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Topographical maps for detecting relevance fields in car interiors – an eyetracking approach

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Andrea Berger

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"I think cars today are almost the exact equivalent of the great Gothic Cathedrals.
I mean the supreme creation of an era, conceived with passion by unknown artists,
and consumed in image if not in usage by a whole population
which appropriates them as a purely magical object."
Roland Barthes, French literary critic and philosopher[1]

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[1] Barthes, 1972, as cited in Sparke, 2004, p. 185

Abstract

As differences in technology, efficiency and price are becoming marginal in the automotive industry, product design provides car manufacturers with the opportunity to differentiate their products from competitive producers. The vehicle interior design not only allows for an individualized and distinct composition but is also decisive for the interaction between driver and vehicle. Unlike previous research that mainly concentrated on design and liking of single interior parts this study's aim was to identify consumer's areas of interest in automobile interiors. An eyetracking study was conducted to investigate those components of the interior equipment of two stimulus cars that participants pay attention to in the context of a purchase situation and during everyday driving tasks. When evaluating the interior equipment with the eyes of a potential customer participants paid most attention to interior components associated with the task of driving and providing feedback about the state of the vehicle and the handling performance and to devices concerned with ambient conditions and entertainment. During a simulated driving task participants mainly observed the instruments of the dashboard and the mirrors. The results of this study provide directions for further research in vehicle interior design and assistance for designers in creating the interior equipment according to the customers' needs and preferences.

Kurzzusammenfassung

Die jeweiligen Modelle unterschiedlicher Automobilhersteller unterscheiden sich immer weniger hinsichtlich Technologie, Effizienz und Preis. Produktdesign ermöglicht es den Herstellern ihre Produkte von denen der Konkurrenz abzugrenzen und einen Wettbewerbsvorteil zu erlangen. Vor allem das Design des Fahrzeuginneren gestattet hier eine individualisierte und distinkte Gestaltung. Außerdem ist das Design des Interieurs ausschlaggebend für die Interaktion zwischen Fahrer und Fahrzeug und damit das Fahrverhalten. Eine Eyetracking-Studie wurde durchgeführt um die Bereiche des Autoinnenraums zu erkunden denen die Konsumenten am meisten Aufmerksamkeit schenken. Dabei ging es einerseits um die Wichtigkeit der Ausstattungselemente bei einer Evaluation des Innenraums im Kontext eines potentiellen Autokaufs und andererseits um die Relevanz der Bereiche und Instrumente während einer simulierten Autofahrt. Die Ergebnisse deuten darauf hin, dass Komponenten die für das Steuern des Fahrzeugs wichtig sind, die Rückmeldung über das Fahrzeug und das Fahrverhalten geben und Komfort- und Unterhaltungsausstattung für die Versuchspersonen die größte Relevanz zu haben scheinen. Während der Fahrsimulation wurden vor allem die Elemente des Armaturenbretts, die Spiegel und das Display der Mittelkonsole betrachtet. Die Ergebnisse der Untersuchung bieten Anregungen für weitere Designforschung und Hilfestellungen für Designer bei der Gestaltung des Fahrzeuginneren gemäß den Bedürfnissen und Präferenzen der Konsumenten.

Contents

1 Introduction

As competition in the marketplace intensifies and differences in terms of technology, quality, and price between competitive products become marginal, product design offers a promising possibility for organizations to differentiate their products from competitors and improve business performance (Berkowitz, 1987; Bloch, 1995; Gemser & Leenders, 2001; Kotler & Rath, 1984; Veryzer, 1995; Veryzer & Borja de Mozota, 2005). This, along with the trend of the ongoing aestheticization of our reality (e.g., Barck, 200; Welsch, 1996) has made product design a key element of the development of products in order to offer products that provide superior value for the customer and gain competitive advantages.

The visual form and appeal of a product is mostly determined by designers' intuitive judgments and educated guesses. Dangers are inherent in this relying solely on intuition and anecdotal evidence to justify a product's visual appearance (Crilly, Moultrie, & Clarkson, 2004). Designers face the challenge of transferring consumers' needs into technical and design specifications. As they often are not representative for the preferences and behavior of their consumers this implies the possibility of existing discrepancies between designer's intent and consumers' responses (Hsu, Chuang, & Chang, 2000). Design research can provide designers with information about consumers' expectations of a product, unmet needs, use patterns and aesthetic preferences and thus offers an opportunity to modify products and designs, better meet consumers' requirements and preferences and optimize a product's market success (Chang, Lai, & Chang, 2007; Crilly et al., 2004; Norman, 2004). Apart from this profitable relevance to the industry, design research is also valuable from a theoretical point of view in order to identify the processes underlying product and/or design perception.

The present study concerns itself with product design in vehicle interiors. In the automotive industry, where comparable models of different manufacturers vary little or not at all in terms of their technical and functional characteristics, design and customer focus play a decisive role (Kempfert, 1999; You, Ryu, Oh, Yun, & Kim, 2006; Zec, 1998). Of particular importance is design in the creation of the automobile interior. On the one hand the design of the vehicle interior allows for a more individualized and distinctive composition (e.g., Karlsson, Aronsson, & Svensson, 2003; Leder & Carbon, 2005). On the other hand the composition of the interior equipment has significant impact on the interaction between man and vehicle and is crucial for the workload imposed on the driver and his or her handling performance.

Nevertheless, research on vehicle interior design is scarce. While research so far mainly concentrated on studying separate interior units (e.g., Jindo & Hirasago, 1997; Wellings, Williams, & Pitts, 2008), the perception of the vehicle interior as a whole has been rather neglected (e.g., Karlsson et al., 2003; Leder & Carbon, 2005). This study is aimed at identifying customers' areas of interest in the front region of the automobile interior. The objective is to find out those parts of the interior equipment that are most relevant to customers when evaluating a vehicle in the context of a purchase situation. Moreover, by means of a simulated driving task, it is intended to identify devices and instruments that are attended to during everyday driving situations. To this end, an eyetracking study was conducted using real automobiles as stimulus material and actual customers as participants. The method of eye movement measurement was used as it allows identification of those elements of the interior equipment that participants pay most attention to as well as the temporal course of the evaluation. The study was conducted in collaboration with Michael Forster who in his diploma thesis (in preparation) will present the analyses of the participant's haptic evaluation of the vehicle interiors.

This thesis is organized into eight chapters. The first four chapters provide theoretical background on product design, human-product interaction and eye movement measurement. The following chapter outlines the economic importance of product design and how it can influence consumers' product choice and buying behavior. Furthermore it gives insight into the challenge of design evaluation and the importance of incorporating design research data in the product development process in order to provide products that satisfy the customers' needs and preferences and succeed at the market. The tasks and objectives of design in automobile construction, in particular as far as the vehicle interior is concerned, are covered in chapter three. In the next, fourth, chapter insight into the multi-sensuality of product experiences and interactions is given. Chapter five provides information on characteristics of eye movements during information processing, more precisely, during scene perception as visually examining the interior of a vehicle is regarded as a task of scene perception. The next part of this work is concerned with the empirical study. In chapter six the research objectives of this study will be elaborated and expected results and effects discussed. Chapter seven outlines details on the design and procedure of the study, the participants and the used materials. The eighth chapter covers the empirical testing of the proposed effects and visualizes the relevance of the respective interior areas in topographical maps. In the final chapter implications of the results for automobile design and future research directions are discussed.

2 Product Design

2.1 Product Design as Competitive Advantage

Nearly every market is today characterized by strong competition. Especially for markets with products exhibiting highly interchangeable technical characteristics (e.g., cars, mobile phones, household appliances, etc.) and varying little or not at all in terms of features, quality, and costs new competitive edges need to be discovered (Carbon & Leder, 2007; Veryzer, 1995; Zec, 1998). Companies have to ensure a clear differentiation from competitive products in order to protect or improve their market position. Product design is a promising possibility for organisations to improve business performance and gain differential advantage at the market-place (Berkowitz, 1987; Bloch, 1995; Dickson, Schneier, Lawrence, & Hytry, 1995; Gemser & Leenders, 2001; Kotler & Rath, 1984; Weggeman, Lammers, & Akkermans, 2007). By producing superiorly designed products for their target markets, companies can "stand out from the crowd" (Kotler & Rath, 1984, p. 16).

Design should influence every aspect of the consumer's product experience (Gemser & Leenders, 2001; Kotler & Rath, 1984; Norman, 2004; Zec, 1998). "Good design addresses the consumer's every concern – how a product works, how it feels in the hand, how easy it is to assemble and fix, and even [...] whether it can be recycled" (Dumaine, 1991, p. 1). Design is the process of transforming "a set of product requirements into a configuration of materials, elements and components" (Gemser & Leenders, 2001, p. 29). Good design should express a product's characteristics through appropriate shaping. It has to visualize the product's functioning and handling and consider issues of user friendliness, ergonomics, durability, and product appearance. Product design also has to take into account ease of manufacture, efficient use of material, environmental friendliness, and recyclability (Bürdek, 2005; Gemser & Leenders, 2001; Kotler & Rath, 1984; Veryzer, 1995). The objective of design is to optimize consumer satisfaction and thereby improve company performance and revenue (Gemser & Leenders, 2001; Kotler & Rath, 1984). Product design is thus a key element of product development in order to sell products that provide superior value for the customer (Boztepe, 2007) and gain competitive advantages (Veryzer & Borja de Mozota, 2005).

The role of product design is further amplified by the fact that we are experiencing a progressive aestheticization of our reality. More and more aspects of our daily life, of our environment are becoming aesthetically mantled (Barck, 2000; Welsch, 1996). When it comes to consumer products, customers more and more take attributes like functionality, affordability, and security in products for granted (Demirbilek & Sener, 2003). They expect more from everyday products, i.e. objects that are aesthetically pleasing, evoke emotions, inspire them, and enhance their lives (Demirbilek & Sener, 2003; Karlsson et al., 2003; Liu, 2003). In this regard, aesthetic and experiential aspects of product design can be a decisive factor of success (Demirbilek & Sener, 2003, Dumaine, 1991; Jordan, 1998). Beautifully designed products provide superior value for the customer, they are pleasant to use and may provide delight and stimulation (Bloch, 1995; Norman, 2004).

Apart from aesthetics, customer focus has become an increasingly important issue in product development in recent years (Jordan, 1998; Veryzer & Borja de Mozota, 2005). Catchwords like *close to the customer* (e.g., Kempfert, 1999) or *user-centred design* (e.g., Jordan, 1998) characterize this turn towards more customer proximity – a product development process that focuses on the customer's problems, needs, and requests. By customizing their commodities and thus providing customers with value-added products, companies try to gain competitive advantages (Kempfert, 1999). A prominent method in this respect is Kansei Engineering (Nagamachi, 1995; Yoshimura & Paplambros, 2004). The idea is to translate the customers' feelings and needs (kansei in Japanese) of a product into design elements. Kansei engineering is a consumer-oriented technology for new product development that shifts the design focus from the requirements of the manufacturer to the feelings and needs of the consumer. In Japan, this technology has been introduced in all kinds of industries, including electric appliances, clothing, automotive industry and so forth, and has provided the companies with increased sales and market success (e.g., Jindo & Hirasago, 1997; Nagamachi, 1995; Yoshimura & Papalambros, 2004).

Empirical research indicates that product design in general and product aesthetics in particular are important determinants of consumers' choice behavior (e.g., Creusen & Schoormans, 2005; Page & Herr, 2002; Veryzer, 1993, 1995; Yamamoto & Lambert, 1994) and customer satisfaction (e.g., Jordan, 1998; Thüring & Mahlke, 2007) and that integrating industrial design in the product development process can enhance overall company performance (e.g., Berkowitz, 1987; Dickson et al., 1995; Gemser & Leenders, 2001). A most commonly cited example of a company gaining differential advantage through innovative and stylish design is Apple. By combining aesthetics and ease of use in its computer and electronic products, Apple was able to set apart from his competitors, increase its market share and profits and reach new market segments (Hesseldahl, 2006, 2009; Reinhardt & Hamm, 1999; Sager, Burrows, & Reinhardt, 1998).

2.2 Psychological Aspects of Product Design

2.2.1 Product Perception

A product's most fundamental characteristic is its exterior form or design (Bloch, 1995). Interactions between a person and a product start with the perception of the product's appearance (Veryzer, 1995). Leder, Carbon and Kreuzbauer (2007) provide a general theoretical framework of product design perception (Figure 2.1). Based on Palmer (1999) they understand perception of product design elements in terms of a four-stage model of object perception. In a first stage, a 2-D retinal image of the visual stimulus is derived. The image-based, second, stage involves image-processing operations such as detecting and linking local edges and lines and defining two-dimensional regions in the image. The third stage consists of the perception of the spatial distribution of visible surfaces. Shadings and shadows, texture, color, and shape are for example utilized to construct the representation of surfaces. In the last stage, 3-D processing of the object takes place. In this process, visual representations of the object are matched with representations of the object stored in memory (Leder et al., 2007; Palmer, 1999).

These levels of product design perception influence how a product is interpreted and categorized and whether it is identified as a member of a given brand (Leder et al., 2007). Object or product categorization involves two processes: First, the object is classified as a member of one of numerous known categories according to its visible properties. Second, this identification evokes information about the objects functions and expectancies about its behavior (Palmer, 1999). Nevertheless, the visible characteristics of an object can also transport an object's function(s) more directly to the user without prior categorization as presented by Gibson (1982). His theory of ecological perception explains that the functions and potential uses of an object – its *affordances* – are directly perceivable to the customer and do not afford prior object categorization. Palmer (1999) assumes that probably both the direct and the indirect process are employed in perceiving an object's or product's functions. Some products' functions – e.g., chairs and cups – are that obviously communicated by their visual properties that a user might not need to categorize the product to understand its usage. Other, more complex products, such as computers and telephones, have functions that are not so intimately tied to their visual characteristics and thus almost certainly need to be categorized first.

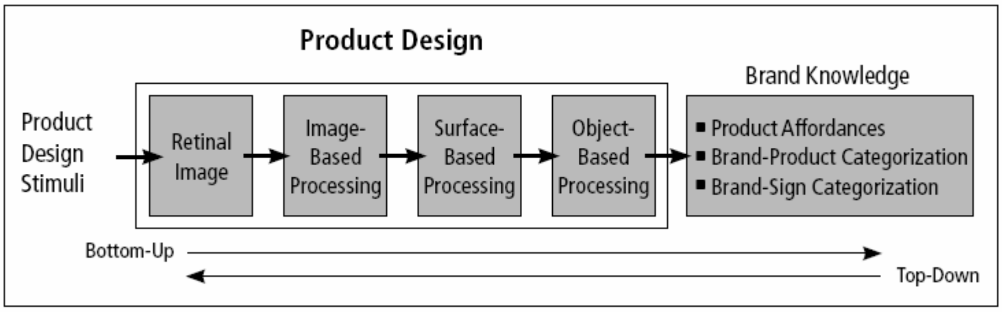


Figure 2.1 Framework of product design information processing (Leder, Carbon, & Kreuzbauer 2007, p. 4).

Kreuzbauer and Malter (2005) could in fact demonstrate that altering respective design elements of a product (here: motorbikes) led to changed perception and classification of the product by the participants.

2.2.2 Implications of Product Design on Consumer Buying Behavior

Bloch (1995) proposes a model describing how product form affects consumers' psychological and behavioral responses to products and hence a product's market success (see Figure 2.2). The form of a product should be designed in such a manner that it pleases the target consumers and at the same time meets relevant design constraints (e.g., performance objectives, ergonomic requirements, and manufacturing costs). The product form elicits cognitive and affective responses from the consumer. As outlined above, on the one hand, a product's form brings forth beliefs about product attributes and performance and also influences how the product is categorized within and among product classes. On the other hand, the perception of a product's form can provoke positive but also negative affective responses. These psychological responses in turn entail behavioral responses, i.e. approach activities if positive and avoidance if negative beliefs and affect are generated. Individual preferences and situational factors mediate the relationship between product form and consumer response. For instance, design preferences are influenced by cultural and social values, prevailing trends, consumers' experiences and personality. In addition, the social setting in which a product is encountered and the portrayal of the product in advertising moderate consumers' responses.

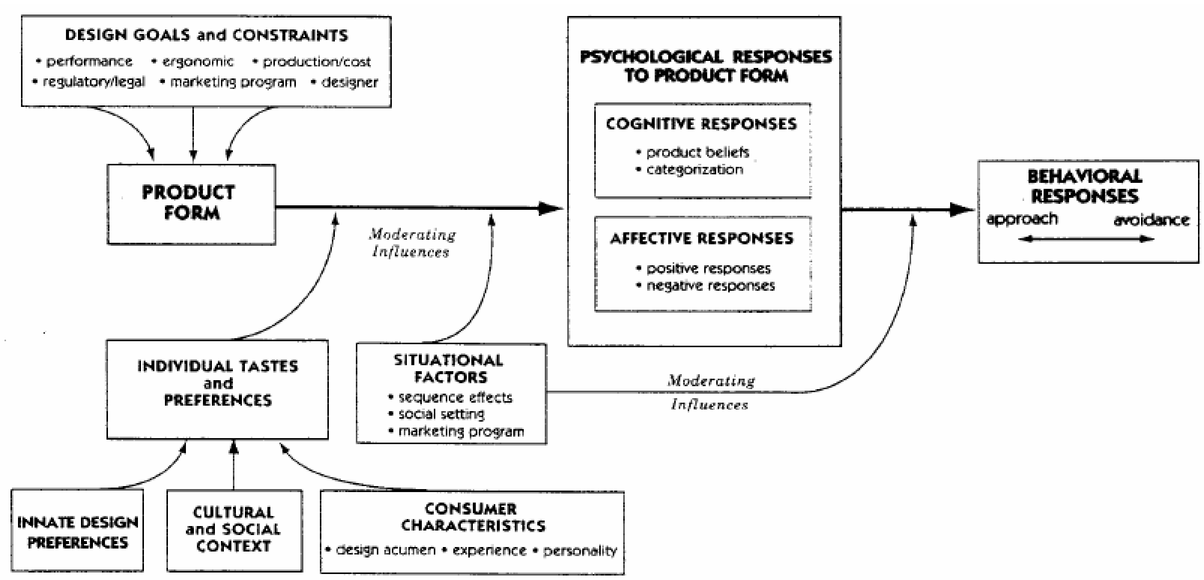


Figure 2.2 Model of consumer responses to product form (Bloch 1995, p.17).

Creusen and Schoormans (2005) identify six different roles of product appearance in consumers' evaluation and choice processes. A product's appearance can communicate (1) aesthetic, (2) symbolic, (3) functional, and (4) ergonomic information. It can (5) draw attention and influence the ease of (6) categorization of the product.

Aesthetic product value. Virtually all objects have an aesthetic component (Allesch, 2006; Leder, Belke, Oeberst, & Augustin, 2004; Norman, 2004; Stich, Knäuper, Eisermann, & Leder, 2007; Veryzer, 1993, 1995). The aesthetic value of a product concerns the pleasure that is derived from merely seeing a product as beholding something beautiful is rewarding in itself (e.g., Kawabata & Zeki, 2004; Norman, 2004). It is hardly surprising that aesthetically pleasing products are preferred to less attractive ones (e.g., Page & Herr, 2002). Furthermore, Creusen and Schoormans (2005) found in their study that more participants based their product choice on aesthetics than on functionality and Yamamoto and Lambert (1994) could show that even for industrial products – e.g., dispense pumps and small gearmotors – product appearance seems to have an impact on product evaluation and preference. Norman (2004) even claims that "attractive things work better" (p. 17) as aesthetically pleasing designed products can induce positive affect and thus enhance the user's performance. In fact, studies on interactive products found a connection between perceived aesthetics and perceived usability in that aesthetically pleasing products or systems were perceived to be more usable than less attractive ones (e.g., Thüring & Mahlke, 2007; Tractinsky, Katz, & Ikar, 2000).

What are the characteristics that render a design aesthetic? Although the subject of aesthetics has been studied for centuries (see e.g. Allesch (2006) for an overview), there does not seem to be a gold standard of what is beautiful and what is not. Traditionally, research on aesthetics was carried out using artificial stimuli such as simple visual patterns (e.g., Berlyne, 1970), polygons (e.g., Boselie & Leeuwenberg, 1985) and the like to find basic features and properties that please or displease. More complex visual stimuli like real artworks (e.g., Hekkert & van Wieringen, 1990, 1996) too have been employed in experimental aesthetics. It is questionable, whether results from traditional research on aesthetics are transferable to everyday objects and consumer products and appropriate to infer guidelines for product design. Generalizability and ecological validity of the results of studies using these artificial stimuli are doubtful (Berlyne, 1971; Stich et al., 2007). Ecological validity concerns the transferability of the obtained results to reality (Clark-Carter, 2004) and it is questionable whether findings based on simple visual patterns or paintings hold true for real-life aesthetic preferences of everyday objects or products. The aesthetic response to complex artifacts is more than simply the sum of the aesthetic responses to its components (Liu, 2003). Furthermore, the results of Stich et al. (2007) suggest that aesthetic judgments of everyday objects differ fundamentally from those of artworks and do not support the notion of one general underlying concept of appreciation. Rather, each object class seems to possess distinctive aesthetic qualities. An essential difference between the appraisal of objects and paintings lies in the fact that everyday objects comprise functional aspects and that the design of these is related to the overall aesthetic evaluation of the object. Besides, while art is primarily perceived visually, the aesthetic appraisal of everyday objects, products, or systems tends to be multi-modal as mostly more than one sensory modality is involved in the process.

The perception of an object or a product can simultaneously address a person's visual, auditory, tactile, and olfactory system (Hekkert, 2006; Liu, 2003). In addition, aesthetic appraisal of a product is interactive. The consumer actively examines the object, interacts with it and tests its reactions (Liu, 2003). Thus, research on (aesthetic) appreciation of product design has to directly address everyday objects and products. Recent research regards aesthetic perception as a multidimensional construct, comprising processes of perception, organization, and understanding. The overall aesthetic response to an artifact is thus the joint outcome of a multitude of factors (Hekkert, 2006; Leder et al., 2004; Liu, 2003; Stich et al., 2007).

Current research concerning aesthetic preferences directly addresses everyday objects (e.g. Cox & Cox, 2002; Hekkert, Snelders, & van Wiering, 2003; Leder & Carbon, 2005; Veryzer & Hutchinson, 1998) and even industrial products (e.g., Yamamoto & Lambert, 1994). Product designs featuring visual organization principles such as unity (e.g., Veryzer & Hutchinson, 1998) and proportion (e.g., Veryzer, 1993) and possession of a medium degree of complexity (e.g., Cox & Cox, 2002) and high prototypicality (e.g., Whitfield & Slatter, 1979; Veryzer & Hutchinson, 1998) have been found to be positively related to aesthetic preference. However, also culturally established conventions of taste, varying trends, and zeitgeist influence aesthetic preferences and affect how designs are interpreted and whether they please or not (Bloch, 1995; Carbon, Hutzler, Minge, 2006; Crilly et al., 2004; Karmasin, 2007).

Symbolic product value. Through its appearance a product can communicate messages and tell us something about itself and its owner (Demirbilek & Sener, 2003; Karmasin, 2007). "The objects we consume both reflect *and* contribute to who we are" (Crilly et al., 2004, p. 562). Via the material objects people buy and possess, they express their (desired) self-image to themselves and to others and demonstrate their social status and lifestyle (Belk, 1988; Demirbilek & Sener, 2003; Sparke, 2004). Consumption allows people to communicate their identity and differentiate from others. At the same time group membership and integration with those that surround them is expressed (Crilly et al., 2004; Karmasin, 2007).

