary for turning insights into strategic action.

A wider employee audience can also be informed about the research content by sharing the results on internal websites and other communication channels. By disclosing results to other employees, knowledge within the organization about relevant future trends can be increased, such that different divisions can integrate the information in their own planning and work.

Most importantly, customer foresight research with visionary samples is an important source for implementing new ideas within an organization. Specifically, four major areas allow for an integration of customer foresight in the strategic decision-making process of the firm:

- 1) Corporate Strategy: Considering short-, mid- and long-term planning, changes and innovations concerning the business model initiated by market pull with the help of customer foresight research.
- 2) Brand Strategy: Adapting brand positioning based on a strong vision and potentials regarding emerging customer needs and changing lifestyles.
- 3) Product Strategy: Initiating the development of better products and revision of the product portfolio by means of customer foresight research.
- 4) Internal and External Communication: Implementing different means and using various channels to sensitize the organization about emerging customer needs and consumption patterns and to demonstrate the firm's future market orientation to external stakeholders based on the generated know-how.

Depending on the scope of the studies, customer foresight research generates ideas and solutions relevant for short-, mid- and long-term planning. In order to initiate implementation of new ideas, internal stakeholders can be integrated in conversations about future challenges and possible solutions.

While internal implementation can be challenging, primary data from visionary customers can support managers in convincing executives of changing needs and possible solutions for the future. In the most successful case, visionary customer insights lay the foundation for mid- or long-term corporate strategy. In the case of initial insights concerning a growing field or trend, customer foresight research can be helpful in informing the design and implementation of future studies and can be instrumental in persuading decision-makers to provide budget for the implementation of further research, where necessary. Please see Fig. 5 for a depiction of the process underlying strategic customer foresight.

7. Limitations and future research

Illustrated by a multi-method study on highly AVs, our findings provide first insights into how visionary customers can enrich corporate foresight research and how companies and different internal stakeholders can use the results to inform strategic decision-making. As our findings come with contextual and methodological constraints and yield initial exploratory insights, we call for further research pursuing the fruitful avenue of strategic customer foresight with visionary customers as well as research in the field of autonomous driving.

Methodologically, two main limitations are inherent in the Trend Receiver approach implemented in the qualitative study, which might imply that the results are not representative of the general population. The first limitation is the small sample size, which is typical for qualitative studies. The sample size in this article exceeds the minimum recommended by McCracken (1988). Nevertheless, the sample does not reflect all criteria of the general population. Furthermore, the specific characteristics of Trend Receivers allow this group to imagine and project important future trends and emerging consumer needs better

than mainstream consumers. At the same time, Trend Receivers differ considerably from mainstream consumers with respect to these characteristics. In order to compensate for the small sample size and specific sample characteristics as well as to ensure a higher acceptance by the internal audience at Audi, we implemented the online survey described, inviting consumers high in emergent nature to mirror trend receivers as well as mainstream consumers to represent the general customer group of premium vehicles. With the help of the online survey, we could validate the relevance of the use cases for visionary and mainstream consumers.

Future research could dedicate studies to reflecting the pyramiding process for recruiting the TR sample as well as to the development of a TR scale for systematically recruiting TRs for qualitative and quantitative studies. In addition, other combinations of different methods, such as patent analysis feeding interview guidelines of TR interviews, might result in even richer discussions and yield interesting results for academia and practitioners alike.

Another limitation of this research is the focus of the present study on customers of premium vehicles which makes it difficult to transfer the results to other customer groups that might have different purchasing powers, interests or preferences. Further research on non-premium markets would allow for interesting comparisons of different purchasing power levels in terms of needs and opportunities. Also, the use cases described might increase the price of highly AVs, with more affordable vehicle segments not being able to offer all use cases or secondary activities described here. However, especially for individuals with a limited budget, more meaningful activities in highly AVs might be an important factor influencing their choice of transport. Follow-up studies with different customers groups might reveal other use cases or activities.