As outlines above, the image of a brand can be communicated through a product's physical appearance. Companies can use certain design elements in the visual shaping of their products so as to give their products a recognizable appeal and make the brand membership identifiable to the consumer (Leder et al., 2007; Creusen & Schoormans, 2005). Thus, appealing product design can breed positive associations and aids brand strength (Leder et al., 2007). Brand-typical design elements are for example the distinctive kidney-shaped grill of a BMW car, the double-eyed headlights of a Mercedes car or the sleek shape and white color of Apple computer and electronics products. Again, culture, social class, age, educational level, prevailing trends, and so on have an impact on how consumers response to meaning triggered by a product and what associations they get from a product's appearance (Demirbilek & Sener, 2003; Creusen & Schoormans, 2005).

Functional product value. Consumers can use a product's appearance to form an impression about the utilitarian functions of a product, its quality, stability, and the like (Berkowitz, 1987;

Creusen & Schoormans, 2005; Dawar & Parker, 1994). A product's functions specify what operations it supports and what it is destined to do (Norman, 1989; 2004). The physical appearance of a product should signal the consumer its purpose, its way of use and how it has to be handled; preferably without instructions and additional information (Demirbilek & Sener, 2003; Norman 1989, 2004; Veryzer, 1995). For example, a switch on an electronic device should signal the user what functions it controls and how it has to be operated (e.g., push, turn clockwise) to perform these functions. As already mentioned above, Gibson (1982) assumes that the visual characteristics of a product directly signal its potential uses, or *affordances*. A chair, for example, affords sitting, the handle of a coffee mug affords grasping. With respect to product design the affordances of an object allow the consumer to perform certain actions and operations (Crilly et al., 2004).

Ergonomic product value. Ergonomics or *human factors* are concerned with the interaction between humans and artifacts. The purpose of ergonomic design activities is "to match systems, jobs, products and environments to the physical and mental abilities and limitations of people" (Helander, 1997, p. 3). This aspect of design is of growing importance as the products that surround us are becoming more and more technically sophisticated and complex (Veryzer, 1995). The task of design in this regard is to give a product a form that maximizes comprehensibility and usability (Creusen & Schoormans, 2005). Usability defines the user's ease to understand a product's mode of operation and the effectiveness in achieving intended goals by using it (Han, Yun, Kim, & Kwahk, 2000; Norman, 2004). When trying out the product consumers can directly experience its operations and ease of use. However, the product's appearance also gives the consumer an indication of the product's ease of use and its ergonomic value (Norman, 1989; Tractinsky et al., 2000). A lack of comprehensibility and usability can give rise to negative emotions and a frustrating usage experience (Norman, 1989, 2004).

Attention-drawing ability. The aim of product appearance in this regard is to attract the consumer's attention and tempt him or her to buy the product (Chang, Lai, & Chang, 2007). As already stated, the market place is full of similar, competing products. In this competitive environment brands are seen in the context of their competitors and appearance can decide which brands enter the individual consumer's consideration set (Garber, 1995). To have the chance to be considered in a purchase situation a product has to stand out visually from competitive products and catch the eye of a potential customer (Creusen & Schoormans, 2005).

Categorization. Product appearance can be used as a cue for categorization (Bloch, 1995; Veryzer, 1995). The appearance of a product influences the ease with which the product is categorized as a member of a certain category. Products that are typical of a category – i.e., resemble other products in the same category – are easier to identify and categorize (Loken & Ward, 1990). A product that is difficult to categorize based on its appearance may not be regarded as a purchase alternative (Creusen & Schoormans, 2005). It has further been shown that more prototypical artifacts are preferred to less typical ones when it comes to aesthetic appeal (e.g., Veryzer & Hutchinson, 1998; Whitfield & Slatter, 1979). One possible explanation for this may be that they are more familiar and therefore are better liked (Gordon & Holyoak, 1983; Loken & Ward, 1990). As typicality increases with familiarity the preference-for-prototypes hypothesis (Whitfield & Slatter, 1979) is compatible with Zajonc's (1968) mere exposure effect stating that repeated exposure – hence familiarity – leads to increased liking.

Opposed to that it has also been demonstrated that novelty, originality, and distinctiveness are highly valued and appreciated attributes. For example, people might choose novel, unconventional products because they want to demonstrate uniqueness and individuality and differentiate from the masses (Simonson & Nowlis, 2000) or because they seek variety and new experiences (Holbrook & Hirschman, 1982). Furthermore, in product categories where prestige and rarity are important, atypical products tend to be preferred (Loken & Ward, 1990). An atypical appearance can moreover catch the customer's attention (Garber, 1995), differentiate the product from competing alternatives of the category and communicate new functional attributes (Creusen & Schoormans, 2005).

Product design has a decisive impact on peoples' daily lives as they see and deal with products every day (Bloch, 1995; Norman, 2004). A good design adds value to the product by increasing the quality of the usage experience associated with it (Bloch, 1995). For companies, product design provides a promising opportunity to differentiate their products and gain competitive advantages (e.g., Berkowitz, 1995; Bloch, 1995; Kotler & Rath, 1984; Veryzer & Borja de Mozota, 2005). The so far presented illustrations indicate that in designing a product, factors such as the current market situation, characteristics of the target market, personal preferences, and prevailing trends have to be taken into account. Creating an "ideal" product form that is universally appreciated thus seems to remain an unrealistic and unachievable ambition (Bloch, 1995). Therefore in order to ensure a product's market success, new products or new product designs need to be evaluated prior to launching (Creusen & Schoormans, 2005; Carbon, Michael, & Leder, 2008). Consumer evaluations of a product yield insights in whether their needs are met and whether the product's design is in line with their aesthetic preferences (Chang, Lai, & Chang, 2007; Crilly et al., 2004, Norman, 2004).

2.3 Design Evaluation

As outlined above, a company's competitive strength and profitability depend largely on the aesthetic and innovative appeal of its products (e.g., Berkowitz, 1987; Buck, 1998; Gemser & Leenders, 2001; Veryzer & Borja de Mozota, 2005). Innovativeness is an important aim of product design as it differentiates the product from its competitors (Buck, 1998; Leder & Carbon, 2005). At the same time, the product design has to please the customers to become widely accepted and achieve market success (Bloch, 1995; Veryzer, 1993, 1995).

In creating the form of a product and its aesthetic appeal designers generally rely on their intuition and experience (Chang et al., 2007; Crilly et al., 2004; Norman, 2004). However, these instincts cannot guarantee the success of the product design as there may be discrepancies between the designer's view and the customer's response. Hsu, Chuang, and Chang (2000) could demonstrate that designers and consumers often interpret products differently and have divergent aesthetic preferences.

Norman (1989, 2004) in this context suggests three different mental images of an object. The image of the product that the designer has in mind is called the "designer's model". The "user's model" is the image that the person using the object has of it. For successful product usage on the part of the user these two models should be identical. The only way how designers communicate with users is through the product itself. Users entirely form their model from the product's appearance, its operation, the feedback it provides, and maybe from accompanying manuals. This information that is provided by the physical product itself is called the "system image". Hence, the designer has to make sure that the right conceptual model is reflected and illustrated by the product's appearance and mode of operation.

New product designs need to be evaluated before market introduction in order to gain information about consumers' liking (Creusen & Schoormans, 2005; Carbon et al., 2008). Consumer evaluation data reduce the marketing risk and aid at better understanding and satisfying the consumers' needs and preferences (Chang et al., 2007; Crilly et al., 2004, Norman, 2004). But this approach is rendered difficult by the lack of methods for measuring consumers' perception of product design and evaluation of product (form) attractiveness (e.g., Carbon & Leder, 2005; Chang et al., 2007; Karlsson et al., 2003; Nagamachi, 1995).

A further challenge presents the fact that consumers' aesthetic preferences and liking of products tend to change dynamically (Carbon & Leder, 2005; Carbon et al., 2006). New products are typically evaluated by means of questionnaires, surveys, simple ratings, customer clinics, or focus groups (e.g., Wilson, 2006). But these techniques measure consumers' evaluation only once and do not reflect real-life experiences with products (Carbon & Leder, 2007; Carbon, Michael, & Leder, 2008) since in reality we are exposed to products longer and more intensively, live and work with them. Thus, these evaluation techniques cannot measure preferences or liking on a valid basis and even less provide valid predictions for future preferences (Carbon & Leder, 2007; Carbon et al., 2008). Innovative designs especially face this problem as these are usually rejected initially but are enjoyed better after a certain phase of familiarization (Carbon & Leder, 2005; Carbon et al., 2006). The same applies to products with long product renewal intervals that should please customers a long time (Carbon & Leder, 2007). An alternative to the above mentioned techniques is presented by Carbon and Leder (2005) who describe a more ecologically valid measurement technique – the *Repeated Evaluation Technique* (RET) – that simulates everyday life experiences and allows the consumers to familiarize with the material before evaluation takes place.

Apart from aesthetics, customer focus in product development is increasingly being recognized as a precondition for successful products (McDonagh, Bruseberg, & Haslam, 2002; Veryzer & Borja de Mozota, 2005). Integrating customers' needs and requests in the design of products brings about value-added products that can be more easily adopted by the customers (Veryzer & Borja de Mozota, 2005). In this context, customers also are increasingly recognized as potential design resources to support product development (McDonagh et al., 2002). Incorporating consumer evaluation data in the design and product development process helps to make sure that consumers' needs and preferences are met and thus optimizes a product's market success (Chang et al., 2007; Crilly et al., 2004; Norman, 2004).

Observation of customers using a product or in-depth interviews on how customers think about a product and its usage provide an opportunity to gain more profound insights into customers' behaviors, requirements, and goals (Cagan & Vogel, 2002, as cited in McDonagh et al., 2002; Kumar & Whitney, 2003). Norman (2004) states that observing the consumers when they use the product naturally and in real situations is crucial for good design that is user-centered and satisfies the needs of the customers. Analyses of product use of potential customers provide information about the adequacy of the product, possible problems with its usage, suggestions for further product developments and inspirations for new product ideas (Schmid, 2008).

Recently, eye movement recording has been recognized in the field of industrial design and design evaluation as a method to gain information about perception and processing of products and designs (e.g. Carbon et al., 2006; Hammer, 1995; Normark, Kappfjell, Tretten, Lundberg, & Gärling, 2007). Eyetracking can be useful in detecting those parts of a product that attract most attention and thus determining the most prominent areas of a product. This in turn can provide information for the positioning of brand names, readouts, handles, switches and the like which must be easy to locate (Hammer, 1995). Moreover, eye movement analysis can help to identify formal elements of a product that embody required semantic dimensions (e.g., powerful, handy, elegant, etc.). In combination with a given task aimed at performing a certain operation with an object, eye movement recordings help to determine which areas of the product are scanned in order to accomplish the task (Hammer, 1995).

Design research can aid designers in better understanding their target customers. User studies help to find out about customers' (unmet) needs and wishes, likes and dislikes. They provide insight in how users experience the product in real-life and reveal the contexts in which the users employ a device, what functions they use and how (Kujala & Mantyla, 2000; McDonagh et al., 2002). Research indicates that user studies are in fact beneficial and provide the designers with information about customers' typical use patterns and help them to prioritize the users' needs (Kujala & Mantyla, 2000). Incorporating consumer evaluation data reduces the marketing risk of the product and aids a better understanding and satisfaction of the consumers' needs and preferences.

3 Design in Vehicle Development

In the automotive industry where comparable models of different manufacturers vary little or not at all in terms of their technical and functional characteristics, a trend towards advanced design and more customer focus can be noticed (Kempfert, 1999; You et al., 2006; Zec, 1998). At its early stage, automobiles were primarily regarded as a means of transportation (Karlsson et al., 2003). By and by, other attributes grew important in cars and apart from functional and security aspects consumers are now more and more interested in usability, comfort and aesthetic and emotional qualities of cars (Jindo & Hirasago, 1997; Karlsson et al., 2003; Kempfert, 1999; Lin & Zhang, 2006; You et al., 2006). Design plays a decisive role in the automotive industry as the differences concerning price and equipment within the different classes are marginal and customers consequently make their buying decisions predominantly based on aesthetic and emotional aspects (Kempfert, 1999; Zec, 1998). “A vehicle must meet consumer’s expectations for look, feel, comfort, and pleasure in order to be a sales success in today’s marketplace” (Lin & Zhang, 2006, p. 697).

In particular, the design of automobile interiors is changing from focusing mainly on function to placing more emphasis on aesthetics (Lin & Zhang, 2006; You et al., 2006). The exterior design of automobiles is often dominated by functional and efficiency constraints which leads to increasingly homogenous designs of competing car brands (Leder & Carbon, 2005; Carbon & Leder, 2005). The design of vehicle interiors, in contrast, allows for a more individualized and distinctive composition (Karlsson et al., 2003) and provides an opportunity to differentiate from competitors (Leder & Carbon, 2005). The vehicle interior is the section of the car that driver and passengers see and experience most frequently and intensely (Burnett & Porter, 2001). The composition of the car interior has significant impact on the interaction between man and vehicle and on the driving behavior in terms of handling performance, mental workload, and well-being (Eby & Kantowitz, 2006; Kempfert, 1999; Lin & Zhang, 2006; Waller & Green, 1997). Küller (1980) has demonstrated that a more pleasant environment can contribute to increased calmness and security and a reduction in aggressiveness and Kempfert (1999) could show that high assessments of vehicle comfort tend to be attended by a more evenly manner of driving.

In general, human factors activities in transportation deal with the fit between the human operator and the transportation system, i.e. the vehicle and the immediate transportation environment. Important topics are, for example, occupant protection (e.g., secureness and comfort of seat belts), optimal vehicle movement (e.g., ride quality) and control (e.g., responsiveness of steering), exterior design, adequate field of view, and seat comfort. Also, ambient conditions such as temperature, noise, and lightening and their effects on physical and cognitive performance are analyzed (Waller & Green, 1997).

In addition, the design of the vehicle interior and its equipment is an important matter in vehicle design (Waller & Green, 1997). Cars of today feature a multiplicity of manual controls (switches, knobs, buttons, etc.) for operating the vehicle's various functions (Burnett & Porter, 2001; Waller & Green, 1997). Important issues in vehicle design are thus the placement of controls and displays, reach distance to particular controls, switch operation force, readability and comprehensibility of displays and form and amount of the provided information (Waller & Green, 1997).

Vehicle controls possess four features: type (e.g., button, knob), location (e.g., centre-console, door), operation (e.g., rotate) and coding (e.g., color, shape). The combination of these features influences the control's ease of operation and the workload on the driver (Eby & Kantowitz, 2006). Another important factor in the design of controls are driver expectancies or stereotypes about the mode of operation of certain controls. For example, drivers may expect a rotary knob to be turned clockwise to increase a value. In order to avoid handling problems and thereby evoked distraction, these expectancies have to be borne in mind in control development (Eby & Kantowitz, 2006).

The number and complexity of in-vehicle technologies is increasing rapidly (Amditis, Polychronopoulos, Andreone, Bekiaris, 2006; Burnett & Porter, 2001; Karlsson et al., 2003). At present, this group of technologies is usually referred to as *Intelligent Transport Systems* (ITS) (Burnett & Porter, 2001). Galer-Flyte (1995, as cited in Burnett & Porter, 2001) discriminates between three groups of in-vehicle systems: (1) Systems that directly affect the driving task (e.g., collision warning systems, adaptive cruise control), (2) systems that provide information relevant to the driving environment, the driver, or the vehicle (e.g., navigation, traffic information), and (3) systems that are unrelated to driving (e.g., entertainment devices). ITS are intended to make the task of driving safer, more effective and comfortable (Burnett & Porter, 2001). However, they require increased attentional and mental demand at the expense of lack of attention on the road (Lansdown, 1997). As for the most part screen-based interfaces are being employed, the driver inevitably has to take the eyes off the road in order to interact with the device. Interacting with in-vehicle systems may distract the driver, infer with the driving performance and prevent the driver from controlling the vehicle safely (Burnett &

Porter, 2001; Reed & Green, 1999). Next to fatigue, driver's distraction is among the main causes of road accidents (Amditis et al., 2006). Especially older drivers, whose number is expected to rise within the next years (Burnett & Porter, 2001), were found to show large performance decrements when using new technology while driving (Reed & Green, 1999). Thus, proper design of in-vehicle systems in general and displays in particular is essential for minimizing driver distraction, additional mental workload and impairments of driving performance (Eby & Kantowitz, 2006).

Displays have three features, namely information content, placement and modality (e.g., visual, auditory). As outlined above, for the placement of displays visibility and minimization of eye and head movements have to be regarded (Eby & Kantowitz, 2006). Up to now the primary modes of ITS are visual and/or auditory but other display modalities are currently investigated (Burnett & Porter, 2001). Especially the potential of haptic information – i.e. information actively sought and picked up by the hands (Peck & Childers, 2003) – is being recognized. The physical design of a manual control and its feedback characteristics can provide information about the control's function, mode of operation and current status without having to make use of the visual system. For example, an advanced crash-warning system by Delphi Delco Electronics Systems (2003) uses tactile information in the form of a haptic seat to inform the driver about a hazard at hand. By triggering sensors in the left, right or center part of the seat, the system directs the driver's attention to a given threat.

The explanations above show that the vehicle interior design is crucial for the workload associated with the driving task, the handling performance and the well-being of the driver (e.g., Eby & Kantowitz, 2006; Lin & Zhang, 2006; Waller & Green, 1997) and its satisfaction with the vehicle (Karlsson et al., 2003; Kempfert, 1999). Nevertheless, research on vehicle interior design appears to be in its infancy (Lin & Zhang, 2006). There are few studies or standardized methods available for measuring the consumers' impression of a vehicle interior (e.g., Carbon & Leder, 2005; Chang et al., 2007; Karlsson et al., 2003). So far, research was mostly concerned with studying separate interior units (e.g., speedometers (Jindo & Hirasago, 1997), steering-wheels (Jindo & Hirasago, 1997), instrument panels (Normark et al., 2007) and switches (Wellings et al., 2008)). There are few studies on the perception of the vehicle interior as a whole (e.g., Karlsson et al., 2003; Leder & Carbon, 2005).

Concerning the aesthetic appeal of vehicle interior design, Leder and Carbon (2005) investigated the appreciation of car interiors varying in certain design components that are thought to affect appraisal, i.e. complexity, curvature and innovativeness. Participants preferred more curved and less innovative versions of car interiors. This finding is consistent with Zajonc's (1986) mere exposure hypothesis that says that repeated exposure and thus familiarity lead to liking. As recent car design is dominated by curved designs (Leder & Carbon, 2005) the findings suggest a preference of the participants for the predominant hence familiar, curved style. The straight designs were considered as being more innovative and were less appreciated (Leder & Carbon, 2005).

As stated above, users' demands for automobiles shifted from functional aspects to aesthetics, comfort and ambience (e.g., Jindo & Hirasago, 1997; Kempfert, 1999; You et al., 2006). Kempfert (1999) investigated vehicle comfort and found four factors that influence subjective evaluation of automobile comfort: (1) driving-relevant aspects (e.g., visibility of instruments and controls, responsiveness of steering, circumferential visibility), (2) convenience aspects (e.g., motor noise development, damping behavior, required expenditure of energy for steering), and (3) external dimensions (e.g., overall length, length of engine hood). Another factor influencing vehicle comfort constitutes (4) design, materials and styling of the interior (e.g., design of dashboard, controls, and switches, material and color of dashboard and centre-console). In this respect, the significance of the haptic qualities of the interior equipment has to be noted.

As indicated by the illustrations above, it is important to consider both visual and tactile properties of the interior equipment (You et al., 2006). On the one hand, customer satisfaction with a product is determined by both its visual and haptic qualities (e.g., Grohmann, Spangenberg, & Sprott, 2007; Wellings et al. 2008; You et al., 2006), on the other hand, haptic information is more and more being recognized as a promising alternative to vision in the design of in-vehicle information systems (e.g., Burnett & Porter, 2001). This next chapter is thus concerned with an introduction on the multi-sensuality of product experiences and interaction.

4 Product Experience

Hekkert (2006, p. 160) defines product experience as “the entire set of effects that is elicited by the interaction between a user and a product”. The product experience comprises the perception and identification of a product, the cognitive associations and emotions it elicits, the delight it bestows upon our senses, and the evaluative judgments it brings about (Desmet & Hekkert, 2007; Schifferstein & Cleiren, 2005).

Vision is usually regarded as the sense that dominates human experience (Hekkert, 2006; Schifferstein, 2006; Goldstein, 2007). However, when perceiving an object, the observer perceives information about the object through various senses and the importance of the different sensory modalities depends on the type of product that is encountered and the task that is performed (Schifferstein, 2006). When interacting with a product a user receives continuous feedback about the product’s performance via the different senses (Schifferstein, 2006). Products are always multimodal in that they address several senses at the same time. For example, when driving a car we do not only see the dashboard and the relevant instruments but also feel the steering wheel, hear the sound of the engine, and smell the leather of the seat (Hekkert, 2006).

On average, vision is the most important sensory modality for product evaluations. Touch was found to be the second most valuable sense, followed by smell, audition, and taste (Schifferstein, 2006). The various sensory modalities provide distinct information about different product aspects and affect how the product is experienced (Macdonald, 2000; Schifferstein & Cleiren, 2005). To identify an object or product and its purpose, functionality, and quality a person will attempt to assess object characteristics like shape, size, color, weight, feel, smell, and so on (Schifferstein, 2006). The various sensory modalities are suitable for different kinds of perceptual tasks (Freides, 1974; Klatzky, Lederman, & Matula, 1993; Schifferstein & Cleiren, 2005). According to the modality appropriateness hypothesis (Freides, 1974), the modality that is most effective in perceiving a certain product aspect will dominate the perception of this aspect. Vision is the only modality that can identify color and is most suitable for encoding geometric properties (i.e., size and shape) and spatial arrangements (Freides, 1974; Klatzky et al., 1993). Touch is superior in the perception of surface and texture properties (Freides, 1974; Klatzky et al., 1993), weight, and temperature (Goldstein, 2007). The senses of smell and taste react to the chemical properties of an object and identify what is nutritious and what is inedible or hazardous for us (Schifferstein, 2006). Audition is most suitable for temporal judgments (Freides, 1974, Goldstein, 2007).

Even though some of the information perceived by the various sensory modalities may overlap, they generally provide different information about the respective product aspects. The combined information adds up to the overall product experience and helps to form an aesthetic evaluation of the product (Macdonald, 2001; Schifferstein & Cleiren, 2005). A study by Klatzky et al. (1993), for example, demonstrates that haptic exploration cannot be substituted by visual exploration. An initial period of exploration by vision alone in their experiment did not reduce the probability of haptic evaluation nor did it decrease the contact duration. This indicates that vision and touch provide different information about an object.

Haptic information has positive influences on consumers' responses to a product in that it leads to more positive product evaluations (Grohmann et al., 2007). Furthermore, when tactile input is available individuals have more confidence in their judgments of a product (Peck & Childers, 2003) and report higher perceived accuracy of evaluations (Grohmann et al., 2007). The physical product carries important product information which can help the consumers in the decision-making process. In purchase situations, where the customers can directly experience the product, this product-related information can help them to make better product choices (Mooy & Robben, 2002). In their study, Mooy and Robben (2002) found that when consumers have direct contact with a product when evaluating it they have the opportunity to gain more product-related information and to process this information on a deeper level. Furthermore, customers who experienced the product with all their senses felt no limitations in evaluating the product and better understood the working of the product. Thus, the product itself provides an opportunity to influence potential customers and can act as a marketing tool itself (Mooy and Robben, 2002).

Macdonald (2001) calls for a design that addresses all of the senses in order to provide products that customers can easily empathize with. In this spirit, the design principle *optimal match* is concerned with the relationship between the impressions of the respective senses (Hekkert, 2006). As we tend to prefer products that pass on similar messages to all our senses, designers should try to make the respective sensory messages congruent with the intended overall experience (Hekkert, 2006).

5 Eye movement Measurement

Eyetracking is the science of measuring movements of the eyes in response to visual, auditory or cognitive stimuli. It is an important and promising method in various fields of research including psychology, cognitive sciences, marketing and advertising, web usability, and product design. Eye movement data provide a remarkable on-line indication of ongoing visual and cognitive processing (Liversedge & Findlay, 2000, Rayner & Pollatsek, 1992). Eye movements of participants have been studied for a wide variety of information processing tasks including reading, scene perception, visual search, face recognition and everyday life tasks. For an overview on eye movements and information processing see Rayner (1998).

5.1 Characteristics of Eye movements during Information Processing

As we look straight ahead, the visual field can be divided into three regions: foveal, parafoveal and peripheral. Only from the central part of the retina – the fovea centralis, a region of the retina corresponding to about the central 2° of the viewed scene – high-quality visual information is acquired (Figure 5.1 below). Towards the parafoveal (which covers 5° on either side of fixation) and peripheral areas (i.e., the region beyond the parafovea) visual acuity declines rapidly (Henderson & Hollingworth, 1999; Rayner, 1998).

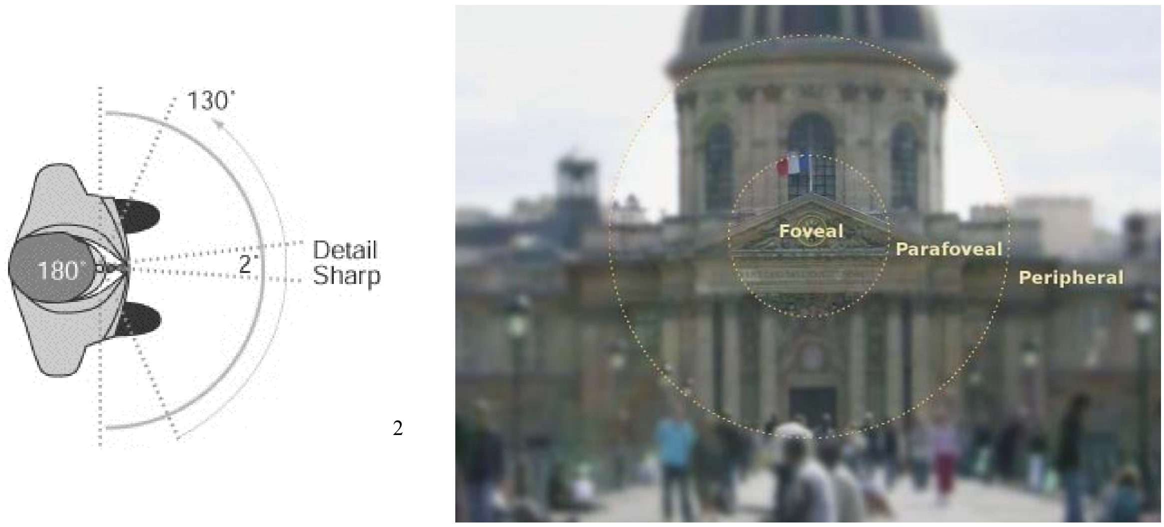


Figure 5.1 Illustrations of the visual field (left image) and visual acuity in the foveal, parafoveal and peripheral area (right image).

[2] Illustration retrieved November, 2009 from http://www.ssc.education.ed.ac.uk/courses/pictures/visualfield1.gif

Hence, we move our eyes – and if necessary head and body – to reorient the fovea towards informative and important regions. These rapid eye movements the eyes make while jumping from point to point in the stimulus are called saccades. They occur about 3 times a second and can reach velocities up to 500°/sec (Rayner & Pollatsek, 1992). The duration of a saccade varies according to the distance covered. In scene perception, saccades typically take around 40 to 50 ms, average saccade length when viewing a scene amounts to 5°. In reading tasks, however, average saccade size is 2°, average saccade duration is 30 ms (Rayner, 1998). The reaction time of the eyes to initiate a new eye movement is called saccade latency and is on the order of at least 150 to 175 ms (Rayner, 1998).

Between the saccades there are short periods of fixation during which the eyes remain relatively still. These fixations last about 200 to 300 ms (Rayner, 1998). Throughout a fixation the eyes remain relatively still and information about the stimulus is gathered and processed (Henderson & Hollingworth, 1999; Just & Carpenter, 1976; Rayner, 1998, Rayner & Pollatsek, 1992). Although the fixated object need not necessarily be the centre of attention as we can dissociate our attention from the point of fixation (Deubel, 1994; Rayner, 1998), most of the time the position of our eyes is consistent with the allocation of our visual attention (Rayner, 1992).

Even during fixations the eyes do not stand absolutely still. Observers usually do not realize that the eyes perform very small eye movements when fixating a stationary object. Three types of involuntary intra-fixational movements can be distinguished: nystagmus, drifts and microsaccades. The eyes never really stand still as there is a constant tremor of the eyes, called *nystagmus*. During longer fixations there can occasionally be small shifts of the fixation point (i.e., *drifts*) because of inaccurate control of the oculomotor system by the nervous system. *Microsaccades* are rapid movements with small amplitude to bring the eyes back to where they were. These micromovements are assumed to generate small displacements of the retinal image when viewing a stationary scene and thus counter retinal adaptation (Engbert & Kliegel, 2003; Nuthmann, Engbert & Kliegl, 2006; Rayner, 1998). Microsaccades furthermore seem to be significant for binocular coordination and are believed to indicate shifts in visual attention (Engbert & Kliegl, 2003).

During a saccade our vision is dramatically reduced. This phenomenon is called *saccadic suppression* and is due to the fact that saccades are high-velocity movements, hence, information gathered during saccades is of poor quality and heavily blurred (Rayner, 1998). Nevertheless, the representation of the environment we perceive is coherent and stable. We do not notice intervals of blurring because this image is masked by information obtained prior to and after the saccade. The result is an overall impression of constant vision (Deubel, 1994; Rayner, 1998).

Apart from saccades there are three other types of eye movements: Moving targets are followed by the eyes via *pursuit movements*. *Vergence movements* occur when we move our eyes from a distant object to a near object or from a near object to a distant one along the same line of sight. *Vestibular eye movements* compensate for head and body movements. (Rayner, 1998; Rayner & Pollatsek, 1992).

5.2 Gaze Control during Scene Perception

"Vision is an active process" (Henderson, 2003, p. 498) in which the viewer selects relevant information. The visual environment surrounding us provides a vast amount of information and our visual system is unable to completely and uniformly absorb it. Only part of the available information is fully processed whereas the remainder is left unneeded (Goldstein, 2007; Kebeck, 1994). Eye movements serve as an overt behavioral index of the allocation of attention in a scene (Henderson, 2003).

This next chapter is concerned with the question of how the eyes are controlled during actively exploring a scene. Which processes control where the fovea tends to be centered during scene viewing and how long the fixation position tends to remain at a certain location? For an overview of the research on eye movement control in scene perception see Rayner and Pollatsek (1992) or Henderson and Hollingworth (1999).

There is neither a clearly defined task of scene perception – it ranges from searching for a particular object or person to performing a certain task to just gathering aesthetic pleasure to simply viewing the world around us without being concerned with a particular intention – nor is there a univocal definition of a scene (Henderson & Hollingworth, 1999; Rayner & Pollatsek, 1992). Henderson and Hollingworth (1999) give a definition of the concept of scene as it is typically used in research on scene perception: The concept of scene is defined as "a semantically coherent (and often nameable) view of a real-world environment comprising background elements and multiple discrete objects arranged in a spatially licensed manner. Background elements are taken to be larger-scale, immovable surfaces and structures […], whereas objects are smaller-scale discrete entities that are manipulable […] within the scene" (p. 244).

The data on eye movement recording during scene perception indicate that fixations are not distributed randomly over a scene (Henderson & Hollingworth, 1999; Rayner & Pollatsek, 1992). The positions of individual fixations in scenes are determined by the informativeness of specific scene regions. Informative regions receive more and longer fixations (e.g., Antes, 1974; Loftus & Mackworth, 1978; Yarbus, 1967). Besides, important or interesting objects or regions in scenes tend to have higher fixation densities (i.e., the total number of discrete fixations in a certain region over the entire course of scene viewing) and are fixated longer than less important objects (e.g., Christianson, Loftus, Hoffman, & Loftus, 1991; Henderson, Weeks, & Hollingworth, 1999; Loftus, 1972, Experiment 1; Yarbus, 1967). Above all, objects that move attract attention (e.g., Boyce & Pollatsek, 1992). Furthermore, stimulus patterns subjects like best or rather rate highest with respect to pleasingness were found to be explored extensively (Berlyne, 1971).

The gist of a scene (i.e., the overall meaning of what is represented) is apprehended very early and rapidly in the process of looking (e.g., Biederman, Mezzanotte, & Rabinowitz 1982; Rousselet, Joubert, & Fabre-Thorpe, 2005; Thorpe, Fize & Marlot, 1996). Still, there is evidence that relevant information is abstracted throughout the time course of viewing (Antes, 1974; Henderson et al., 1999; Loftus, 1981; Rayner, Smith, Malcolm, & Henderson, 2009). Although significant information about objects can be extracted extrafoveally (e.g., Biederman et al., 1982; Henderson, Pollatsek, & Rayner, 1989; Saida & Ikeda, 1979), direct fixation seems to be needed for full object identification (e. g., Hollingworth, Williams, & Henderson, 2001; Parker, 1978). The number of fixations made on a scene seems to be associated with memory for a scene: More fixations result in higher recognition scores (Christianson et al., 1991, Experiment 3; Loftus, 1972).

The placement of individual fixations is probably driven by visual properties of the stimulus. More precisely, low-level visual factors such as luminance, brightness, color, texture, contrast, contours and edge density seem to play a decisive role in determining where to move the eyes (e.g., Baddeley & Tatler, 2006; Mannan, Ruddock, & Wooding, 1995, 1996; Parkhurst, Law, & Niebur, 2002). Apart from this stimulus-driven, bottom-up guided gaze control the placement of individual fixations as well as their duration is also influenced by top-down factors such as stored knowledge about other similar scenes, observer's expectations, intentions, and goals (e.g., Land & Hayhoe, 2001; Shinoda, Hayhoe, & Shrivastava, 2001). For example, different tasks – e.g., memorization, visual search – yield different fixation patterns (e.g., Henderson et al., 1999; Shinoda et al, 2001; Underwood & Foulsham, 2006).

Initial fixation placement seems to be controlled by visual features in the scene (Antes, 1974; Mannan, Ruddock, & Wooding, 1995, 1996) rather than semantic characteristics (Henderson et al., 1999; Loftus & Mackwort, 1978). Semantic informativeness does not appear to influence the placement of the first few fixations but it does have an impact on overall fixation density in a given region. In the course of scene viewing later fixation placement can be controlled by visual characteristics of a region as well as the meaning of previously fixated regions (Henderson et al., 1999; Henderson & Hollingworth, 1999).

Henderson, Weeks, and Hollingworth (1999) propose a framework for understanding eye movement control during scene perception. Their *saliency map framework* is a modification of Henderson's sequential attention model (1992) which in turn was an extension of Morrison's (1984) model of eye movement control in reading. From a fast initial analysis of low-level stimulus attributes a map of potential saccade targets is formed. Each region is assigned a weight according to its salience. Initially, this saliency map is based on low-level stimulus factors such as luminance, contrast and so on. The region with the highest weight within the saliency map has the highest probability of receiving attention. There is a functional relationship between the covert allocation of visual attention and overt movements of the eyes. After processing of the foveal stimulus is completed, attention shifts to the next region with the highest saliency weight and eye movement programs are initiated to bring the eyes to that region. The amount of time the eyes rest on a given region is determined by the amount of time it takes to complete perceptual and cognitive processing of that region. Attention will shift within regions difficult to analyze which entails refixations within those regions until successful processing is achieved. As scene viewing progresses the basis of the saliency weight for an already fixated region changes from mainly visual to mainly cognitive. The saliency map will thus primarily be based on factors such as semantic informativeness, memory concerns and so on. Hence, as scene exploration unfolds cognitively salient regions are more likely to receive attention than visually salient ones.

6 Research Objective

As outlined in the previous sections, deliberate design in general and aesthetics and customer focus in particular are decisive factors of success in today's marketplace (e.g., Berkowitz, 1987; Bloch, 1995; Kotler & Rath, 1984; Veryzer & Borja de Mozota, 2005) – a trend that can be observed particularly in the automotive industry (e.g., Karlsson et al., 2003; Kempfert, 1999; Lin & Zhang, 2006). Whereas the design of the automobile exterior is often limited by functional and efficiency constraints (Carbon & Leder, 2005; Leder & Carbon, 2005), the vehicle interior permits a greater scope for individual design (Karlsson et al., 2003). Moreover, the vehicle interior is the section of the car that driver and passenger see and experience most frequently (Burnett & Porter, 2001) and its composition is of vital importance as it influences driving behaviour (Eby & Kantowitz, 2006; Kempfert, 1999; Lin & Zhang, 2006; Waller & Green, 1997). Research on vehicle interior design has thus far focused mainly on specific components of the interior (e.g., Jindo & Hirasago, 1997; Normark, et al., 2007; Wellings et al., 2008) and scantly on the interior as a whole (e.g., Karlsson et al., 2003).

This study is exploratory in nature and is aimed to identify customer's areas of interest in the front region of the automobile interior. The objective is to find out those zones that are most important to customers regarding either their relevance for purchase decisions or their importance in everyday driving situations. High ecological validity of the results was a primary concern of this study. Hence, a field study was conducted using real automobiles as stimulus material and actual customers as participants.

The research questions can be phrased as follows: What areas or, to be more precise, what controls, devices, instruments, appliances, components and the like of an automobile interior are potential customers most interested in? To which of the respective devices do they attend to the most, to which the least when evaluating the automobile interior? It is hypothesized that some areas are preferred over others. For example, it is expected that areas in front of the driver and components and devices directly related to the task of driving will be explored more extensively. Furthermore, it is assumed that displays will receive a lot of attention.

Another aim of this study was to investigate whether participants give areas that they viewed longer higher attractiveness ratings than areas they viewed to a lesser extent. Based on Zajonc's (1968) mere-exposure hypothesis stating that repeated exposure leads to liking it is hypothesized that participants will rate those areas that they inspected longer as more attractive.

Of further interest was, when participants attend to the respective areas. How is the chronological sequence of the evaluation? Which components are examined first and which last in the course of the evaluation? Which areas attract interest right at the beginning of the evaluation phase and which are noticed later on? It is expected that the various areas are evaluated differently over time. Areas related to the driving task, displays and entertainment devices, for example, are expected to be explored sooner whereas the other areas are assumed to be examined later on in the course of viewing.

Two stimulus cars – a compact car and a medium-sized car – were applied in this study to investigate whether differing or the same areas are important in cars of diverse classes. Do cars of different classes vary in the relevance of the respective components?

In the realm of aesthetics and product design it has been demonstrated that experts and lay people have different (aesthetic) preferences (e.g., Hekkert & van Wieringen, 1996; Hekkert et al., 2003; Leder & Carbon, 2005) and evaluate and interpret product designs differently (e.g., Hsu et al., 2000; Kujala & Mantyla, 2000). Appraisal and evaluation of cars has as well been found to be influenced by participants' expertise in and knowledge about automobiles (e.g., Hekkert et al., 2003; Karlsson et al., 2003). This study is thus also concerned with differences in viewing patterns between car experts and laymen: Do car experts pay attention to the same components as laymen? Do experts and laymen evaluate varying areas to different extents? As indicated by the literature it is expected that experts and laymen do differ in the importance they attach to the various components and devices of the interior equipment and that they observe different areas differently long.

Another aim of this study is to investigate whether men and women differ in this regard. Women represent a growing and important target group in the automotive industry. Nearly one third of all passenger cars is registered to women (Kortus-Schultes, 2005) and when it comes to deciding on which car to buy, women increasingly are the driving force. However, so far the automotive industry to a large extent neglected women's wishes and needs regarding automobiles (Fügener in Wesselhöft, 2005). Kortus-Schultes (2005) found that male and female drivers demand different things of passenger cars. For example, women expressed a greater interest in storage room inside the car and adjustability of seats and steering-wheel. A further research question thus concerns differences between men and women in the examination of the vehicle interior. It is hypothesized that men and women differ in the extent of evaluation of the various areas of the interior. Based on the results of Kortus-Schultes (2005), it is for instance hypothesized that female participants will examine storage facilities longer than male participants. Furthermore, women are expected to explore the passenger's side more extensively than men, as women still take the seat at the passenger's side more often than men.

Apart from examination patterns when evaluating a potential purchase alternative, another research objective is concerned with the importance of the respective components of the interior when driving a car. Driving is a complex task involving dealing with the road itself (steering, speed control), other road users and relevant sources of information (e.g., road signs, in-vehicle devices) (Land, 2007). Cars nowadays feature a multitude of in-vehicle devices, systems and displays (Burnett & Porter, 2001). They are aimed at aiding the driver and making the task of driving easier and more comfortable and yet are another source of information the driver has to pay attention to (Gale, 1997). It is beyond the scope of this thesis to go into details of gaze behavior when driving a car (see for overviews on this topic Land 1998, 2007) as this study is not aimed at analyzing eye movement behavior when steering. Rather, this study is concerned with finding out which in-vehicle devices the driver attends to during the task of driving. Which areas of the interior matter when driving a car? Which devices or instruments are utilized during the car ride by the driver? It is expected that mainly instruments that provide feedback about the state of the vehicle and the handling performance (e.g., dashboard) will be examined during the driving simulation. In addition, it is hypothesized that displays – foremost the central display – will be inspected while driving (cf. Lansdown, 1997).

In order to answer these research questions, an eyetracking study was conducted so as to detect participants' gaze behavior and their distribution of visual attention. Eye movement recording allows to identify which specific elements of the interior equipment participants pay more attention to in contrast to other available components that are rather neglected. Furthermore, the chronology of visual product evaluation can be retraced and thus determined which elements are evaluated when or how fast in the course of viewing.

As has been elaborated in the previous sections, product experiences are always multi-modal (Hekkert, 2006; Schifferstein, 2006) and tactile or haptic input helps consumers to render more accurate product evaluations (e.g., Grohmann et al., 2007; Peck & Childers, 2003). To detect participants' product evaluation and interaction in this study more fully, in addition, video recordings of participants' movements of the hands – that is to say of their haptical evaluation of the interior equipment – were taken. These haptic data were analyzed by Michael Forster (in preparation) within the scope of his diploma thesis.

7 Method

7.1 Participants

Thirty-three participants took part in the study, seventeen of which were male. All subjects had normal or corrected-to-normal vision. They were between 19 and 67 years old (M = 40.36, SD = 15.31). Participants were long-time clients of the car dealership and friends and acquaintance interested in buying a new car. Acquisition of participants was carried out by the sales manager of the car dealership and the experimenters. Participants did not receive any compensation for participation. Their motives for participating were interest in the topic of the study, the eyetracking techniques or the stimulus cars.

7.2 Stimulus Material

As stimulus material a 2007 Renault Clio Exception – a compact car – and a 2007 Renault Laguna Dynamic – a medium-sized vehicle – were used (see Figure 7.1 and Figure 7.6 and 7.7 below for detailed images of the two vehicles, particularly their interiors).

Figure 7.1 Images of the stimulus cars. Upper row: exterior and interior view of the Clio, lower row: exterior and interior view of the Laguna. [3]

To investigate viewing patterns and evaluation of the interior equipment during driving, a driving task was simulated. The driving situation was simulated using two video recordings of a car ride. Two different scenarios were videotaped by one of the experimenters in December 2007. The videos show the traffic from the driver's perspective. One displays a drive through the inner city of Linz, the other pictures a ride on the freeway (Highway A7 towards Unterweitersdorf). See Figure 7.2 and 7.3 for screenshots of the two videos. Both videos are approximately two minutes long. They were projected onto the wall opposing the stimulus cars.

[3] *Copyright of pictures Renault, retrieved from www.renault.com.

Figure 7.2 Still of the inner-city driving scenario video

Figure 7.3 Still of the highway driving scenario video

7.3 Apparatus

Eye movements were monitored using an SMI iView^{TM} X RED system. Viewing was binocular, only the right eye was tracked. A head-mounted device was used (see Figure 7.4). Thus, participants were able to make normal range of head and body movements, walk around and sit inside the vehicles. The device is not too uncomfortable to wear and as it does not restrict participants' liberty of actions it was conducive to a high ecological validity.

Figure 7.4: Images of the portable eyetracking device (upper row) and a subject wearing the device and sitting in one of the stimulus cars (lower row).

Two Sony DCR-HC27E video cameras were employed to record participants' haptic exploration of the vehicle interiors. One camera was positioned at the back seat behind the passenger's seat, the other one outside the open passenger's door. See Figure 7.4 and Figure 7.5e and f for pictures illustrating the positioning of the cameras.

As already mentioned above, empirical research indicates that expert and laymen differ in the assessment of product designs in general (e.g., Hsu et al., 2002; Kujala & Mantyla, 2000) and of the design of automobiles in particular (e.g. Hekkert et al., 2003; Karlsson et al., 2003). Especially with cars, basically two kinds of people can be distinguished. On the one hand those who consider a car as a useful means of transportation, to who a car is little more than a means to an end. On the other hand, car lovers who concern themselves a lot with cars, read up on this topic and show extensive knowledge about different car models and manufacturers (Hekket et al., 2003). Such knowledge about a product class is best measured by an objective knowledge test (Park, Mothersbaugh, & Feick, 1994). Thus, participants' expertise concerning automobiles was assessed via a car questionnaire developed at the Department of Psychological Basic Research of the Faculty of Psychology at the University of Vienna (Autofragebogen V 2.0, see the Appendix for a reprint of the questionnaire). This questionnaire comprises a set of knowledge questions on technical and design aspects of cars and was used to separate car experts from non-experts or rather technical experts and laymen and design experts and laymen.

After evaluating the respective cars, participants were asked to complete a short questionnaire concerning how they liked selective parts of the interior equipment. Reprints of these evaluation forms can also be found in the Appendix. Paper-pencil versions of all questionnaires were employed.

7.4 Procedure and Design

The test took place at the exhibition room of a car dealership in Schärding, Upper Austria. See Figure 7.5 for images of the experimental set-up. All participants were tested individually. At the onset, standardized tests on the participant's acuteness of vision and handedness were carried out. Additionally, the participant was tested for color blindness using the Ishihara Color Test. Afterwards the participant was made familiar with the eyetracking helmet and was supported in donning it. The eye-tracking device had to be calibrated for each participant anew.