8. Conclusion

In times of transformation through business model innovations and radically new technologies, companies must understand emerging customer needs and the impact of trend and weak signals on consumption behavior in order to remain competitive. This paper contributes to research on corporate foresight by outlining how customer foresight research can enhance organizations' strategic decision-making. With the help of a case study on highly automated driving, this research shows how relevant customer insights can be gathered with visionary consumers and that these insights lay a significant foundation for an organization's strategic decision-making in the automotive industry. This paper also contributes to research on the impact of highly AVs by describing changes in consumption behavior, arising customer needs, and implications for practitioners in relation to highly automated cars. Offering many more degrees of freedom to passengers in terms of space and time usage will result in new consumption patterns, new priorities and strategic partnerships for car manufacturers and suppliers, as well as new business models. This corporate foresight research has contributed to the research landscape of an automotive industry partner and motivated decision-makers to adapt the company's business model and branding strategy according to visionary customer insights. Further, this research helped the firm to reflect on strategic mid- and long-term opportunities that influence the development of new products and service-ecosystems.

Declaration of interests

Dr. Rupert Hofmann and Andreas Meinheit work for Audi Business Innovation GmbH and AUDI AG, respectively. This research has been funded by AUDI AG.

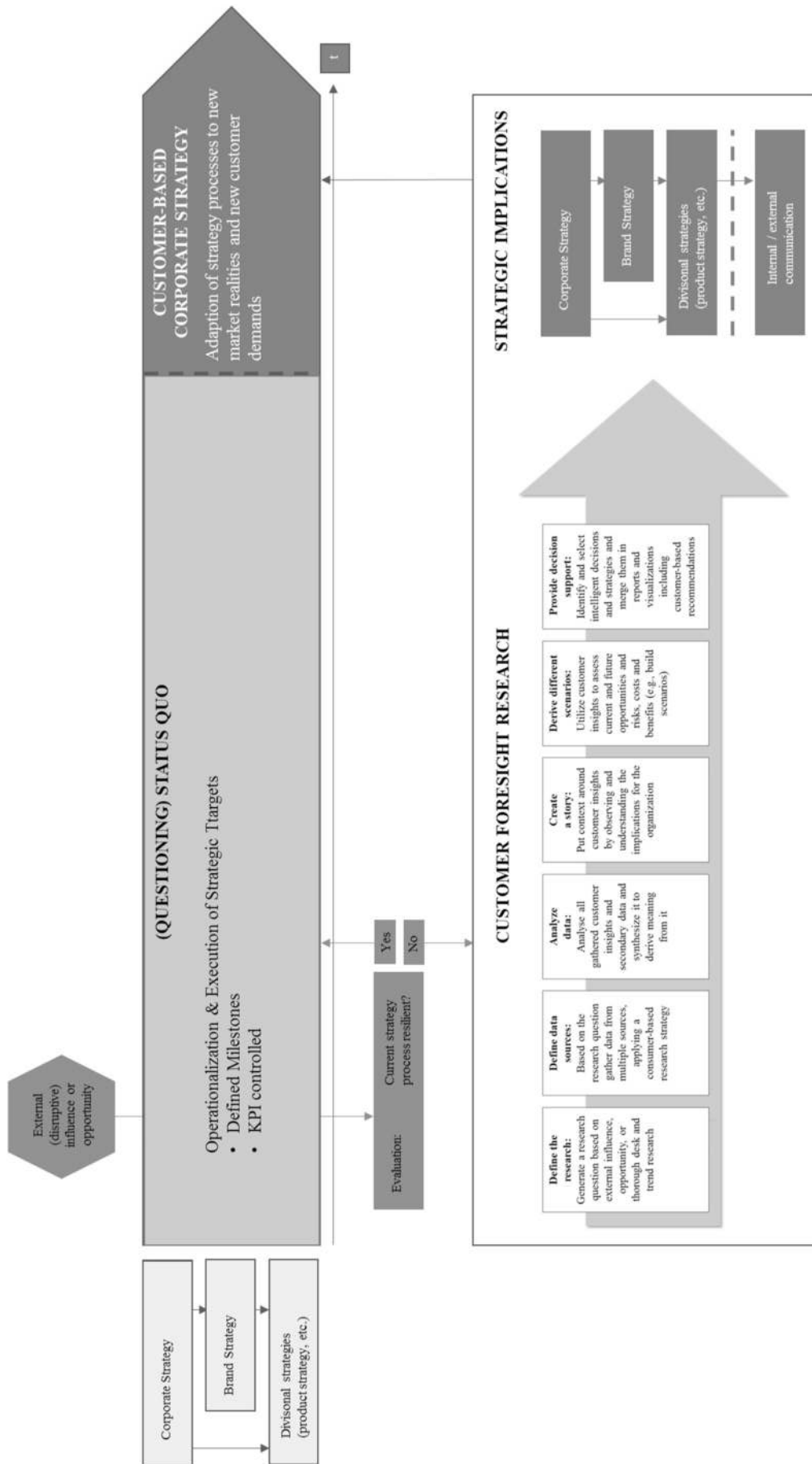


Fig. 5. Depiction of the strategic customer foresight process from research to corporate strategy.

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Appendix A. SAE International: six levels of driving automation (SAE International, 2014)

Level	Name	Narrative definition	Execution of steering and acceleration/deceleration	Monitoring of driving environment	Fallback performance of dynamic driving task	System capability (driving modes)	ISO level	SAE level
Human driver monitors the driving environment								
0	No Automation	the full-time performance by the human driver of all aspects of the dynamic driving task, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a	Driver only	0
1	Driver Assistance	the driving mode-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the human driver perform all remaining aspects of the dynamic driving task	Human driver and system	Human driver	Human driver	Some driving modes	Assisted	1
2	Partial Automation	the driving mode-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the human driver perform all remaining aspects of the dynamic driving task	System	Human driver	Human driver	Some driving modes	Partially automated	2
Automated driving system ("system") monitors the driving environment								