Calibration consisted of having the participant fixate several calibration markers on the opposing wall.

The participant was then accompanied to the first car. S/he was instructed to imagine being interested in buying a new car and to consider purchasing the present car. The participant was asked to evaluate the automobile interior, to examine the parts and components he or she is interested in or that he or she attaches importance to. The participant was then assisted in entering the car in order to protect the fragile eyetracking helmet from abutting against the car ceiling. During the assessment the participant sat at the driver's seat. S/he was alone in the vehicle. The doors at the driver's side were closed, the ones at the passenger's side were left open due to the positioning of the video cameras (see Figure 7.5e). The participant was allowed to use the time s/he needed in order to examine the car interior. During this evaluation phase a couple of participants had wanted to take a closer look at the backseats or the trunk as well. They were asked to only evaluate the cockpit during the study and were assured that they would have the chance to assess the rest of the vehicle after the end of the study. Several participants took advantage of this opportunity.

After the participant had concluded the evaluation of the first car the driving task was simulated. Thereto one of the videos was projected onto the wall in front of the car (see Figure 7.5f). The participant was instructed that he was going to see a video of a car journey. S/he was further instructed to now imagine test-driving the present car and to behave like in a real driving situation. S/he was asked to concentrate on the traffic – that was simulated by the video projected onto the opposing wall – and at the same time keep an eye on the vehicle interior and make him- or herself familiar with the interior equipment.

After this task the participant was assisted in getting out of the vehicle. S/he was guided to the writing desk (see Figure 7.5d) and asked to fill in a questionnaire about the just evaluated car and two questions concerning the just seen driving scenario (see the Appendix for a reprint of the questionnaires). During this, the participant was offered coffee and cake as light refreshments. In the meantime, the experimenters were preparing the other vehicle for the test. After the participant had finished the questionnaires, calibration of the eyetracking device was checked and recalibrated if necessary.

Thereafter, the participant was guided to the second car and was again asked to imagine considering buying this car and to evaluate its interior according his or her preferences. S/he was again allowed to evaluate the car interior at his/her own pace. After s/he had finished, the second driving scenario was projected onto the opposing wall and the participant received the same instruction as was the case with the first video.

After this task, the participant was assisted in getting out of the vehicle and was then delivered from the eyetracking helmet. Finally, s/he was asked to fill in further questionnaires, namely an evaluation form on the just examined car and the above described car questionnaire (reprints of the questionnaires can be found in the Appendix). In the end, the participant was debriefed about the exact purpose of the study if requested. A whole session took about 45 minutes on average. Also see the storyboard in the Appendix for a detailed illustration of the test procedure, highlighted by way of example on one participant.

Figure 7.5 Images of the experimental set-up: a) calibration station, b) and c) positioning of the two stimulus cars, d) writing desk, e) and f) positioning of video cameras and video projector.

It was tried to provide comparable test conditions for all participants. However, as this research was conducted in the field – that is to say in a car dealership during daily business – members of staff entering the test room every now and then were not avoidable. This circumstance is not considered a problem though since a test situation as similar as possible to a real purchase situation was envisaged. Participants did not seem to be too disturbed by employees passing by and in real selling situations distractions by employees often occur.

This study used a within-subjects design. All participants evaluated both cars. Presentation order of vehicles was balanced so as to avoid order effects. Half of the subjects first evaluated the Clio and afterwards the Laguna, the other half of the subjects first evaluated the Laguna and subsequently the Clio. The same was true for the two driving scenarios. There were several independent variables, namely area, gender, design expertise and technical expertise. The dependent variable was viewing time or rather relative share of total evaluation duration regarding each participant.

7.5 Data Analysis

The output of the eyetracking system provides an image of the scene in front of the driver. A marker is superimposed over this, indicating the driver's estimated point of regard. Eye fixation data were scored by a frame-by-frame analysis of this scene video. The duration of each fixation on a given region, i.e., the number of consecutive frames of film for which a fixation was at a constant location was registered. Timestamps for each fixation were listed as well. Thus, it was analyzed both when and for how long a certain region was fixated. That way, total viewing time per region and the exact temporal course of the evaluation were detected. Periods where no estimation of the point of regard was provided in the scene video were coded as missing values (see the Appendix for an extract of the Excel data sheet). Total viewing time (tvt) per region was computed by adding up the durations of all single fixations on a given region. This tvt in frames for each region was then converted into seconds (25 frames per second) and for further statistical analysis into relative share of total evaluation duration per participant.

A total of 33 participants were tested. Of five participants, no eyetracking data could be obtained due to glasses or too bright eyes. The evaluation videos of another nine subjects could not be analyzed as too often the estimated gaze position was not visible. Possible reasons could be that these participants acted rather hectically or were looking down frequently, which led to the pupil being covered by the lid and thus made it impossible to define its position. One participant was wearing contact lenses which seem to have disrupted estimation of gaze position. Of two participants, only the evaluation videos of the Clio could be analyzed due to recording problems during evaluation of the other car. For another participant, only the video of the evaluation in the Laguna was analyzable. All in all, 18 participants' evaluation videos of the Clio and 17 participants' evaluation videos of the Laguna could be analyzed.

For statistical analysis of eye movement data, the numerous small subregions of the respective interiors were combined to superordinate regions. The following seven areas of interest were defined: *instrument panel, steering-wheel, centre-console, gearshift and handbrake area, left and driver's door area, passenger's side*, and *ceiling*. Figures 7.6 and 7.7 below give images of these areas and show which instruments and components the respective areas comprise.

Area Centre-console:


*

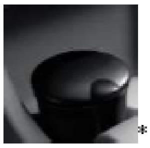
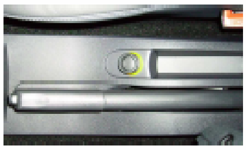

display, central ventilation shaft

control of air-conditioning (left), air-conditioning display (center), control of ventilation (right)


car radio, warning lights switch

Area gearshift:


*


*

*


gearshift, cupholder, handbrake, cigarette lighter

Area left and driver's door:


*


left ventilation shaft, control of headlights,

Power window switch. control of side mirror. door handle


*


driver's door, compartment in driver's door, driver's seat and seat-belt, left side mirror

Figure 7.6 Images of the Clio interior equipment and the components of the defined areas of interest. *Copyright of picture Renault.

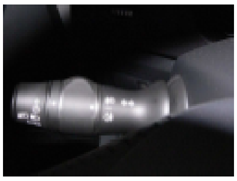
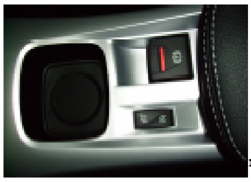
	  * multifunction switch left-hand (left image), multifunction switch right-hand and car radio control (right image)
Area Centre-console: 	 *  * display, car radio  *  control of air-conditioning and ventilation, starter button,  central ventilation shafts, keycard holder, warninglights switch, cupholder
Area Gearshift:  *	 *  * gearshift, silver box, compartment after gearshift, handbrake switch, arm-rest
Area left and driver's door: 	  left ventilation shaft, control of headlights,

Figure 7.7 Images of the Laguna interior equipment and the components of the defined areas of interest. *Copyright of picture Renault.

Eye movement data of the simulated driving tasks were also analyzed by registering which areas of the vehicle interior were fixated when and for how long. Analysis of fixations on the driving video only noted, how long the road and the traffic situation – i.e. the video – were fixated but not where on the road or traffic exactly the participants directed gaze as the aim of this study is determining those components, devices and instruments of the interior equipment that are used by the driver during a car ride. For statistical analysis, the respective components of the interior that were fixated by the participants during the driving tasks were merged to superordinate areas. These were *instrument panel* (comprising the subregions speed indicator, dashboard display, tachometer, lining), *steering-wheel* (comprising top, left and right side of the steering-wheel, left and right multifunction switch), *centre-console* (comprising the elements central display, car radio, ventilation shafts, control of ventilation and air-conditioning), *mirrors* (left and right side mirror, rear-view mirror), and *passenger's side* (comprising the subregions passenger's door and lining of passenger's side).

Of eight participants, analysis of eye movement data during the simulated driving tasks was not feasible. One participant had too bright eyes, one was wearing contact lenses and three further participants were wearing glasses. The videos of another three participants contained too many missing values – i.e., too often estimation of gaze position was not possible – for an adequate analysis. The driving videos of 25 participants were analyzable. The videos of two participants were analyzed but were still not submitted to the analysis as the participants that provided these videos kept watching the road during the entire duration of the simulated driving task. Thus, these videos do not present useful information for the aspired aim of identifying those areas of the interior that are important to drivers during a car ride. All in all, eye movement data of 23 participants were submitted to statistical analysis. Of nine participants eye movement data of only one of the two driving scenarios were utilizable as these participants also only fixated the road when watching the other driving scenario. Fourteen participants provided valuable data of both scenarios and vehicles.

To investigate differences between experts and laymen in the visual exploration of the vehicle interiors two expertise scores were collected: design and technical expertise. They were blocked based on a median split into design experts and laymen (Clio: $Mdn = 14.00$; $M_{\text{Design laymen}} = 10.50$, $M_{\text{Design experts}} = 19.19$; $t = -6.34$, $p < .001$; Laguna: $Mdn = 14.00$; $M_{\text{Design laymen}} = 10.78$; $M_{\text{Design experts}} = 19.19$; $t = -5.96$, $p < .001$) and technical experts and laymen (Clio: $Mdn = 5.75$; $M_{\text{Technical laymen}} = 3.61$, $M_{\text{Technical experts}} = 7.94$, $t = -6.34$, $p < .001$; Laguna: $Mdn = 6.00$; $M_{\text{Technical laymen}} = 3.72$, $M_{\text{Technical experts}} = 8.19$, $t = -6.01$, $p < .001$) respectively (the corresponding Histograms can be found in the Appendix).

8 Results

On average, participants evaluated the Clio 2.4 minutes long ($M = 145.95$ sec, $SD = 59.28$) and the Laguna three minutes long ($M = 179.01$ sec., $SD = 75.08$). A dependent T-Test on evaluation durations of those sixteen participants of who the videos of both cars could be analyzed revealed a significant difference in evaluation duration between the Clio and the Laguna, $t(15) = -2.22$, $p < .05$, $r = .53$. On average, the Laguna ($M = 183.32$, $SE = 18.50$) was evaluated longer than the Clio ($M = 151.58$, $SE = 15.11$).

The Clio interior as a whole was on average assessed as pleasing ($M = 6.06$, $Mdn = 6.00$, $SD = 1.03$). One third of the participants found the Clio interior very pleasing, more than half of them (54.5 %) rated it as pleasing. Only two participants did not like the design of the Clio interior. The Laguna interior was rated as very pleasing by 48.5 percent of participants. Another 45.5 percent of them judged it as pleasing. One participant liked the Laguna interior a bit, another one was indifferent. About two thirds of the participants (67.7 %) could (possibly) imagine buying the Clio, nearly half of them (48.5 %) would buy the Laguna. About a third of the participants (33.2 %) was not interested in buying the Laguna, 21.2 percent could not imagine buying the Clio. As pro-purchase arguments for the Clio participants named for instance the vehicle's size and sportiness, seat-comfort, roominess, easy handling of the equipment and a good price/performance ratio. What was criticized about the Clio was its small size and too small operating controls and switches. The Laguna was appreciated for its roominess, the clearly arranged and high-quality equipment and its attractive and modern appeal. Critical points of the Laguna mainly concerned the size of the vehicle – too small for some, too big for others – and the assumed upscale price.

Table 8.1 Mean liking ratings for selected parts of the vehicle interiors with standard deviation (*SD*)

	Clio			Laguna		
	M	*SD*	*N*	*M*	*SD*	*N*
Steering-wheel	6.21	1.03	19	6.26	0.99	19
Gearshift	6.37	0.60	19	6.05	0.91	19
Handbrake	6.17	0.79	18	5.06	1.69	16
Control of Air-conditioning	581	1.05	16	5.88	1.03	16
Radio	5.95	1.08	19	6.00	1.54	19
Power window switch	6.16	0.83	19	6.11	0.99	19
Radio control at Steering-wheel	6.23	0.73	13	6.28	0.75	18
Tachometer and Speed indicator	6.33	0.59	18	6.37	0.60	19
Driver's sun visor	5.80	0.94	15	5.75	0.86	16
Rearview mirror	6.05	1.03	19	5.89	1.02	18
Ceiling lights	5.85	1.14	13	6.00	1.04	14
Left multifunction switch	5.83	1.15	18	5.63	1.50	19

Note. Means are based on the evaluation data of those participants of whom valuable eye movement data could be obtained. Ratings of those participants who were not able to judge a specific component and missing values were excluded from the analysis.

Participants had also been asked to rate selected components of the interior equipment on a 7-point Likert scale according to how much they liked it[4]. As can be seen from Table 8.1, on average, participants liked all of the selected devices. To find out whether participants' liking of selected components and their extent of examination of these parts are related, correlation analyses were conducted. No substantial relationships between these two variables were found. This finding is rather unexpected as it was hypothesized that – in line with the mere-exposure effect proposed by Zajonc (1968) – participants would rate those devices and instruments that they evaluated longer and more intensively as more attractive. However, as indicated by the correlation coefficients in Table 8.2 and 8.3, viewing times of the defined areas and liking of these areas correlate only to a small extent. In the Clio interior, the strongest relationships were found for the control of the car radio at the steering-wheel, $r = .46$, p (one-tailed) = .07, and the control of the ceiling lights, $r = -.46$, p (one-tailed) = .07. Interestingly, the correlation between viewing time values of the ceiling lights and the liking of this interior component is negative. This suggests that as viewing time of the control of the ceiling lights increases, liking of it decreases.

Table 8.2 Correlations between extent of evaluation and liking of selected components of the Clio interior

	Liking											
viewing time	Steering-wheel	Gear-shift	Hand-brake	ACC-Control	Radio	Power window switch	Radio control	Tacho + Speed indic.	Sun visor	Rear mirror	Ceil. Light	Direct. Indic.
St.-w.	.10											
Gear		.06										
Handbr.			-.08									
ACC-C.				.19								
Radio					.24							
PWS						-.04						
Radio C.							.46					
Tacho								.22				
Sun visor									.05			
Rear m.										.19		
C. light											-.46	
Dir. Ind.												-.21

In the Laguna interior there was a medium strong relationship between viewing time values and liking of the handbrake, $r = -.35$, p (one-tailed) = .11, the radio control at the steering-wheel, $r = .46$, p (one-tailed) = .11, and the ceiling lights, $r = -.34$, p (one-tailed) = .14. The

[4] Response levels correspond to: 1 = like it a lot, 2 = like it, 3 = like it a bit, 4 = neither like it nor dislike it, 5 = dislike it a bit, 6 = dislike it, 7 = dislike it a lot. For further statistical analysis the scale was recoded such that 7 equates to strong liking and 1 to strong disliking.

relationship for the handbrake and the ceiling lights is again negative meaning that participants who inspected these devices longer rated them as less pleasing. All in all these results indicate that there does not seem to be a relationship between the time the participants spent inspecting a given component of the interior equipment and the pleasure they associate with it.

Table 8.3 Correlations between extent of evaluation and liking of selected components of the Laguna interior

	Liking											
viewing time	Steering-wheel	Gear-shift	Hand-brake	ACC-Control	Radio	Power window switch	Radio control	Tacho + Speed indic.	Sun visor	Rear mirror	Ceil. Light	Direct. Indic.
St.-w.	-.41											
Gear		.18										
Handbr.			-.35									
ACC-C.				.06								
Radio					.18							
PWS						.07						
Radio C.							.33					
Tacho								-.19				
Sun visor									-.25			
Rear m.										.27		
C. light											-.34	
Dir. Ind.												.10

In the following, the results of Analyses of Variance of the eye movement data are presented. Eyetracking data were first analyzed for the two stimulus cars Clio and Laguna separately. As evaluation data of both cars was available of only 16 participants, this subset was then consulted to analyze differences between the two cars concerning viewing time in the defined superordinate areas.

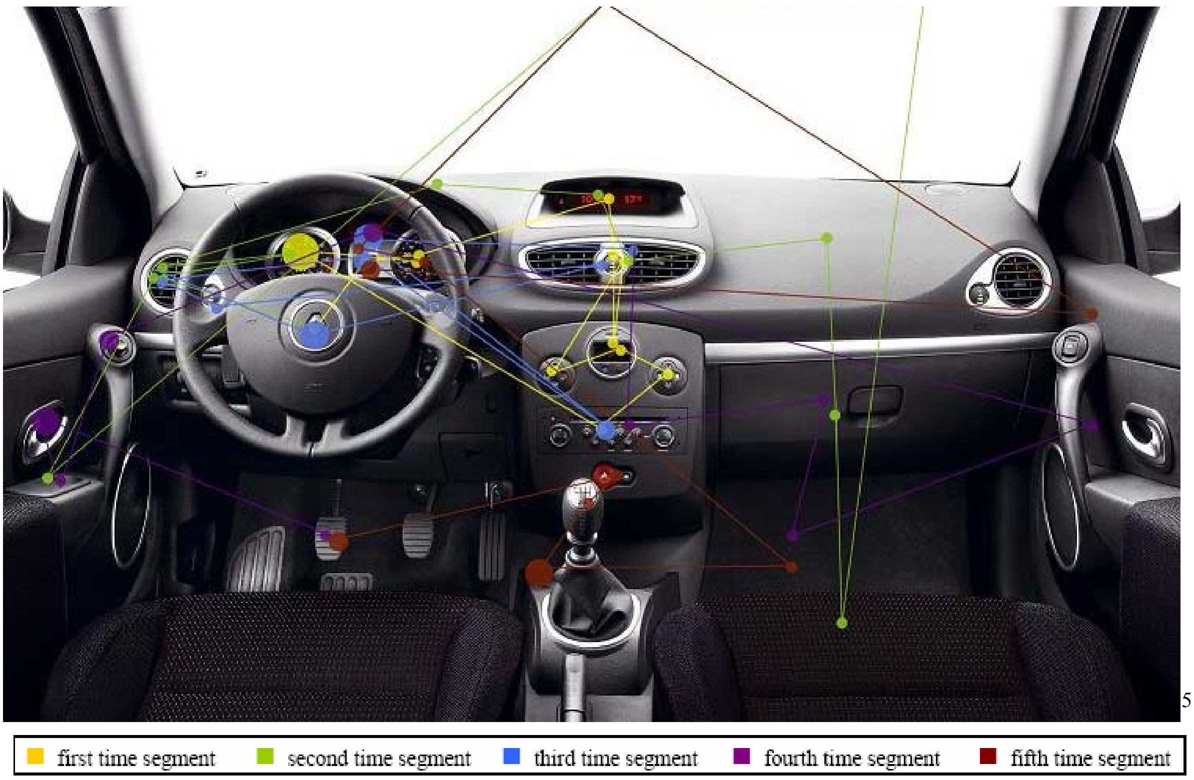
Subsequent to analyses of eye movement data when evaluating the interior equipment, eyetracking data during the simulated driving tasks will be analyzed. As already outlined above, in this regard this study is only concerned with discovering those parts of the vehicle interiors that participants paid attention to during the driving tasks and not with the analysis of the distribution of fixations on the road and the surrounding traffic situation.

8.1 Evaluation of Clio Interior

8.1.1 Global Analysis of the Interior

The main focus of interest in the present study is the extent of visual examination of different areas in the automobile interior. It is hypothesized that areas right in front of the driver's seat and devices and components directly related to the task of driving will be evaluated more extensively, whereas regions more remote from the driver are expected to receive less attention. It is furthermore assumed that displays will be explored more closely.

For illustration purposes a typical scan path of the evaluation of the Clio interior is given in Figure 8.1. The image indicates that most attention was paid to the instrument panel, the steering-wheel and the centre-console. These areas moreover seem to have been inspected at the initial phases of the evaluation, whereas the more remote areas seem to have been evaluated later on in the course of viewing.



[5]

Figure 8.1 Typical scan path for Clio interior.

[5] Copyright of photo Renault, retrieved from www.renault.com; adaptations by the author.

Table 8.4 gives the averaged relative shares of total evaluation duration for the seven superordinate areas. A one-way repeated measurement ANOVA with *Area* (instrument panel, steering-wheel, centre-console, gearshift and handbrake area, left and driver's door area, passenger's side, ceiling) as within-subjects factor was conducted. The analysis revealed a significant effect of Area, $F(6, 102) = 12.23$, $p < .001$, $\eta_P^2 = .42$, indicating that viewing times differed significantly across the respective areas. On average, about 21 % of total evaluation duration were spent looking at the centre-console. Post-hoc comparisons using Sidak correction for multiple comparisons revealed that the centre-console ($M = 20.67$), the steering-wheel ($M = 17.31$) and the left area ($M = 12.46$) were explored significantly longer than the gear area ($M = 8.00$), the passenger's side ($M = 7.63$) and the ceiling ($M = 7.32$; all $p < .05$). Viewing time of the instrument panel ($M = 12.81$) was not significantly different from that of the other areas (all $p > .05$).

Table 8.4 Averaged relative share of total evaluation duration of the defined superordinate areas with standard deviations (SD)

	Clio			Laguna		
	M	*SD*	*N*	*M*	*SD*	*N*
Instrument panel	12.81	6.46	18	12.70	4.62	17
Steering-wheel	17.31	8.15	18	17.03	6.73	17
Centre-console	20.67	8.35	18	26.10	10.76	17
Gearshift area	8.00	2.50	18	12.35	5.78	17
Left and driver's door area	12.46	3.94	18	11.39	4.74	17
Passenger's side	7.63	4.52	18	5.60	3.99	17
Ceiling	7.32	4.88	18	7.60	4.85	17

Another aim of this study was the detection of relevant individual differences. In the following, analyses concerned with the influence of gender and car expertise on viewing patterns are presented. As indicated by a survey of the Competence-centre Woman and Automobile (Kortus-Schultes, 2005; Wesselhöft, 2005), men and women do seem to have different demands on automobiles and especially when it comes to the interior equipment, male and female consumers seem to have different preferences. It is thus expected that male and female participants evaluate the vehicle interior differently and examine differing areas more closely. The case is similar with the distinction of car experts and non-experts. Research indicates that experts and laymen interpret product design in general (e.g., Hsu et al., 2000) and car design in particular (e.g., Karlsson et al., 2003) differently and can differ in their (aesthetic) preferences (e.g., Hekkert et al., 2003). Thus, it is hypothesized that both technical experts and laymen and design experts and laymen will show divergent evaluation behaviors and will pay attention to differing areas.

Effects of Gender. To find out whether viewing time of the respective areas is different for men and women, a two-way mixed ANOVA with *Area* as within-subjects factor and *Gender* as between-subjects factor was conducted. Only the main effect of Area was significant, $F(6, 96) = 12.42$, $p < .001$, $\eta_P^2 = .44$. Neither the main effect of Gender, $F(1, 16) = 0.004$, $p = .95$, nor the interaction effect between Area and Gender, $F(6, 96) = 0.96$, $p = .46$, reached significance. This indicates that gender does not seem to have an influence on how long the various areas of interest in the Clio interior are explored visually.

Effects of Expertise. A two-way mixed ANOVA with *Area* as within-subjects factor and *Technical expertise* as between-subjects factor revealed a non significant main effect of Technical expertise, $F(1, 16) = 1.41$, $p = .25$, and a non significant interaction effect between Technical expertise and Area, $F(6, 96) = 1.13$, $p = .35$. Only the main effect of Area was significant, $F(6, 96) = 12.33$, $p < .001$, $\eta_P^2 = .44$ (see illustration of the meaning of this effect above). The only significant effect revealed by a two-way mixed ANOVA with *Design expertise* as between-subjects factor was again the main effect of Area, $F(6, 96) = 11.36$, $p < .001$, $\eta_P^2 = .42$. Neither the main effect of Design expertise, $F(1, 16) = 0.47$, $p = .50$, nor the interaction effect between Area and Design expertise, $F(6, 96) = 0.17$, $p = .98$, reached significance. These results suggest that car experts and laymen did not differ in the extent of evaluation of the respective areas of the Clio interior.

8.1.2 In-depth Analysis of defined Areas

As a next step, viewing times in the subregions of the respective superordinate areas were analyzed. It was expected that not all subregions received the same amount of attention but rather, that some components and devices were examined more closely than others. For example, it is expected that displays, important switches and entertainment devices receive greater attention than other components.

Again, differences between men and women and car experts and laymen will be analyzed as it is hypothesized that gender and expertise differences exist on the subregions level as well. Car experts and laymen are assumed to pay attention to different devices, switches and components in the respective subregions of the superordinate areas. Similarly, women are expected to place emphasis on different regions in their evaluation than men. For example, the results of the survey of the Competence-centre Woman and Automobile (Kortus-Schultes, 2005; Wesselhöft, 2005) suggest that women might focus more on storage facilities, adjustability of the equipment, room for children.

Instrument panel. A one-way repeated measures ANOVA with *Area* (tachometer, speed indicator, dashboard display, lining) as within-subjects factor discovered a significant main effect of Area, $F(3, 51) = 16.77$, $p < .001$, $\eta_P^2 = .50$. Post-hoc comparisons (Sidak corrected) showed that the lining of the instrument panel ($M = 0.43$) was inspected significantly shorter than the other components (all p < .001). Tachometer ($M = 3.85$), speed indicator ($M = 3.73$) and dashboard display ($M = 4.8$) did not differ significantly in terms of viewing time (all $p > .05$).

Additional two-way mixed ANOVAs with either *Gender*, *Design expertise* or *Technical expertise* as between-subjects factors revealed no further significant effects. Neither the main effects of Gender, $F(1, 16) = 2.57$, $p = .13$, Design expertise, $F(1, 16) = 0.03$, $p = .86$, and Technical expertise, $F(1, 16) = 3.20$, $p = .09$, nor the respective two-way interactions with Area reached significance (Gender x Area: $F(3, 48) = 1.80$, $p = .16$; Design expertise x Area: $F(3, 48) = 0.13$, $p = .94$; Technical expertise x Area: $F(3, 48) = 2.55$, $p = .07$).

Steering-wheel. A one-way repeated measures ANOVA on viewing times in the Steering-wheel area (steering-wheel center, outer regions of steering-wheel, multifunction switch right-hand and left-hand, car radio control, key hole) was conducted. The results show that the subregions of this area vary significantly in terms of viewing time, $F(5, 58) = 12.95$, $p < .001$, $\eta_P^2 = .43$. Post-hoc comparisons (Sidak corrected) revealed that averaged over all participants the outer regions of the steering wheel ($M = 3.94$), the right ($M = 6.41$) and the left multifunction switch ($M = 3.21$) did not differ significantly in viewing time (all $p > .05$) but were observed to a significantly greater extent than the car radio control at the steering-wheel ($M = 1.01$) and the keyhole ($M = 0.05$; all $p < .05$). Viewing time of the centre of the steering-wheel (M = 2.70) only differed significantly from that of the keyhole ($p < .001$).

A two-way mixed ANOVA with *Area* as within-subjects factor and *Gender* as between-subjects factor revealed a non-significant main effect of Gender, $F(1, 16) = 1.21$, $p = .29$, but a significant interaction effect between Area and Gender, $F(5, 80) = 3.67$, $p = < .01$, $\eta_P^2 = .17$. This interaction effect indicates that men and women differed in the amount of attention they paid to the respective subregions of the steering-wheel area. Simple effects analysis were conducted in order to compare male and female participant's viewing time values within each area. Univariate tests revealed that men and women differed significantly in the extent of evaluation of the left multifunction switch, $F(1, 16) = 4.50$, $p = .05$, η_P^2. Female participants ($M = 5.03$) examined the switch significantly longer than male participants ($M = 2.05$).

To break down the interaction between area and gender, contrasts comparing male and female viewing time values of pairs of subregions were performed in addition. These revealed significant interactions when comparing male and female viewing time values of the left multifunction switch compared to the steering-wheel centre, $F(1, 16) = 5.68$, $p < .05$, $\eta_P^2 = .26$, the outer regions of the steering-wheel, $F(1, 16) = 5.72$, $p < .05$, $\eta_P^2 = .26$, and the keyhole, $F(1, 16) = 4.67$, $p < .05$, $\eta_P^2 = .23$, and when comparing male and female viewing time values of the right multifunction switch and the outer regions of the steering-wheel, $F(1, 16) = 9.07$, $p < .01$, $\eta_P^2 = .36$.

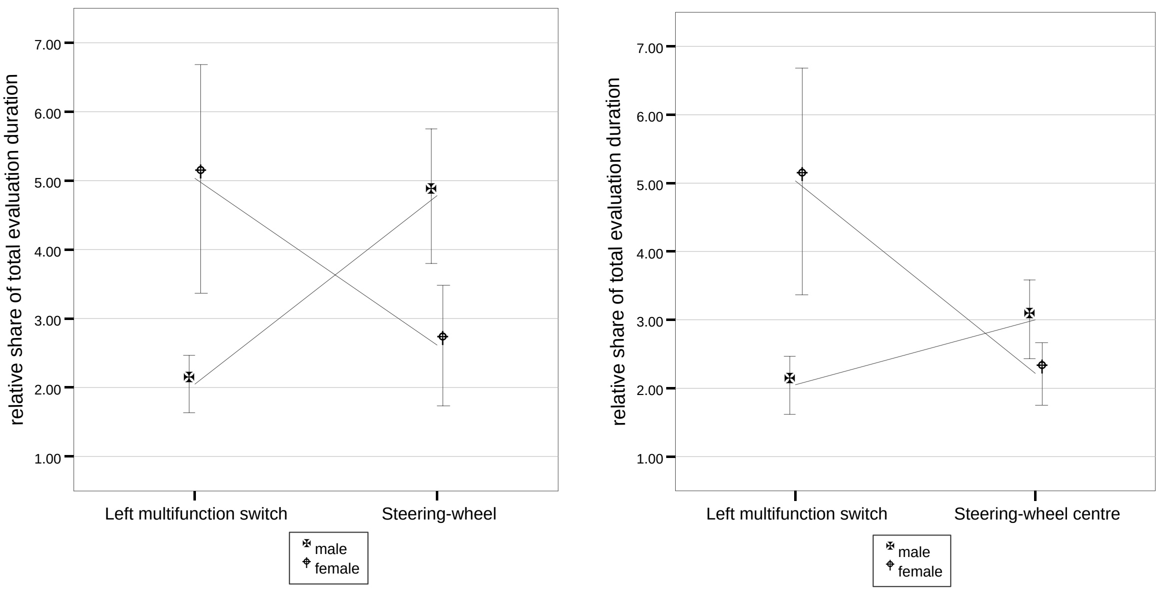


Figure 8.2 Interaction between area and gender when comparing viewing time values of the left and right multifunction switch to the steering-wheel (centre). Steering-wheel represents the outer regions of the steering-wheel. Dots show mean relative share of total evaluation duration. Error Bars show mean +/- one SE (of the mean).

Looking at the interaction graphs (see Figure 8.2 above and Figure 12.3 in the Appendix) these effects reflect that male participants paid more attention to the steering wheel-center and the outer regions of the steering-wheel than to the left multifunction switch whereas female participants inspected the left switch significantly longer than the steering-wheel. The right multifunction switch was examined by men about equally long as the outer regions of the steering-wheel. Women, in contrast, watched the right multifunction switch much longer than the steering-wheel. These results indicate that women attached greater importance to the left and right multifunction switch than men did. Female participants seem to have found the switches more relevant than the steering-wheel whereas male participants seemed to consider the steering-wheel more important.

Two-way mixed ANOVAs on the viewing time values in the steering-wheel area with either *Design expertise* or *Technical expertise* as between-subjects factor revealed non-significant main effects of Design expertise, $F(1, 16) = 0.12$, $p = .74$, and Technical expertise, $F(1, 16) = 0.00$, $p = .95$. The two-way interactions between Area and Design expertise, $F(5, 80) = 1.92$, $p = .10$, and Area and Technical expertise, $F(5, 80) = 2.07$, $p = .08$, also did not reach significance.

Centre-console. A one-way repeated measures ANOVA with *Area* (display, central ventilation shaft, control of air-conditioning, air-conditioning display, control of ventilation, car radio, warninglights switch) as within-subjects factor revealed a significant effect of Area, $F(6, 102) = 13.23$, $p < .001$, $\eta_p^2 = .44$. The warninglights switch (M = 0.99) and the control of ventilation ($M = 1.22$) were both observed for only about 1 % of total evaluation duration. This was significantly shorter than the viewing times of the other areas (all $p < .05$). The control of the air-conditioning ($M = 3.16$), the air-conditioning display ($M = 3.43$) and the central ventilation shaft ($M = 3.44$) did not differ from each other in terms of viewing time and from none of the other areas (all $p > .05$) except for the aforementioned warninglights switch and ventilation control. The car radio ($M = 5.72$) was inspected significantly longer than the centre-console display ($M = 2.72$), the warninglights switch and the control of ventilation (all $p < .05$).

A two-way mixed ANOVA with *Area* as within-subjects factor and *Gender* as between-subjects factor found no significant main effect of Gender, $F(1, 16) = 0.24$, $p = .63$, and no significant interaction effect between Area and Gender, $F(6, 96) = 0.54$, $p = .78$. The same was true for the two-way mixed ANOVAs with either *Design expertise* or *Technical expertise* as between-subjects factor. They revealed non-significant main effects of Design expertise, $F(1, 16) = 0.01$, $p = .93$, and Technical expertise, $F(1, 16) = 1.88$, $p = .19$, and non-significant two-way interactions between Area and Design expertise, $F(6, 96) = 0.22$, $p = .97$, and between Area and Technical expertise, $F(6, 96) = 1.12$, $p = .36$). Thus, expertise in cars does not seem to influence how long the various subregions of the centre-console are examined.

Gear shift area. Analysis of Variance of the Gearshift area (gearshift, cupholder, handbrake, cigarette lighter) showed that viewing times differed significantly across the subregions of this area, $F(3, 51) = 7.97$, $p < .001$, $\eta_P^2 = .32$. On average, viewing times of the gearshift (M = 2.66), the cupholder (M = 2.66) and the handbrake (M = 2.30) were of similar length (all p > .05). The cigarette lighter (M = 0.038) was inspected to a significantly lesser extent than the other components (all $p < .01$).

Additional two-way ANOVAs with either *Gender*, *Design expertise* or *Technical expertise* as between-subjects factor revealed no further significant main effects (Gender: $F(1, 16) = 0.79$, $p = .39$; Design expertise: $F(1, 16) = 0.10$, $p = .75$; Technical expertise: $F(1, 16) = 0.003$, p = .96) and no significant two-way interactions (Gender x Area: $F(3, 48) = 0.74$, $p = .53$; Design expertise x Area: $F(3, 48) = 0.46$, $p = .71$; Technical expertise x Area: $F(3, 48) = 0.32$, p = .81).

Area left and driver's door. A one-way repeated measures ANOVA with *Area* (control of headlights, left ventilation shaft, control of side mirror, power window switch, door handle, driver's door, driver's seat and seat-belt, left side mirror, compartment in driver's door) as within-subjects factor revealed a significant effect of Area, $F(8, 136) = 9.08$, $p < .001$, η_P^2 = .35. Post-hoc comparisons (Sidak corrected) revealed that the control of the left side mirror (M = 3.09) was observed significantly longer than all remaining areas (all $p < .05$) except for the left ventilation shaft (M = 2.54) and the door handle (M = 1.54; all $p > .05$). The left ventilation shaft and the power window switch (M = 1.51) were examined to a significantly greater extent than the driver's seat and seat-belt (M = 0.27) and the compartment in the driver's door (M = 0.30; all $p < .05$). No other comparisons between pairs of areas reached significance (all $p > .05$).

A two-way mixed ANOVA with *Area* as within-subjects factor and *Gender* as between-subjects factor found no significant main effect of Gender, $F(1, 16) = 0.22$, $p = .65$, and no significant interaction effect between Area and Gender, $F(8, 128) = 0.72$, $p = .68$. A two-way mixed ANOVA with *Design expertise* as between-subjects factor and a two-way mixed ANOVA with *Technical expertise* as between-subjects factor revealed non significant main effects of Expertise (Design: $F(1, 16) = 0.53$, $p = .48$; Technical: $F(1, 16) = 0.10$, $p = .76$) and non-significant interactions between Area and Expertise (Area x Design expertise: $F(8, 128) = 1.19$, $p = .31$; Area x Technical expertise: $F(8, 128) = 0.31$, $p = .96$).

Passenger's side. Analysis of Variance of the viewing times in the Passenger's area (right ventilation shaft, passenger's seat, passenger's seat-belt, glove compartment, passenger's door, lining of passenger's side, bottom area of passenger's side) revealed a significant effect of Area, $F(6, 102) = 11.35$, $p < .001$, $\eta_P^2 = 40$, indicating that the subregions vary significantly in viewing time. Post-hoc comparisons using Sidak correction for multiple comparisons revealed that only viewing time of the glove compartment ($M = 3.23$) differed significantly from viewing time of the right ventilation shaft ($M = 0.46$), the passenger's seat-belt ($M = 0.39$), the lining at the passenger's side ($M = 0.55$) and the bottom area of the passenger's side ($M = 0.74$; all $p < .05$). No other pairwise comparisons reached significance (all $p > .05$).

Two-way mixed ANOVAs with *Area* as within-subjects factor and either *Gender*, *Design expertise* or *Technical expertise* as between-subjects factor revealed no further significant main effects (Gender: $F(1, 16) = 0.43$, $p = .86$; Design expertise: $F(1, 16) = 0.77$, $p = .39$; Technical expertise: $F(1, 16) = 1.03$, $p = .33$) and no significant interaction effects (Gender x Area: $F(6, 96) = 0.43$, $p = .86$; Design expertise x Area: $F(6, 96) = 1.10$, $p = .37$; Technical expertise x Area: $F(6, 96) = 0.71$, $p = .65$).

Ceiling. A one-way repeated measures ANOVA with *Area* (ceiling light, rear-view mirror, driver's and passenger's sun visor, passenger's and driver's ceiling area) as within-subjects factor revealed that viewing times of the subregions of this superordinate area differed significantly, $F(5, 85) = 8.68$, $p < .001$, $\eta_P^2 = .34$. The ceiling light ($M = 1.97$), the driver's sun visor ($M = 2.39$) and the rear-view mirror ($M = 2.15$) were all inspected for approximately 2 percent of total evaluation duration. Post-hoc comparisons (Sidak corrected) revealed that these regions were observed significantly longer than the passenger's ($M = 0.08$) and the driver's ceiling area ($M = 0.09$; all $p < .01$). Viewing time of the passenger's sun visor ($M = 0.65$) did not differ significantly from viewing time of any other subregion (all $p > .05$).

A two-way mixed ANOVA with *Area* as within-subjects factor and *Gender* as between-subjects factor found no significant main effect of Gender, $F(1, 16) = 0.44$, $p = .52$, and no significant interaction effect between Area and Gender, $F(5, 80) = 1.36$, $p = .25$. Likewise, a two-way mixed ANOVA with *Design expertise* as between-subjects factor and a two-way mixed ANOVA with *Technical expertise* as between-subjects factor revealed non-significant main effects of Design expertise, $F(1, 16) = 0.08$, $p = .78$, and Technical expertise, $F(1, 16) = 0.38$, $p = .55$ and non-significant interaction effects between Area and Design expertise, $F(5, 80) = 0.59$, $p = .71$, and between Area and Technical expertise, $F(5, 80) = 0.51$, $p = .77$.

8.1.3 Variation of Evaluation Behavior over Time

So far it has been analyzed, which areas, devices and components of the Clio interior were overall considered most important by the customers and received most attention. This chapter will now be concerned with the question of when the respective areas and subregions were evaluated in the course of viewing and whether they were evaluated differently over time. It is hypothesized that the different areas of the interior are examined at different times in the course of evaluation. It is, for example, presumed that the areas containing devices directly related to the driving task – i.e. the instrument panel, the steering-wheel – will be explored sooner, whereas the other areas are assumed to be evaluated later on in the course of viewing.

In a first step, average amount of seconds until the respective areas of interest were first fixated was computed. As can be seen in Table 8.5, on average, participants fixated the instrument panel after just less than one second, whereas the ceiling area was fixated latest, more precisely, after about 40 seconds. A one-way repeated measures ANOVA on these data revealed significant differences in time until first fixation in the respective areas of interest, $F(6, 102) = 12.56$, $p < .001$, $\eta_P^2 = .43$. Sidak-corrected post-hoc comparisons between all areas revealed that the instrument panel, the steering-wheel and the centre-console were fixated significantly sooner than the passenger's side and the ceiling (all $p < .05$). On average participants also fixated the left area sooner than the ceiling ($p < .05$).

Table 8.5 Seconds until first fixation in the defined areas of interest

	Clio		Laguna	
	M	*SD*	*M*	*SD*
Instrument panel	0.57	1.24	0.40	1.15
Steering-wheel	2.32	5.05	1.15	1.29
Centre-console	8.05	9.60	6.94	6.24
Gear area	26.95	31.72	24.73	21.88
Left area	11.43	15.84	21.59	31.04
Passenger's side	26.58	16.91	46.53	34.86
Ceiling	40.45	27.61	67.20	51.95

In order to find out how extent of evaluation of the respective areas changes over time, total evaluation duration was broken down into five time segments. Thereto each participant's total evaluation time was split up into five equal time segments. Averaged over all participants it was analyzed how long each area of interest was examined in each time segment. Looking at Table 8.6 and Figure 12.4 in the Appendix, the mean relative shares of total viewing time of the defined superordinate areas and time segments suggest that the respective areas of the Clio interior were evaluated in varying durations across the five time segments. Figure 12.4 indicates that while in the early stages of the evaluation mainly the instrument panel, the steering-wheel and the centre-console were examined the remaining areas seem to have been inspected to a greater extent later on in the course of viewing.

Table 8.6 Mean relative shares of total evaluation duration for the five time segments of the superordinate areas of Clio and Laguna

		Clio		Laguna	
		M	*SD*	*M*	*SD*
	time segment				
Instrument panel	T1	4.80	2.69	4.20	2.73
	T2	2.10	2.14	1.91	1.84
	T3	1.49	1.90	1.61	1.93
	T4	2.18	2.52	2.25	2.31
	T5	2.24	1.69	2.74	2.82
Steering-wheel	T1	3.67	1.92	4.03	2.73
	T2	4.83	3.83	3.84	3.13
	T3	3.49	3.79	3.79	4.67
	T4	2.36	2.47	2.52	2.83
	T5	2.96	3.07	2.81	2.62
Centre-console	T1	3.96	3.15	5.97	3.95
	T2	4.64	4.31	4.97	3.56
	T3	4.63	4.10	3.85	4.74
	T4	3.82	3.76	6.30	5.58
	T5	3.62	2.54	5.01	4.01
Gear area	T1	1.47	1.54	1.74	1.74
	T2	0.87	1.51	3.83	4.38
	T3	1.81	1.99	3.39	3.36
	T4	2.34	2.32	1.58	2.20
	T5	1.51	1.51	1.81	2.71
Left area	T1	2.27	2.17	2.11	2.01
	T2	2.86	3.12	2.23	2.52
	T3	1.75	2.06	1.75	2.44
	T4	2.22	2.30	2.41	3.01
	T5	3.43	2.87	2.88	2.29
Passenger's side	T1	0.45	0.66	0.28	0.63
	T2	1.24	1.89	0.89	2.32
	T3	2.35	2.98	1.09	1.44
	T4	1.70	2.12	1.32	1.63
	T5	1.88	1.25	2.03	1.92

Ceiling	T1	0.83	1.40	0.21	0.54
	T2	1.27	2.09	0.78	1.81
	T3	2.39	3.45	3.04	4.33
	T4	1.79	2.98	2.35	2.95
	T5	1.03	1.83	1.23	2.13

A two-way repeated measures ANOVA on the viewing time values of the respective time segments and areas with *Area* (instrument panel, steering-wheel, centre-console, gearshift area, left area, passenger's side, ceiling) and *Time* (five time segments) as within-subjects factors was conducted. The analysis revealed a significant main effect of Area, $F(6, 102) = 12.23$, $p < .001$, $\eta_P^2 = 42$, and a non-significant main effect of Time, $F(4, 68) = 1.30$, $p = .28$. The interaction effect between Area and Time also reached significance, $F(24, 408) = 1.67$, $p < .05$, $\eta_P^2 = .42$. This interaction effect provides evidence for the assumption that the various areas of the Clio interior were evaluated differently in the course of evaluation and that different areas attracted participants' attention at different time segments.

Simple main effects (using Sidak adjustment for multiple comparisons) between all seven superordinate areas within each time segment revealed that in the first time segment the instrument panel ($M = 4.80$) and the steering wheel ($M = 3.67$) were both evaluated significantly longer than the gear area ($M = 1.47$), the passenger's side ($M = 0.46$) and the ceiling ($M = 0.83$, all $p < .05$). The centre-console ($M = 3.96$) was also inspected to a greater extent than the passenger's side and the ceiling (all $p < .05$). Viewing time value of the left area ($M = 2.27$) only differed significantly from that of the passenger's side, to the effect that the former was observed significantly longer than the latter ($p < .05$). In the second time segment only the viewing time value of the gear area differed significantly from viewing time values of the steering-wheel and the centre-console; the gear area ($M = 0.87$) was inspected to a significantly lesser extent than the steering-wheel ($M = 4.84$) and the centre-console ($M = 4.64$). In the third, fourth and fifth time segment the superordinate areas of the Clio interior did not differ in terms of viewing time values. This indicates that in the last three time segments the various areas were not examined significantly differently long. Thus, only at the onset of the evaluation there have been significant differences in the extent of evaluation of the respective areas in that the instrument panel, the steering-wheel and the centre-console were examined longer than the passenger's side and the ceiling.

It was not only hypothesized that the superordinate areas of the interior are evaluated differently in the course of viewing but also that the respective subregions of these areas are examined differently long in the five defined time segments. For example, it is assumed that displays are examined sooner than other components. To find out whether the respective subregions, components or devices of the superordinate areas were examined at different points in time in the course of evaluation, viewing time values of the five time segments of the subregions were analyzed. For the sake of clarity, only significant results of these analyses will be provided. SPSS-Outputs of all further statistical results can be found in the Appendix Chapter 12.2.6.