3	Conditional Automation	the driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task with the expectation that the human driver will respond appropriately to a request to intervene	System	System	Human driver	Some driving modes	Highly automated	3
4	High Automation	the driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task, even if a human driver does not respond appropriately to a request to intervene	System	System	System	Some driving modes	Fully automated	4
5	Full Automation	the full-time performance by an automated driving system of all aspects of the dynamic driving task under all roadway and environmental conditions that can be managed by a human driver	System	System	System	All driving modes	-	5

Appendix B. Overview of 29 trend receivers participating in qualitative pilot study. I = interview, F = focus group

TR	Country	Profession	Participation
TR 1	GER	Chief Branding Officer of a large peer-to-peer property rental company	I & F
TR 2	GER	CEO of a medium-sized pharmaceutical company	I & F
TR 3	GER	Data Scientist, Blogger, CEO of a startup for mobile data technology	I & F
TR 4	GER	Managing Director of a sports marketing and communication agency	I & F
TR 5	GER	Professor of illustration at a school of design/university	I & F
TR 6	GER	Founder and owner of a coaching company and leadership trainer	I & F
TR 7	GER	Head of innovation of the largest manufacturer of home appliances in Europe	I & F
TR 8	GER	Partner and Founder of an innovation group and university professor at a school of finance and management	I & F
TR 9	GER	Chief Technology and Innovation Officer of a worldwide leading TV-media investor	I & F
TR 10	GER	Senior Consultant trend scouting and open innovation of the largest engineering company in Europe	I & F
TR 11	GER	Consultant	I & F
TR 12	GER	Managing Director at an institute offering consultancy in the area of inclusive business innovations	I & F
TR 13	GER	Founder and Managing Director of a consultancy for branding and organizational development	I & F
TR 14	GER	Director business development of a provider for messaging services	I & F
TR 15	CHN	Director of a national energy institute	I
TR 16	CHN	CTO of a global supplier of electric motors, motor controllers, and auxiliary equipment for the industrial vehicle industry	I
TR 17	CHN	Professor of industrial engineering at a university	I
TR 18	CHN	Director of a transportation research center	I
TR 19	CHN	CMO at a ski resort	I
TR 20	CHN	Co-Pilot of an airline	I
TR 21	CHN	Founder of a designer brand	I
TR 22	CHN	General Manager of a fashion company	I
TR 23	USA	Global Innovation Manager of a multinational and leading sports company	I
TR 24	USA	CEO of one of the largest crowd-investing platforms worldwide	I
TR 25	USA	Director of research and strategy of a provider of business intelligence for elite creative professionals	I
TR 26	USA	Associate of a large financial service provider	I
TR 27	USA	Director of marketing of a leading supplier of specialty chemical products and industrial materials	I
TR 28	USA	Education Coordinator of a large US American library	I
TR 29	USA	Professor of marketing at a university	I