Instrument panel. A two-way repeated measures ANOVA with *Area* (tachometer, speed indicator, dashboard display, lining) and *Time* as within-subjects factors revealed a significant main-effect of Area, $F(3, 51) = 16.77$, $p < .001$, $\eta_P^2 = .50$, and a significant main effect of Time, $F(4, 68) = 7.31$, $p < .001$, $\eta_P^2 = .30$. The main effect of area was already characterized above (see Chapter 8.1.2) and will thus not be illustrated here again. The main effect of time indicates that the instrument panel was examined differently long across the five time segments. Post-hoc comparisons (Sidak corrected) revealed that in the first time segment of total evaluation duration, the instrument panel was inspected significantly longer than in the remaining periods (all $p < .05$). On average, about one percent of total evaluation duration ($M_{T1} = 1.20$) were spent observing each subregion in the first time segment. In the remaining time segments, the subregions of this area were only inspected for about half a percent of total evaluation duration ($M_{T2} = 0.53$, $M_{T3} = 0.37$, $M_{T4} = 0.55$, $M_{T5} = 0.56$).

Steering-wheel. Analysis of Variance of the viewing time values of the Steering-wheel area (outer regions of steering-wheel, steering-wheel center, left and right multifunction switch, radio control, key hole) revealed a significant interaction effect between Time and Area, $F(20, 340) = 1.83$, $p < .05$, $\eta_P^2 = .10$. Simple main effects were calculated in order to compare viewing time values of all areas within each time segment. See the Appendix for a table of means of each subregion and time segment. Simple effects analysis (Sidak corrected) revealed that in the first time segment, the outer regions of the steering-wheel ($M = 1.39$), the steering-wheel centre ($M = 1.03$) and the right multifunction switch ($M = 0.88$) were examined significantly longer than the car radio control ($M = 0.01$) and the keyhole ($M = 0.02$, all $p < .05$). The left multifunction switch ($M = 0.88$) did not differ significantly in viewing time from any other subregion (all $p > .05$). In the fifth time segment the outer regions of the steering-wheel ($M = 7.20$) were observed to a significantly greater extent than the car radio control ($M = 0.04$) and the keyhole ($M = 0.00$) that was not observed at all in the final stages of the evaluation (all $p <$

.05). There were no other significant differences between areas. These results indicate that extent of examination of the various subregions of the steering-wheel area differed substantially mainly in the first time segment, whereas evaluation of the respective regions in the later time segments was rather balanced. In the first time segment, the steering-wheel and the right multifunction switch were inspected significantly longest.

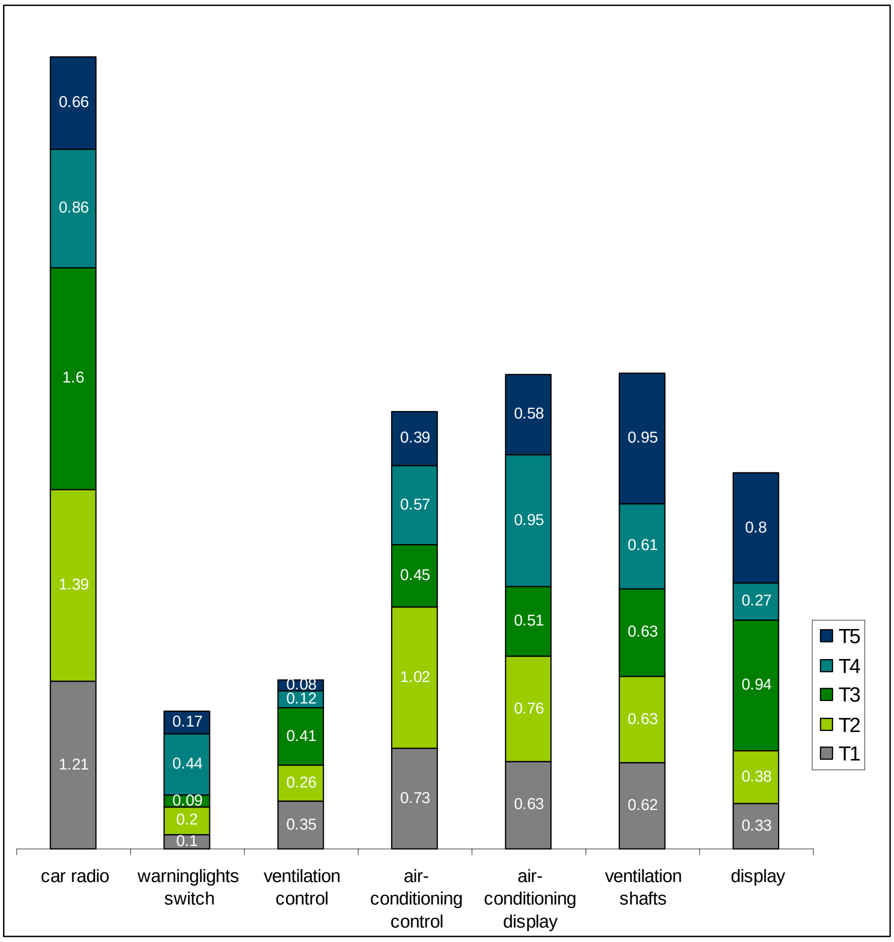


Figure 8.3 Bar graph showing mean relative shares of total evaluation duration in the five time segments for the subregions of the centre-console

Centre-console. A two-way repeated measures ANOVA with *Area* (car radio, control of air-conditioning, air-conditioning display, control of ventilation, central display, warninglights switch, central ventilation shaft) and *Time* as within-subjects factors found a significant interaction effect between Area and Time, $F(24, 408) = 1.59$, $p < .05$, $\eta_p^2 = .09$. This interaction indicates that the various components of this area were examined differently long in the course of evaluation (see Figure 8.3). Simple main effects – using Sidak correction for multiple comparisons – between the subregions of the centre-console within each time segment revealed significant differences in viewing time values between the warninglights switch and the air-conditioning display in the first and third time segment (all $p < .05$) In both time segments the warninglights switch ($M_{T1} = 0.10$, $M_{T3} = 0.09$) was examined significantly shorter than the display of the air-conditioning ($M_{T1} = 0.63$, $M_{T3} = 0.51$). In the fifth time segment the car radio ($M = 0.66$) was inspected to a significantly greater extent than the warninglights switch ($M = 0.17$) and the control of the ventilation ($M = 0.08$).

Gear area. Analysis of Variance of viewing time values of the Gearshift area (gearshift, handbrake, cupholder, cigarette lighter) revealed a significant interaction effect between Time and Area, $F(12, 204) = 2.06$, $p < .05$, $\eta_P^2 = .11$. The corresponding means are given in Figure 8.4. Simple main effects analysis revealed that extent of evaluation of the subregions of the gear area differed significantly only in the first time segment as the gearshift (M = 1.18) was explored significantly longer than the cupholder (M = 0.10) and the cigarette lighter (M = 0.00, all p < 05). In the remaining time segments differences in viewing time values between areas did not reach statistical significance.

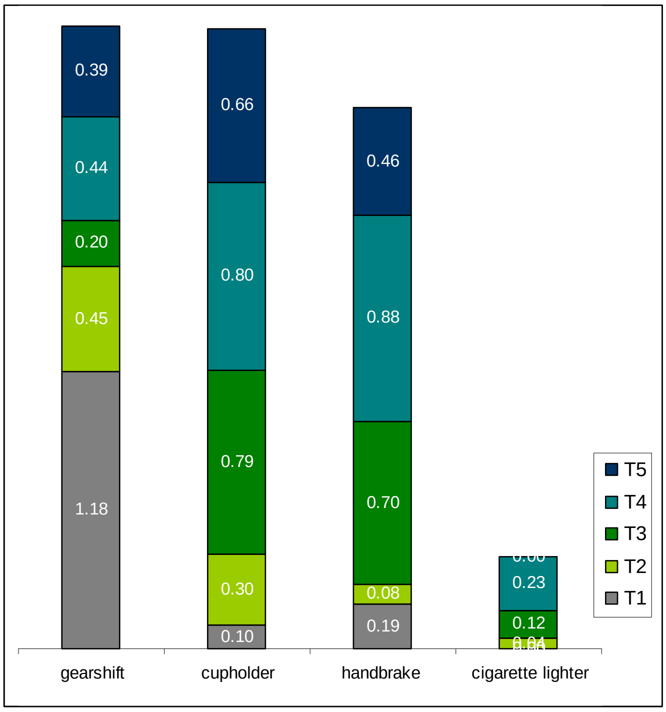


Figure 8.4 Bar graph showing mean relative shares of total evaluation duration in the five time segments for the subregions of the gearshift area.

Passenger's side. A two-way repeated measures ANOVA with *Area* (right ventilation shaft, lining of passenger's side, glove compartment, passenger's door, passenger's seat and seatbelt, bottom area of passenger's side) and *Time* as within-subjects factors revealed a significant main effect Time, $F(4, 68) = 2.52$, $p < .05$, $\eta_p^2 = .13$, and a significant interaction effect between Time and Area, $F(24, 408) = 2.69$, $p < .001$, $\eta_p^2 = .14$. Sidak corrected post-hoc comparisons revealed that in the first time segment ($M = 0.07$) the passenger's side was examined to a significantly lesser extent than in the fifth ($M = 0.27$) time segment ($p < .005$). Viewing time values of the remaining time segments did not differ significantly ($M_{T2} = 0.18$, $M_{T3} = 0.34$, $M_{T4} = 0.24$; all $p > .05$). This indicates that the passenger's side was primarily inspected in the middle and later phases of the evaluation. The interaction effect between time and area further indicates that the respective subregions of this area were evaluated differently long at various points in time in the course of evaluation (see Figure 8.5 for the means in each time segment). Simple main effects were conducted comparing viewing time values of all areas within each time segment. Post-hoc comparisons using Sidak correction for multiple comparisons revealed no significant differences between pairs of areas in any of the five time segments. Thus, a LSD correction, a less conservative correction to control the familywise error was used. The analysis revealed that in the first time segment the passenger's seat-belt ($M = 0.00$) was inspected significantly shorter than the glove compartment ($M = 0.16$) and the passenger's door ($M = 0.05$; all $p < .05$). In the second time segment, no pairwise comparisons of areas reached significance (all $p > .05$). In the third time segment the glove compartment ($M = 1.63$) was observed significantly longer than all other areas (all $p < .05$) except for the passenger's seat ($M = 0.24$; $p = .06$). The passenger's seat-belt, in contrast, was not watched at all in the third time segment and thus inspected significantly shorter than the other subregions (all $p < .05$) except for the right ventilation shaft ($M = 0.11$, $p = .06$). In the fourth time segment a similar pattern of results was found. The passenger's seat-belt was again not watched at all in this time segment and differed significantly from the right ventilation shaft ($M = 0.08$), the glove compartment ($M = 0.67$), the bottom area of the passenger's side ($M = 0.24$) and the lining of the passenger's side ($M = 0.07$; all $p < .05$). The glove compartment ($M = 0.67$) was again viewed significantly longer than most of the other areas (all $p < .05$). In the fifth time segment, the passenger's door ($M = 0.51$) was examined to a significantly greater extent than the right ventilation shaft ($M = 0.21$), the passenger's seat ($M = 0.12$) and the lining ($M = 0.16$; all $p < .05$).

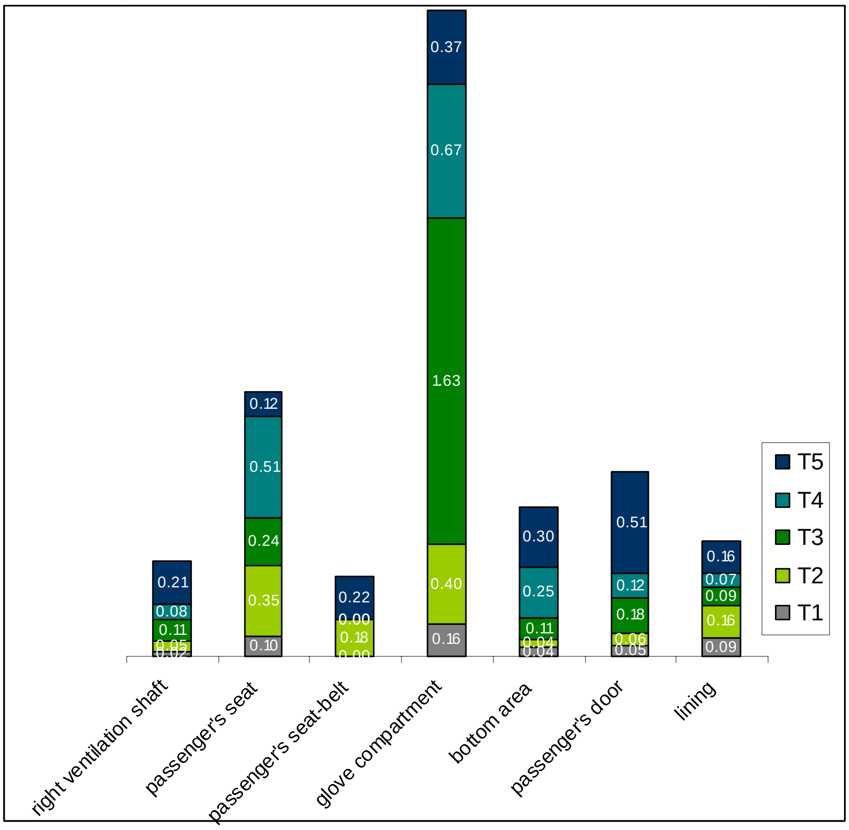


Figure 8.5 Bar graph showing mean relative shares of total evaluation duration in the five time segments for the subregions of the passenger's side.

8.1.4 Summary and Visualization of Results

Analysis of eye movement data of evaluation of the Clio interior revealed that – as expected – the various areas differed in the extent of attention they received by the participants. Figure 8.6 and Figures 8.8 to 8.12 map the relevance of the areas and components of the Clio interior. The coloring was chosen in analogy to classic heatmaps. It has to be noted that the illustrations are based on the mean relative shares of total evaluation duration of the respective areas and devices. They do not give information on statistically significant differences between viewing time values, but provide an intuitive way of assessing the results.

The topographical maps were realized in the graphics editing program Gimp, an open source alternative to Photoshop. First, the areas of the car interior were selected by hand using Beziers Curves. Second, new Layers were allocated to each selection, in which the colors were attributed according to the average relevance. The required transparency and overlay modes of these layers were adjusted indivually with regard to the brightness of subjacent elements. Furthermore, the visualization of time differences was illustrated by layers of striped patterns. For the sake of clarity, the outside environment of the car, visible in the windows and mirrors, was replaced by unobtrusive white color in some photographs.

As illustrated by Figure 8.6, the most prominent area of the Clio interior was the centre-console. This is little surprising as the centre-console is a large area containing many different components and devices. Nevertheless, this finding is interesting as the centre-console itself has little to do with the actual driving task but is mainly concerned with driving comfort and entertainment. As such, this result is in line with prior research (e.g., Kempfert, 1999) indicating that comfort and ambience in the automobile interior design carry great weight for customers.

[6]

Figure 8.6 Map illustrating the relevance of interior areas of the Clio.

[6] Copyright of photo Renault, retrieved from www.renault.com; adaptations by the author.

In line with the proposed expectations, the steering-wheel and the instrument panel received extensive attention as well and are thus assumed to be of great importance to the participants. Interestingly, these three areas of interest were examined to a greater extent than the remaining areas right at the onset of evaluation. Figure 8.7 illustrates the sequence of “detection” of the areas of interest of the Clio interior, i.e. how long after the onset of evaluation a component of a given area was first fixated. The areas that were most relevant to the participants were, on average, also fixated sooner than the less important areas. These findings suggest that those regions that participants attached most importance to were evaluated in the initial phases of the evaluation whereas the parts that participants regarded as not so relevant were examined later on.

The gear area, the passenger’s side and the ceiling were watched least by the participants. While the minor significance of the latter is little surprising the small attention on the gearshift area is rather unexpected. After all, the gearshift and to some extent the handbrake as well are essential devices for steering a vehicle. As the gearshift has been examined visually rather little, it would be interesting to see whether it received a greater amount of haptic evaluation. The interested reader is asked to refer to Forster (in preparation) for these and more results on the haptic evaluation of the interior equipment.

Figure 8.8 to 8.12 map the relevance of the respective components of the defined areas of interest. As indicated by Figure 8.8 and 8.9 the instruments of the dashboard received a lot of attention. These devices are crucial parts of the interior equipment providing major feedback about the state of the vehicle and the handling performance. It is thus little surprising that they were examined closely by the participants. On average, the most relevant fields of the steering-wheel were found to be the two multifunction switches and the outer regions of the steering-wheel. These overall most important areas of the steering-wheel have – in contrast to the other components – been examined extensively right at the onset of evaluation. Interestingly, the control of the car radio at the steering-wheel (not visible in Figure 8.8, see Figure 7.6 above for a picture of this device) has only been observed sparsely by the participants. Here it remains to be clarified whether this controller is of little relevance to the customers or whether they just were not aware of this device and did not detect it.

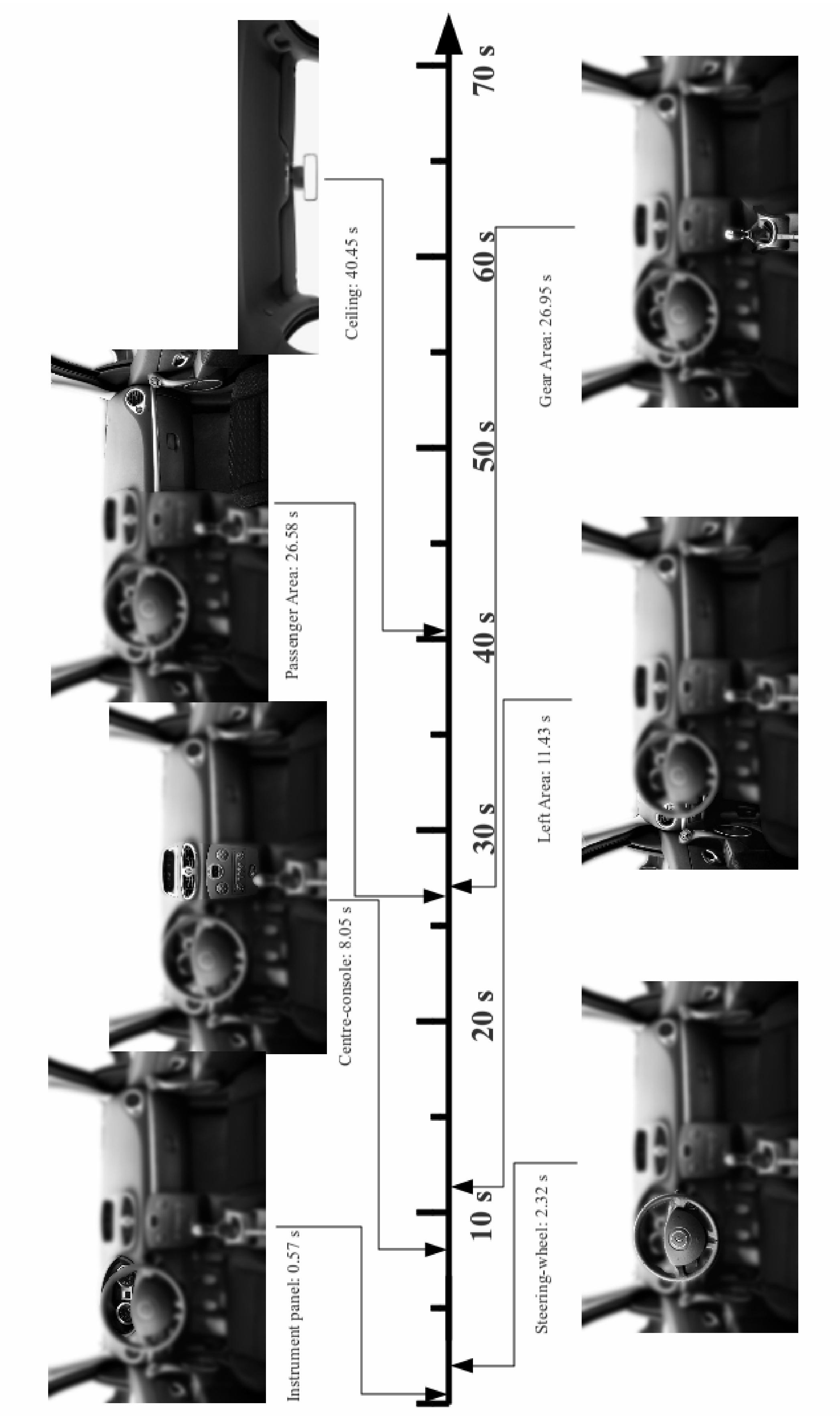


Figure 8.7 Time line illustrating average amount of seconds until first fixation in the defined areas of interest of the Clio interior. Copyright of picture Renault, adaptations by the author.

[7]

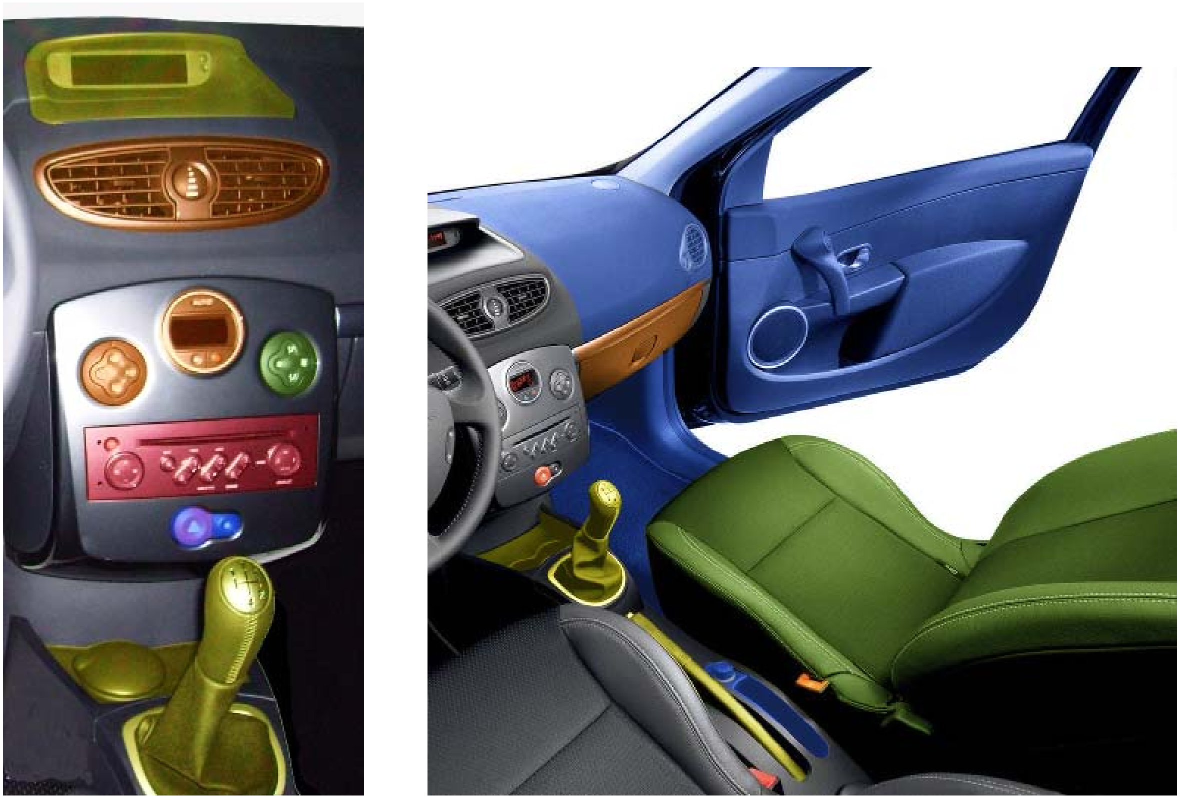
Figure 8.8 Map illustrating the relevance of the components of the instrument panel and the steering-wheel of the Clio interior.

Figure 8.9 Map illustrating the relevance of the components of the instrument panel of the Clio interior.

The most prominent components of the centre-console have been the car radio, the control and display of the air-conditioning as well as the central ventilation shaft (see Figure 8.10). On average, the central display seems to have been examined to a lesser extent than these components – although it has to be noted that the differences in viewing times did not reach

[7] Copyright of photo Renault, retrieved from www.renault.com; adaptations by the author.

statistical significance. Still, the minor examination of the display is unexpected. Possible reasons may be that the display would be switched off by default during the tests. Participants optionally could switch it on by turning on the radio. The shorter viewing times of the display could of course also be due to a minor relevance of this device or a dislike of its design.


[8]

Relative share of total evaluation duration:
0 – 1 % 1.1 – 2 % 2.1 – 3 % 3.1 – 4 % > 4 %

Figure 8.10 Maps illustrating the relevance of the components of the centre-console, the gearshift area and the passenger's side of the Clio interior.

At the gearshift area, the gear switch, the handbrake lever as well as the cupholder and the surrounding compartment seem to be equally important to the participants. The cigarette lighter in contrast received hardly any attention. As indicated by Figure 8.10, the longest observed component of the passenger's side is the glove compartment whereas the lining and the passenger's door seem to have been of minor relevance to the participants. At the driver's door area (Figure 8.11 below) participants paid most attention to the control of the side mirror and the left ventilation shaft. Next to the passenger's side the ceiling area was the least examined area of the Clio interior. Of the components of the ceiling participants, on average,

[8] Copyright of photo Renault, retrieved from www.renault.com; adaptations by the author.

seemed to attach most importance to the rear-view mirror and the driver's sun visor (see Figure 8.12 below).

Figure 8.11 Map illustrating the relevance of the components of the driver's door area of the Clio interior.

Figure 8.12 Map illustrating the relevance of the components of the ceiling of the Clio interior.

All in all, results of eye movement data of evaluation of the Clio interior indicate that the most relevant components of the equipment seem to be devices related to the task of driving (e.g., instruments of dashboard, switches at steering-wheel, steering-wheel itself, gearshift) and tools concerned with ambient conditions and entertainment (e.g. control of air-conditioning, ventilation shafts, car radio). Especially the latter finding is in line with prior research demonstrating that apart from functional features consumers are more and more interested in comfort aspects of vehicles (e.g., Kempfert, 1999).

8.2 Evaluation of Laguna interior

8.2.1 Global Analysis of the Interior

For the Laguna interior too, extent of evaluation of the respective superordinate areas was analyzed. The same hypotheses proposed for the Clio interior hold true for the Laguna interior as well.

To illustrate a typical viewing pattern of evaluation of the Laguna interior Figure 8.13 below depicts a typical scan path. Also in the Laguna interior the centre-console, the steering-wheel and the instrument panel seem to have been fixated longest.

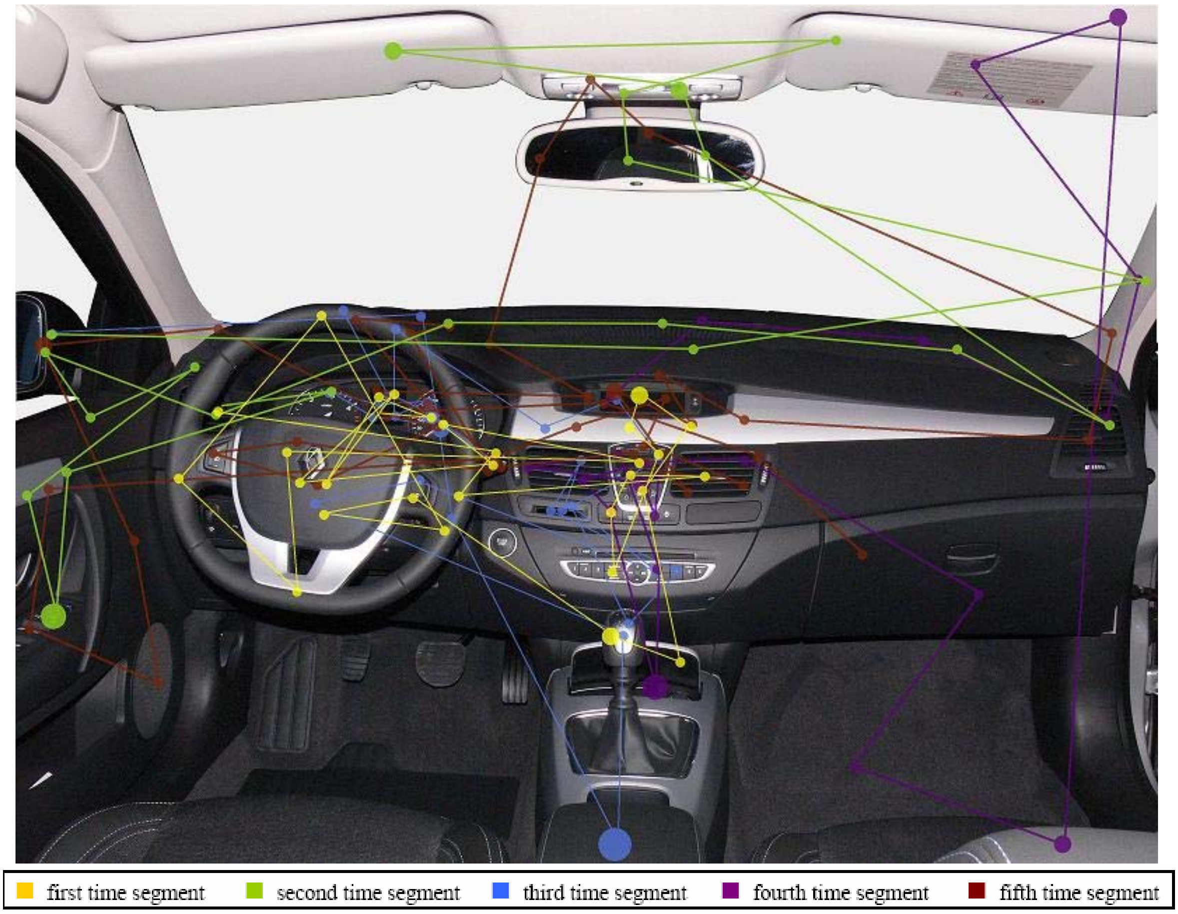


Figure 8.13 Typical scan path of Laguna interior.

Relative shares of total evaluation duration for each superordinate area of the Laguna were again subjected to a one-way repeated measurement ANOVA with *Area* (instrument panel, steering-wheel, centre-console, gearshift and handbrake area, left and driver's door area, passenger's side, ceiling) as within-subjects factor. The analysis revealed a significant effect of Area, $F(6, 96) = 16.95$, $p < .001$, $\eta_P^2 = .51$. Averaged relative shares of total evaluation duration for the defined areas can be found in Table 8.4 above. Post-hoc comparisons using Sidak correction for multiple comparisons revealed that the centre-console (M = 26.10) was explored significantly longer than all other areas (all $p < .05$) except for the steering-wheel (M = 17.03; p = .19). The latter was observed to a significantly greater extent than the passenger's side (M = 5.60) and the ceiling (M = 7.60; all $p < .05$). The passenger's side was explored significantly shorter than the instrument panel (M = 12.70), the steering-wheel, the centre-console, the gear area (M = 12.35) and the left area (M = 11.39; all $p < .05$) but did not differ significantly from the ceiling (p = .98). Viewing times of the instrument panel, the steering-wheel, the gear area and the left area did not differ significantly from each other (all $p > .05$).

Again, the influence of gender and car expertise on evaluation behavior was analyzed. As was the case with the Clio interior, it is hypothesized that men and women and car experts and laymen evaluate the Laguna interior differently and focus on different components and devices.

Effects of Gender. A two-way mixed ANOVA with *Area* as within-subjects factor and *Gender* as between-subjects factor found no significant main effect of Gender, $F(1, 15) = 2.00$, p = .18. The interaction effect between Area and Gender also did not reach significance, $F(6, 90) = 0.38$, p = .89. Only the main effect of Area reached significance, $F(6, 90) = 14.78$, $p < .001$, $\eta_P^2 = .50$. See illustrations above for the meaning of this effect.

Effects of Expertise. Two-way mixed design ANOVAs with *Area* as within subjects factor and either *Design expertise* or *Technical expertise* as between-subjects factor were conducted to investigate the influence of car expertise on viewing times in the defined interior areas. The main effect of Technical expertise reached significance, $F(1, 15) = 5.13$, $p < .05$, $\eta_P^2 = .26$. The main effect of Design expertise, $F(1, 15) = 1.70$, p = .21, as well as the interaction effects between Area and Technical expertise, $F(6, 90) = 1.88$, p = .09, and between Area and Design expertise, $F(6, 90) = 0.72$, p = .63, were not significant. The main effect of expertise indicates that, on average, technical laymen and experts spent different amounts of time examining the interior of the Laguna. On average, experts observed the interior significantly longer than laymen.

8.2.2 In-depth Analysis of defined Areas

The subregions of the superordinate areas of the Laguna interior are also expected to vary in the extent of examination they receive. As above, devices concerned with the task of driving, important switches and displays are expected to be observed longer than other components. Again, the effect of gender and car expertise is analyzed to test the hypotheses that gender and expertise influence the evaluation of the interior equipment.

Instrument panel. A one-way repeated measures ANOVA with *Area* (speed indicator, dashboard display, tachometer, fuel gauge, lining) as within-subjects factor revealed significant differences in viewing time across the subregions of this area, $F(4, 64) = 16.32$, $p < .001$, $\eta_P^2 = .51$. On average, about 6 % of total evaluation duration in the Laguna were spent looking at the dashboard display. Post-hoc comparisons (Sidak corrected) revealed that the dashboard display ($M = 6.23$) was explored significantly longer than the speed indicator ($M = 1.92$), the fuel gauge ($M = 0.87$) and the lining of the instrument panel ($M = 0.59$; all $p < .01$). The lining was inspected significantly shorter than all other subregions except for the fuel gauge ($p = .95$). The tachometer ($M = 3.09$) was examined not significantly differently long than the dashboard display ($p = .22$).

A two-way mixed ANOVA with *Area* as within-subjects factor and *Gender* as between-subjects factor was conducted to investigate differences in viewing times of the respective subregions between men and women. The main effect of Area was the only significant effect, $F(4, 60) = 15.09$, $p < .001$, $\eta_P^2 = .50$. Neither the main effect of Gender, $F(1, 15) = 0.32$, $p = .58$, nor the interaction effect between Area and Gender reached significance, $F(4, 60) = 0.60$, $p = 66$. A two-way mixed ANOVA with *Area* as within-subjects factor and *Design expertise* as between-subjects factor revealed no further significant effects. The main effect of Design expertise, $F(1, 15) = 0.91$, $p = .35$, and the interaction effect between Area and Design expertise, $F(4, 60) = 0.28$, $p = .89$, both did not reach significance. A two-way mixed ANOVA with *Technical expertise* as between-subjects factor also found a non-significant main effect of Technical expertise, $F(1, 15) = 3.61$, $p = .08$, and a non-significant interaction effect between Area and Technical expertise, $F(4, 60) = 1.67$, $p = .17$. These results indicate that neither gender nor car expertise seem to have an influence on how long the respective subregions of the instrument panel were examined.

Steering-wheel. Analysis of Variance of the Steering-wheel area (steering-wheel center, top, bottom, right and left side, right and left multifunction switch, car radio control, adjustment of steering-wheel) revealed a significant effect of Area indicating that the various subregions of this area differ significantly in terms of viewing time, $F(8, 128) = 8.38$, $p < .001$, $\eta_P^2 = .34$. The right multifunction switch ($M = 5.56$) was observed for about 5.5 % of the total evaluation duration. It was observed significantly longer than all other subregions (all $p < .05$) except for the left multifunction switch ($M = 3.97$) and the car radio control at the steering-wheel ($M = 1.86$; all $p > .05$). The steering-wheel adjustment ($M = 0.08$) was examined to a significantly lesser extent than the steering-wheel center ($M = 1.85$), the left multifunction switch, the right multifunction switch, and the right ($M = 1.08$) and left ($M = 1.21$) side of the steering-wheel (all $p < .05$). The steering-wheel center was explored significantly longer than the bottom area of the steering-wheel ($M = 0.49$, $p < .005$). No other pairwise comparisons reached significance (all $p > .05$).

Two-way mixed ANOVAs with *Area* as within-subjects factor and either *Gender*, *Design expertise* or *Technical expertise* as between-subjects factor revealed a non-significant main effect of Gender, $F(1, 15) = 0.20$, $p = .66$, a non-significant main effect of Design expertise, $F(1, 15) = 0.21$, $p = .65$, and a non-significant main effect of Technical expertise, $F(1, 15) = 0.13$, $p = .73$. The two-way interaction effects between Area and Gender, $F(8, 120) = 0.72$, $p = .67$, Area and Design expertise, $F(8, 120) = 0.85$, $p = .56$, Area and Technical expertise, $F(8, 120) = 0.60$, $p = .78$ too did not reach significance.

Centre-console. Analysis of Variance of the Centre-console area (display, central ventilation shafts, control of heating and air-conditioning, cupholder, keycard holder, start button, warninglights switch, car radio, lining) revealed significant differences in viewing time between the various subregions of this area, $F(8, 128) = 15.88$, $p < .001$, $\eta_P^2 = .50$. Post-hoc comparisons (Sidak corrected) revealed that the car radio (M = 6.88) and the control of heating and air-conditioning ($M = 6.30$) were not viewed significantly differently long ($p = 1.00$) but were both examined to a significantly greater extent than the warninglights switch ($M = 1.78$), the start button ($M = 0.56$), the keycard holder ($M = 0.98$), the cupholder ($M = 0.48$) and the lining of the centre-console ($M = 0.95$; all $p < .05$). The centre-console display ($M = 4.54$) and the central ventilation shafts ($M = 3.73$) were both inspected significantly longer than the start button, the keycard holder, the cupholder and the lining (all $p < .05$). The control of heating and air-conditioning, the car radio, the display and the ventilation shafts were all not explored significantly differently long (all $p > .05$). No other comparisons between pairs of subregions reached significance (all $p > .05$).

To find out whether men and women or car experts and laymen examined the various subregions of the centre-console differently, two-way mixed ANOVAs with *Area* as within-subjects factor and either *Gender*, *Design expertise* or *Technical expertise* as between-subjects factor were conducted. Neither of the main effects (Gender: $F(1, 15) = 0.09$, $p = .77$; Design expertise: $F(1, 15) = 0.93$, $p = 35$; Technical expertise: $F(1, 15) = 2.93$, $p = .11$) or interaction effects (Gender x Area: $F(8, 120) = 0.23$, $p = .99$; Design expertise x Area: $F(8, 120) = 0.47$, $p = .88$; Technical expertise x Area: $F(8, 120) = 1.14$, $p = .34$) were significant. This indicates that gender and car expertise did not influence extent of evaluation of the subregions of the centre-console.

Gear area. A one-way repeated measures ANOVA on the viewing time values in the Gear area (gearshift, handbrake switch, silver box, compartment behind gearshift, arm-rest) with *Area* as within-subjects factor revealed a significant effect of Area, $F(4, 64) = 5.55$, $p < .01$, $\eta_P^2 = .26$. Post-hoc comparisons using Sidak correction for multiple comparisons showed that viewing time of the compartment behind the gearshift ($M = 0.44$) differed significantly from those of the remaining subregions (all $p < .05$) except for the arm-rest ($M = 2.18$; $p = .16$). The compartment was examined to a significantly lesser extent than the other areas. Viewing time values of the gearshift ($M = 3.75$), the silver compartment ($M = 2.37$) the handbrake switch ($M = 3.62$) and the arm-rest ($M = 2.18$) were not significantly different (all $p > .05$).

A two-way mixed ANOVA with *Area* as within-subjects factor and *Gender* as between-subjects factor revealed no significant effect of Gender on viewing time values of the subregions of the gear area, $F(1, 15) = 2.31$, $p = .15$, and no significant interaction effect between Gender and Area, $F(4, 60) = 0.45$, $p = .70$. Additional two-way ANOVAs with either *Design expertise* or *Technical expertise* as between-subjects factor found no further significant effects. The main effects of Design expertise, $F(1, 15) = 1.20$, $p = .29$, and Technical expertise, $F(1, 15) = 2.25$, $p = .16$, and the interaction effects between Area and Design expertise, $F(4, 60) = 0.47$, $p = .76$, and between Area and Technical expertise, $F(4, 60) = 0.47$, $p = .76$, all did not reach significance.

Area left and driver's door. A one-way repeated measures ANOVA on the viewing times in this area revealed a significant effect of Area, $F(8, 128) = 8.79$, $p < .001$, $\eta_p^2 = .36$. On average, participants examined the power window switch ($M = 4.24$) for more than 4 % of total evaluation duration. Post-hoc comparisons (Sidak corrected) revealed that this device was observed significantly longer than the driver's door ($M = 1.33$), the left ventilation shaft ($M = 0.84$), the control of headlights ($M = 0.58$), the door-handle ($M = 0.58$), and the driver's seat-belt ($M = 0.25$; all $p < .001$). Comparison of viewing time values of the power window switch and the compartment in the driver's door ($M = 0.84$) just missed significance ($p = .056$). The other subregions did not differ in viewing times (all $p > .05$).

Two-way mixed ANOVAs with *Area* as within-subjects factor and either *Gender*, *Design expertise* or *Technical expertise* as between-subjects factor found no significant main effects of Gender, $F(1, 15) = 0.01$, $p = 9.1$, Design expertise, $F(1, 15) = 1.05$, $p = .32$, and Technical expertise, $F(1, 15) = 2.48$, $p = .14$. The two-way interactions between Area and Gender, $F(8, 120) = 0.59$, $p = .79$, Area and Design expertise, $F(8, 120) = 0.94$, $p = .49$, and Area and Technical expertise, $F(8, 120) = 1.28$, $p = .26$, also did not reach significance. These results suggest that extent of evaluation of the subregions of the left area was not influenced by participants' gender or expertise in cars.

Passenger's side. Analysis of Variance of the Passenger's side (glove compartment, passenger's seat and seat-belt, lining at passenger's side, passenger's door, right ventilation shaft, bottom area) showed that the subregions of this area vary significantly in terms of viewing time, $F(6, 96) = 6.53$, $p < .001$, $\eta_p^2 = .29$. Post-hoc comparisons using Sidak correction for multiple comparisons revealed no significant pairwise comparisons between the respective subregions (all $p > .1$). Thus, a less conservative correction – Least significant difference (LSD) – was applied. This analysis revealed that the passenger's seat ($M = 1.40$) and the glove compartment ($M = 1.89$) were inspected significantly longer than the other subregions (all $p < .05$). The other subregions, i.e. the passenger's door ($M = 0.67$), the right ventilation shaft ($M = 0.43$), the lining at the passenger's side ($M = 0.47$), the bottom area of the passenger's side ($M = 0.28$) and the passenger's seat-belt ($M = 0.46$), did not differ from each other in viewing time significantly (all $p > .05$).

A two-way mixed ANOVA with *Area* as within-subjects factor and *Gender* as between-subjects factor found no significant main effect of Gender, $F(1, 15) = 0.05$, $p = .83$, and no significant interaction effect between Area and Gender, $F(6, 90) = 0.65$, $p = .69$. Male and female's viewing time values of the respective subregions of this area did not vary to a significant extent. Two-way mixed ANOVAs with *Design expertise* and *Technical expertise* as between-subjects factor revealed non-significant main effects of Design expertise, $F(1, 15) = 0.12$, $p = .73$, and Technical expertise, $F(1, 15) =0.01$, $p = .91$, and non-significant interaction effects between Area and Design expertise, $F(6, 90) = 1.71$, $p = .13$, and Area and Technical expertise, $F(6, 90) = 0.74$, $p = 62$.

Ceiling. Analysis of Variance of viewing times of the Ceiling area (control of ceiling light, rearview mirror, driver's and passenger's sun visor, driver's and passenger's ceiling area) revealed that the subregions of this area differ significantly in viewing times, $F(5, 80) = 7.11$, $p < .001$, $\eta_P^2 = .31$. Post-hoc comparisons (Sidak corrected) revealed that the ceiling light ($M = 1.72$) and the driver's sun visor ($M = 2.02$) were both examined to a significantly greater extent than the passenger's sun visor ($M = 0.57$) and the driver's ($M = 0.17$) and passenger's ceiling area ($M = 0.22$; all $p < .05$). The rearview mirror ($M = 2.92$) did not differ significantly in viewing time from any of the other subregions (all $p > .05$).

Two-way mixed ANOVAs with *Area* as within-subjects factor and either *Gender*, *Design expertise* or *Technical expertise* as between-subjects factor revealed no further significant effects. Neither the main effects of Gender, $F(1, 15) = 0.22$, $p = .65$, Design expertise, $F(1, 15) = 0.34$, $p = .57$, and Technical expertise, $F(1, 15) = 0.36$, $p = .56$, nor the interaction effects between Gender and Area, $F(5, 75) = 0.15$, $p = .98$, Design expertise and Area, $F(5, 75) = 0.87$, $p = .50$, and Technical expertise and Area, $F(5, 75) = 0.81$, $p = .55$, reached significance.

8.2.3 Variation of Evaluation Behavior over Time

Eye movement data of the evaluation of the Laguna interior were also analyzed regarding the influence of time on the extent of examination of the various areas. As was the case with the Clio interior, it was expected that the defined superordinate areas of the Laguna interior are evaluated differently long at different times in the course of evaluation.

A two-way repeated measures ANOVA with *Area* (instrument panel, steering-wheel, centre-console, gearshift area, left area, passenger's side, ceiling area) and *Time* (five time segments) as within-subjects factors was conducted. The main effect of Area, $F(6, 96) = 16.88$, $p < .001$,

η_P^2= .51, was the only one to reach significance. Neither the main effect of Time, $F(4, 64)$ = 0.12, p = .98, nor the interaction effect between Area and Time, $F(24, 384)$ = 1.49, p = .07, were statistically significant. Other than expected, this suggests that the various superordinate areas were not evaluated significantly differently long in the different time segments. However, the interaction effect between area and time just missed statistical significance and looking at the mean relative shares of total viewing time of the respective areas and time segments in Table 8.6 above and Figure 12.5 in the Appendix indicates that there does seem to be a trend towards varying extent of evaluation of the respective areas over time.