Appendix C. Country-specific demographics for sample of online survey

	n	Mean Age	% of Females
Germany	284	41	41.2
USA	230	42	50.4
China	219	38	47.5

Appendix D. Description of highly AVs in online survey

Highly automated driving means that your car will take over driving for you in specific situations, for example on the highway. You will have to remain seated in the front seat during that time; however you will not have to control the steering wheel, the accelerator or the brakes. For several hours, your car will completely take over driving for you.

If the car needs your attention, for example when you approach the motorway exit, you will have approximately 10 s to regain control over the car. In case you do not take back control over the wheel within those 10 s, the car will park itself on the emergency lane.

While your car drives autonomously, you will have a lot of time for other activities. We would now like to know how you want to make use of that time in your car.

Appendix E. Written description of use cases

E.1. Entertainment

Would you prefer to do things like watching TV or movies, exploring new music, making new playlists (e.g. on iTunes, Spotify, SoundCloud), listening to audio books, or playing computer or parlor games during that time?

E.2. Work

Would you prefer to do things like working on new concepts and ideas, writing reports or create presentations, talking to your colleagues or business partners via (video) telephone, writing emails or networking during that time?

E.3. Communication and relaxation

Would you prefer to give yourself a rest, eat and drink something, pursue your personal interests like surfing the internet (e.g. blogging, YouTube, online shopping), or talking with friends and family on the phone during that time?

Appendix F. Secondary activities in highly AVs as part of quantitative online survey

- Television, e.g. watch movies, series, documentaries, news, society news or sports; listen to music and audio books, e.g. listen to own playlists, explore new music, listen to audio books
- Gaming, e.g. play video games with console or parlor and card games
- Develop ideas and concepts, e.g. do online research, read information offline, do brainstorming, develop ideas or new concepts
- Organizing and implementing, e.g. edit documents, write reports, coordinate with business partners or plan appointments and to-do lists
- Networking, e.g. have conversations via video telephone or personally in the car, strengthen contacts via professional networking platforms like Xing/LinkedIn
- Stock up on some energy, e.g. snooze, relax, enjoy the landscape or privacy, eat and drink
- Pursue personal interests, e.g. surf online on YouTube or Facebook, read a book, contact friends or family, explore the environment via travel advice from the car

Appendix G. Use case * country cross tabulation, n = 661². Each subscript letter denotes a subset of country categories whose column proportions do not differ significantly from each other at the 0.05 level (Ent = entertainment, CR = communication and relaxation)

		Country			Total	
		GER	USA	CHN		
Use case	ENT	Count	64 _a	71 _a	47 _a	182
		% within use case	35.2%	39.0%	25.8%	100.0%
		% within country	24.4%	32.3%	26.3%	27.5%
		% of total	9.7%	10.7%	7.1%	27.5%
		Standardized residual	-1.0	1.3	-0.3	

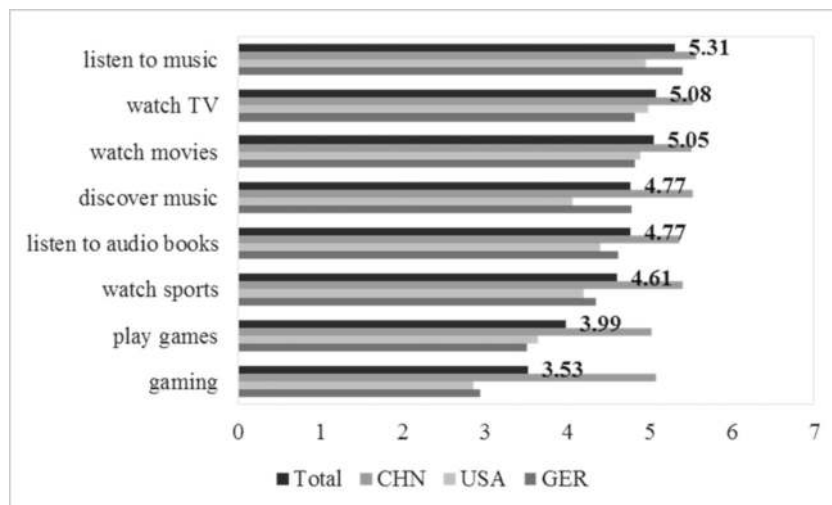
Work	Count	78 _a	58 _a	27 _b	163
	% within use case	47.9%	35.6%	16.6%	100.0%
	% within country	29.8%	26.4%	15.1%	24.7%
	% of total	11.8%	8.8%	4.1%	24.7%
	Standardized residual	1.7	0.5	-2.6	
	Count	120 _a	91 _a	105 _b	316
CR	% within use case	38.0%	28.8%	33.2%	100.0%
	% within country	45.8%	41.4%	58.7%	47.8%
	% of total	18.2%	13.8%	15.9%	47.8%
	Standardized residual	-0.5	-1.4	2.1	
Total	Count	262	220	179	661
	% within use case	39.6%	33.3%	27.1%	100.0%
	% within country	100.0%	100.0%	100.0%	100.0%
	% of total	39.6%	33.3%	27.1%	100.0%

Appendix H. Use case * gender cross tabulation, n = 661². Each subscript letter denotes a subset of country categories whose column proportions do not differ significantly from each other at the 0.05 level (Ent = entertainment, CR = communication and relaxation)

Dimension			Gender		Total
			Female	Male	
ENT	Work	Count	101 _a	81 _b	182
		% within use case	55.5%	44.5%	100.0%
		% within gender	33.6%	22.5%	27.5%
		% of total	15.3%	12.3%	27.5%
		Standardized residual	2.0	-1.8	
	CR	Count	57 _a	106 _b	163
		% within use case	35.0%	65.0%	100.0%
		% within gender	18.9%	29.4%	24.7%
		% of total	8.6%	16.0%	24.7%
		Standardized residual	-2.0	1.8	
Total	Work	Count	143 _a	173 _a	316
		% within use case	45.3%	54.7%	100.0%
		% within gender	47.5%	48.1%	47.8%
		% of total	21.6%	26.2%	47.8%
		Standardized residual	-0.1	0.1	
	CR	Count	301	360	661
		% within use case	45.5%	54.5%	100.0%
		% within gender	100.0%	100.0%	100.0%
		% of total	45.5%	54.5%	100.0%

Appendix I. Statistical analyses for and depiction of specific secondary activities within the use case entertainment

Kruskal Wallis tests comparing the three country samples within the use case entertainment were significant for almost all attributes at $p \leq 0.05$, meaning that the mean ranks differ between countries (watching movies: $H(2) = 9.18, p = 0.010$; watching TV: $H(2) = 6.31, p = 0.043$; watching sports: $H(2) = 17.83, p < 0.001$; discovering music: $H(2) = 30.86, p < 0.001$; listening to audio books: $H(2) = 11.52, p = 0.003$; gaming: $H(2) = 64.44, p < 0.001$; playing parlor games: $H(2) = 36.74, p < 0.001$). Gender comparisons only revealed a higher preference among men for watching sports matches in the car in comparison to women ($U = 6539.50, p = 0.001$)

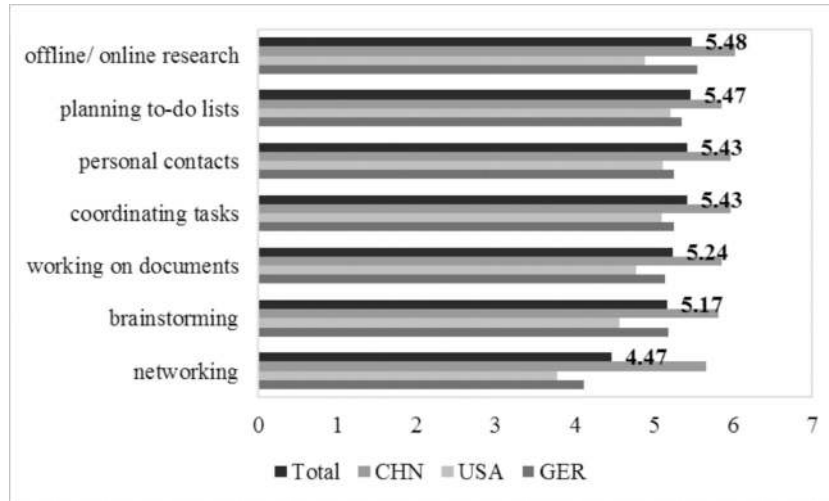


Depiction of mean perceived relevance of eight specific activities in the context of entertainment in a highly AV, for the overall sample within this

use case (n = 261) and between countries. For this and the subsequent figures, depicted means reflect the overall sample within this use case. Items were rated on a Likert scale from 1 (not relevant at all) to 7 (highly relevant).

Appendix J. Statistical analyses for and depiction of specific secondary activities within the use case work

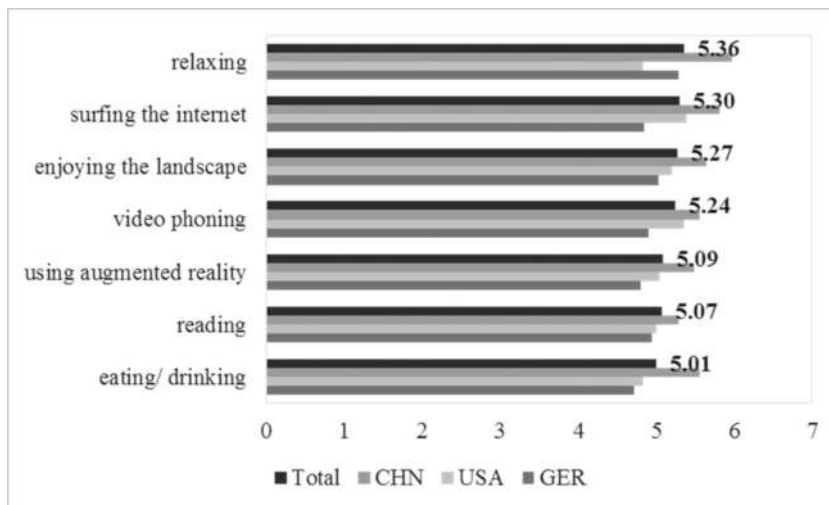
Kruskal Wallis tests comparing mean rank scores between countries for the use case work revealed significant differences for all specific attributes except planning to-do lists (offline/online research: $H(2) = 15.24, p < 0.001$; brainstorming: $H(2) = 20.85, p < 0.001$; working of documents: $H(2) = 15.49, p < 0.001$; coordinating tasks: $H(2) = 10.36, p = 0.006$; networking: $H(2) = 46.43, p < 0.001$; contact with colleagues/business partners: $H(2) = 10.16, p = 0.006$). Gender comparisons revealed no significant differences.



Depiction of mean perceived relevance of seven specific activities in the context of work in a highly AV, for the overall sample within this use case (n = 218) and between countries.

Appendix K. Statistical analyses for and depiction of specific secondary activities within the use case “communication and relaxation”

Kruskal Wallis tests, examining likely differences between countries for the use case communication and relaxation, were significant for the attributes “relaxing” ($H(2) = 23.33, p < 0.001$), “eating/drinking” ($H(2) = 10.57, p = 0.005$) and “surfing the internet” ($H(2) = 14.02, p = 0.001$). Again, differences on the attribute level between female and male respondents were not significant.



Depiction of mean perceived relevance of seven specific activities in the context of communication and relaxation in a highly AV for the overall sample within this use case (n = 254) and between countries.

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