Simple main effects comparing all areas within each time segment suggest that in the first, $F(6, 11)$ = 58.57, p < .001, η_P^2 = .97, and second time segment, $F(6, 11)$ = 4.62, p < .05, η_P^2 = .72, the various superordinate areas were examined to different extents. Pairwise comparisons (Sidak corrected) indicate that in the first time segment the instrument panel (M = 4.20), the steering wheel (M = 4.03) and the centre-console (M = 5.97) were examined to a significantly greater extent than the passenger's side and the ceiling area (all p < .01). The gear area (M = 1.74) was inspected significantly shorter than the centre-console (p = .04), longer than the ceiling (p = .02) and did not differ significantly from the remaining areas (all p > .05). In the second time segment, the centre-console (M = 4.97) was examined to a significantly greater extent than the ceiling area (M = 0.78; p < .05).

Analysis of mean time until first fixation in a given area of interest (see Table 8.5 above) revealed significant differences between the respective areas of the Laguna interior, $F(6, 96)$ = 14.63, p < .001, η_P^2 = .48. The instrument panel was fixated for the first time after only about half a second (M = 0.40), the steering-wheel after about a second (M = 1.15). Post-hoc comparisons – Sidak corrected – revealed that, on average, these two areas were fixated significantly sooner than the centre-console, the gear area, the passenger's side and the ceiling (all p < .05). The centre-console (M = 6.94) received the first fixation significantly sooner than the passenger's side (M = 46.53) and the ceiling (M = 67.20), the gear area (M = 24.73) sooner than the ceiling area (all p < .05).

To find out whether the respective subregions and components of the defined superordinate areas are evaluated differently long across the five time segments and to detect those devices that are inspected first and last respectively, evaluation behavior over time of the subregions of the superordinate areas was analyzed. For the sake of clarity, again, only significant effects will be provided.

Instrument panel. A two-way repeated measures ANOVA with *Area* (tachometer, speed indicator, dashboard display, fuel gauge, lining) and *Time* as within-subjects factors revealed a significant main effect of Area, $F(4, 64) = 16.32$, $p < .001$, $\eta_P^2 = .51$, a significant main effect of Time, $F(4, 64) = 2.97$, $p < .05$, $\eta_P^2 = .16$, and a significant interaction effect between Time and Area, $F(16, 256) = 1.73$, $p < .05$, $\eta_P^2 = .10$. The main effect of Area has already been explained above (see section 8.2.2). The main effect of Time indicates that the instrument panel was examined differently long in the five time segments. Post-hoc comparisons using LSD correction for multiple comparisons revealed that in the first time segment the subregions of this area were on average inspected significantly longer than in the second, $F(1, 16) = 8.28$, $p < .05$, $\eta_P^2 = .34$, and third time segment, $F(1, 16) = 9.67$, $p < .01$, $\eta_P^2 = .38$. No other differences between time segments were significant (all $p > .05$). Simple main effects comparing the subregions within each time segment revealed significant differences (Sidak corrected) in viewing time values between the subregions in the first time segment (see Figure 8.14). The dashboard display ($M = 2.05$) was examined significantly longer than the speed indicator ($M = 0.69$), the fuel gauge ($M = 0.38$) and the lining of the instrument panel ($M = 0.09$, all $p < .05$). The tachometer ($M = 1.00$) was also examined to a significantly greater extent than the fuel gauge and the lining (all $p < .05$). The instrument panel's lining was watched significantly shorter than all other areas (all $p < .01$) except for the fuel gauge ($p = .11$). In the second and fourth time segment the only significant differences in viewing time values were found when comparing the dashboard display ($M = 0.94$) and the fuel gauge ($M = 0.05$) and the dashboard display ($M = 1.54$) and the lining ($M = 0.19$, all $p < .05$) respectively. These results indicate that the most prominent components of this area – the dashboard display and the tachometer – were not only examined longest but also sooner than the remaining components of the instrument panel.

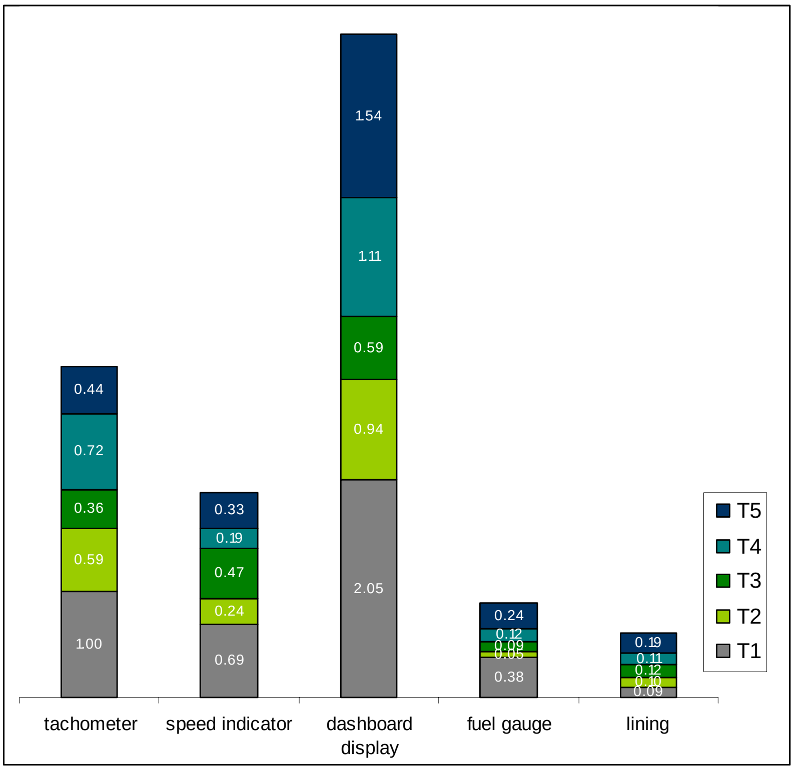


Figure 8.14 Bar graph displaying mean relative shares of total evaluation duration in the five time segments for the subregions of the instrument panel.

Gear area. A two-way repeated measures ANOVA with *Area* (gearshift, silver box, handbrake switch, compartment behind gearshift, arm-rest) and *Time* as within-subjects factors revealed a significant interaction effect between Area and Time, $F(16, 256) = 2.07$, $p < .01$, $\eta_P^2 = .12$, and a significant main effect of Area, $F(4, 64) = 5.55$, $p < .001$, $\eta_P^2 = .26$. The main effect of Time did not reach significance, $F(4, 64) = 1.95$, $p = .11$. To break down the interaction effect, simple main effects analyses were conducted to compare the subregions of the gear area within each time segment (see Figure 8.15). Pairwise comparisons using a Sidak correction to control familywise error found no significant differences between areas. Thus, the analysis was repeated using a LSD correction. This revealed that in the first time segment the gearshift ($M = 1.12$) was examined to a significantly greater extent than the other subregions (all $p < .05$). The remaining regions did not differ in viewing time significantly (all $p > .05$). In the second time segment the gearshift ($M = 1.61$), the handbrake switch ($M = 1.15$) and the silver box ($M = 0.95$) were inspected significantly longer than the compartment behind the gearshift ($M = 0.04$) and the arm-rest ($M = 0.08$, all $p < .05$). In the last three time segments the respective subregions of the gear area were not evaluated significantly differently long (all $p > .05$). These results indicate that those subregions of the gear area that were all in all inspected longest by the participants were also evaluated longer at the onset of the evaluation than the remaining parts. However, these differences have to be handled with care as no control of the familywise error rate was conducted and there thus may be the danger of type I errors.

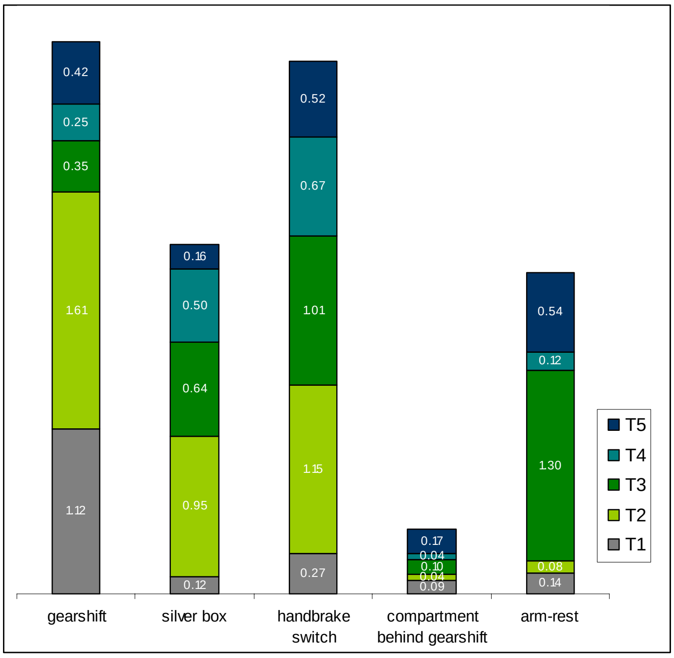


Figure 8.15 Bar graph displaying mean relative shares of total evaluation duration in the five time segments for the subregions of the gearshift area

Passenger's side. A two-way repeated measures ANOVA with *Area* and *Time* as within-subjects factors revealed a significant main effect of Time, $F(4, 64) = 2.53$, $p < .05$, $\eta_P^2 = .14$. Post-hoc comparisons using Sidak correction for multiple comparisons revealed that in the first time segment ($M = 0.04$) the respective subregions of this area were examined to a significantly lesser extent than in the fifth time segment ($M = 0.29$; $p = .03$). The other subregions did not differ significantly (all $p > .05$). These results indicate that the passenger's side was on average mainly examined later on in the course of evaluation.

Ceiling. A two-way repeated measures ANOVA with *Area* and *Time* as within-subjects factors revealed a significant main effect of Time for the viewing time values of the Ceiling area, $F(4, 64) = 2.95$, $p < .05$, $\eta_P^2 = 16$. Post-hoc comparisons (corrected with LSD) revealed that viewing time values of the first time segment differed significantly from those of the third and fourth time segment (all $p < .05$). In the first time segment ($M = 0.04$) the respective subregions of this area were inspected to a significantly lesser extent than in the third ($M = 0.51$) and fourth ($M = 0.39$) time segment. This indicates that the ceiling area was mainly evaluated in the middle phases of the evaluation and little at the beginning.

8.2.4 Summary and Visualization of Results

Figure 8.16 illustrates the most prominent areas of the Laguna interior, Figures 8.18 to 8.23 provide details on the importance of the respective components of the superordinate areas. Just like in the Clio, in the Laguna the areas of greatest interest were the centre-console, the steering-wheel, the instrument panel and the driver's door area. Ceiling area and passenger's side were again examined least. As can be seen from Figure 8.16 also in the Laguna the instrument panel, the steering-wheel and the centre-console were on average inspected significantly longer than the other areas at the onset of evaluation whereas a rather irrelevant region, the passenger's side, was evaluated mainly against the end of evaluation. Figure 8.17 also illustrates that the most relevant areas of interest were first fixated sooner than the less important areas.

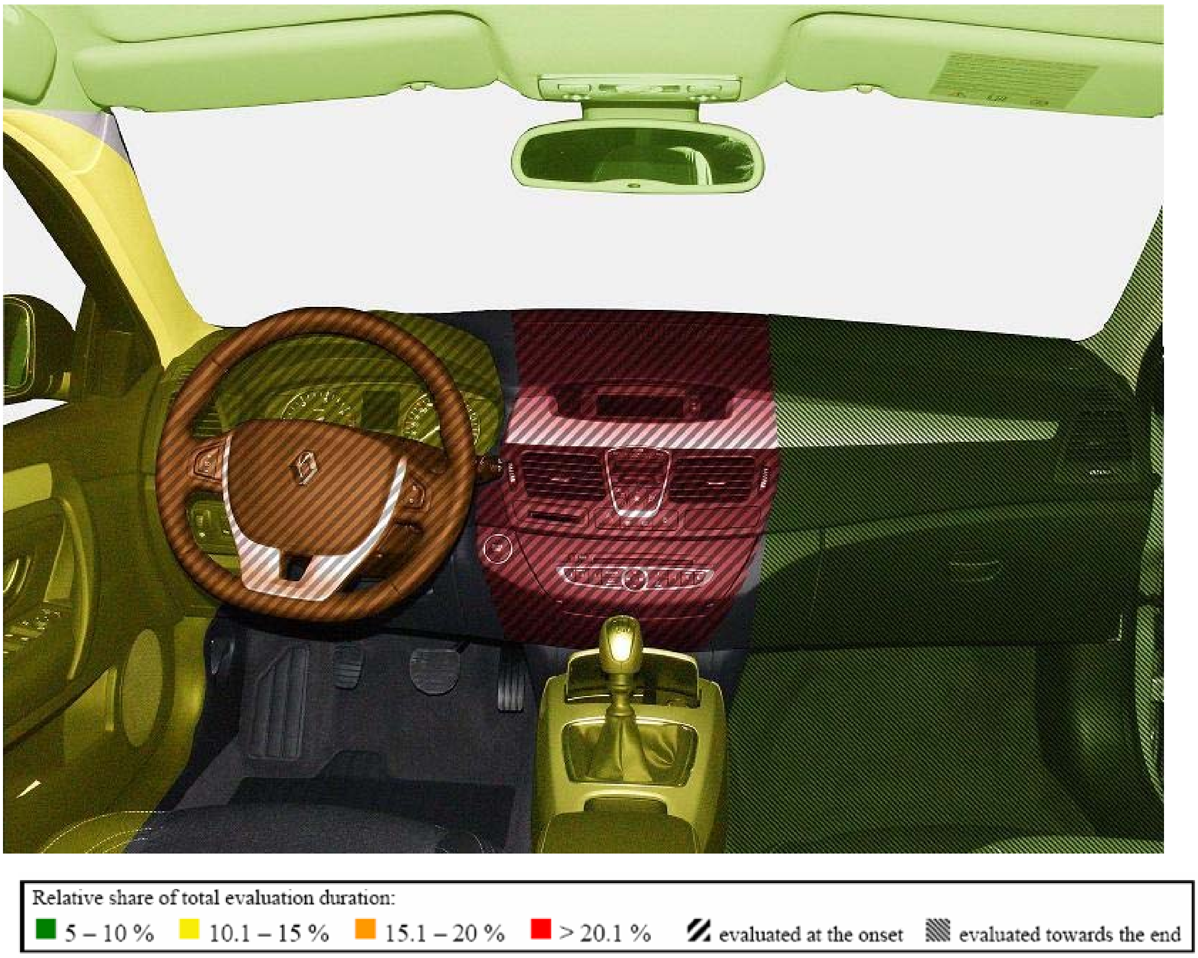


Figure 8.16 Map illustrating the relevance of the interior areas of the Laguna.

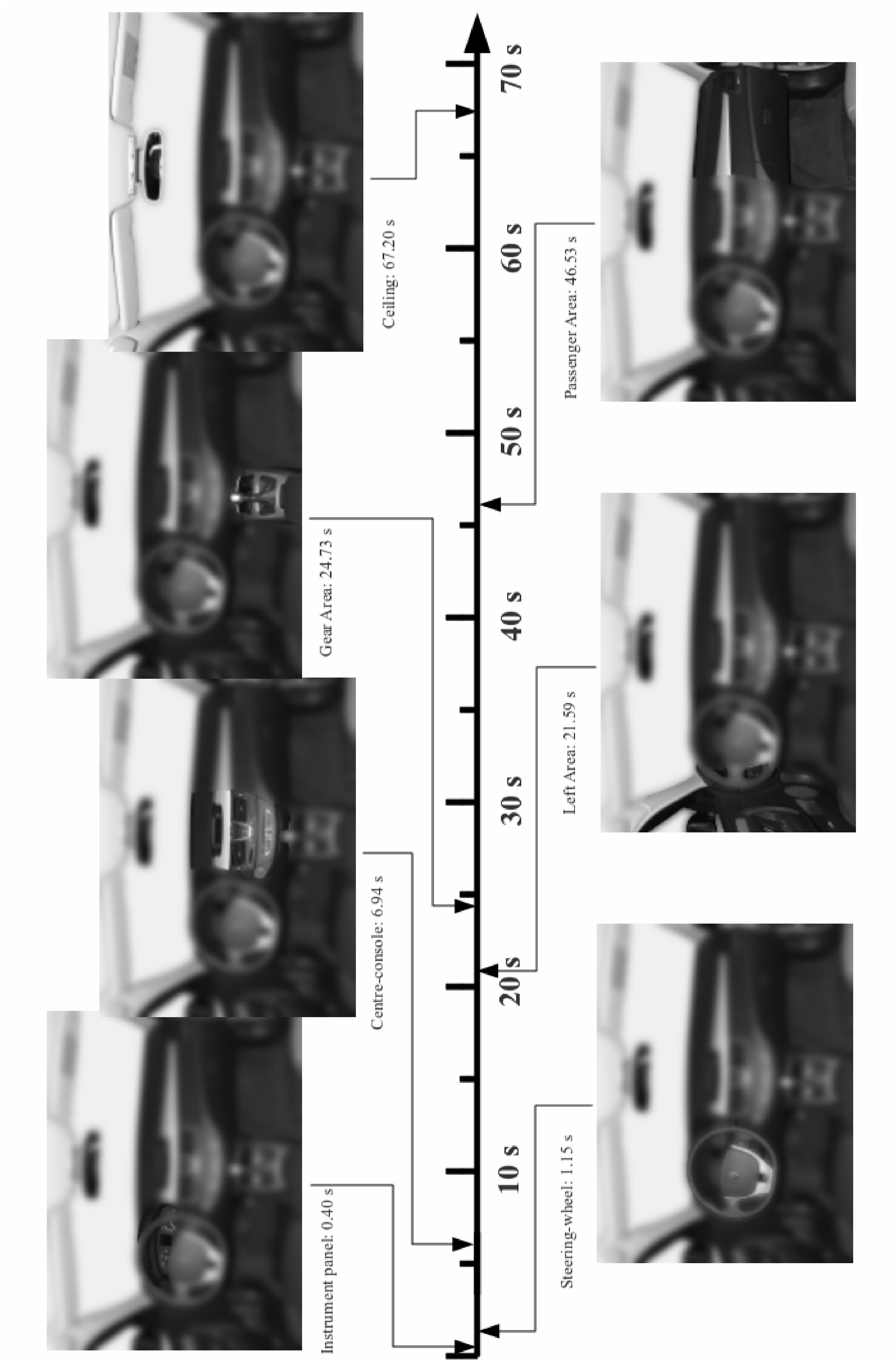


Figure 8.17 Time line illustrating average amount of seconds until first fixation in the defined areas of interest of the Laguna interior. Copyright of picture Renault, adaptations by the author.

The gearshift area seems to be of greater importance for the participants in the Laguna interior than in the Clio. This might be due to the bigger size of this area in the Laguna. Furthermore, the Laguna does not feature a handbrake lever but instead of that a handbrake switch. This is not yet standard in automobile interiors and thus might have surprised participants and entail more extensive examination of this area.

Figure 8.18 maps the relevance of the instruments of the dashboard. On average, participants viewed the dashboard display and the tachometer longest. Again, these most prominent instruments were also examined longest right at the onset of evaluation. The most prominent components of the steering-wheel area seem to be the multifunction switches left- and right-hand. The control of the car radio again seems to be of minor relevance (see Figure 8.20).

Figure 8.18 Map illustrating the relevance of the components of the instrument panel of the Laguna interior.

Figure 8.19 Map illustrating the relevance of the components of the instrument panel, the steering-wheel and parts of the left side of the Laguna interior.

Figure 8.20 Map illustrating the relevance of the components of the gearshift area and the steering-wheel of the Laguna interior.

Figure 8.21 Map illustrating the relevance of the components of the centre-console and the gearshift area of the Laguna interior.

As indicated by Figure 8.21, the areas of greatest interest of the centre-console seem to be the car radio, the control of ventilation and air-conditioning as well as the central display. In the gearshift area, participants paid most attention to the gearshift and the handbrake switch.

Looking at Figure 8.22 and 8.19 indicates that the power window switch was the most prominent component of the driver's door area. The other components and the door itself were examined to a lesser extent. The passenger's side and the ceiling area of the Laguna interior were both paid least attention to by the participants. Figure 8.22 depicts that all single components of the passenger's side were examined sparsely. In the ceiling area the most relevant component seems to be the rear-view mirror (see Figure 8.23). The ceiling was to a significant extent examined longer in the middle phases of the evaluation than at the onset and end.

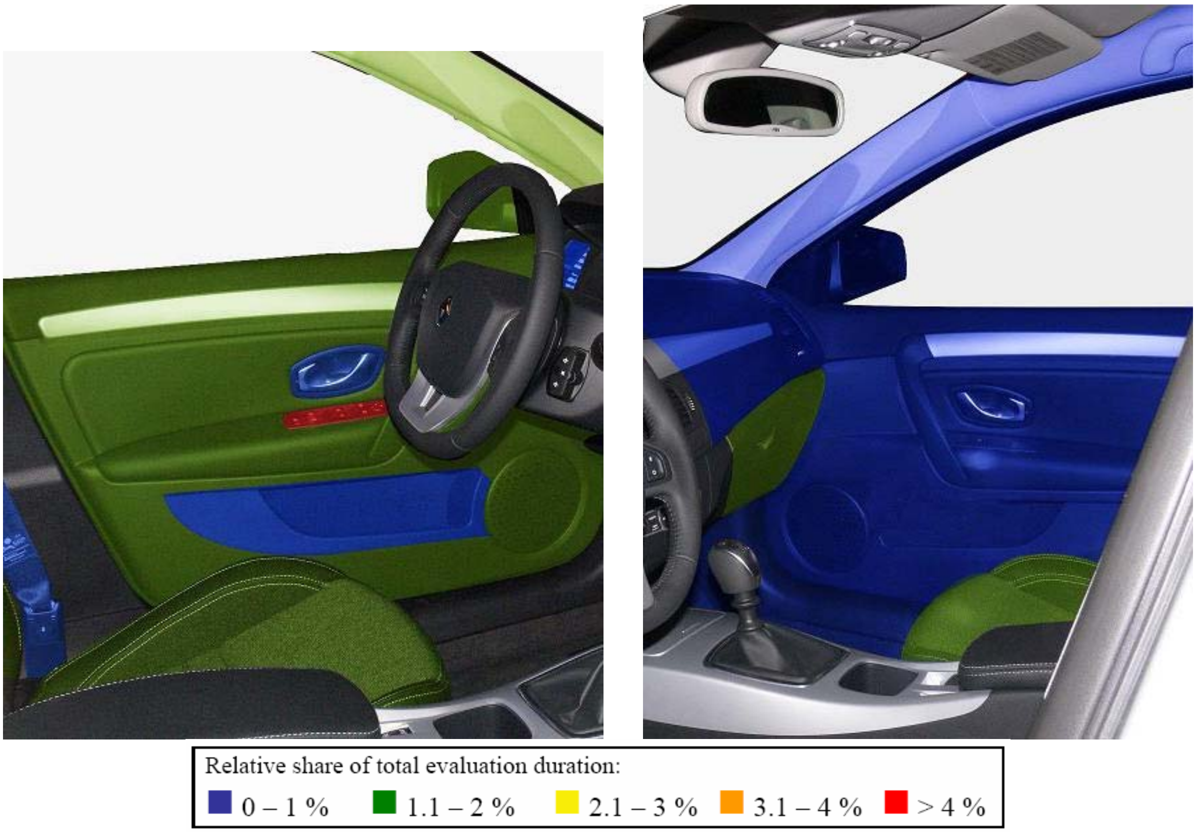


Figure 8.22 Map illustrating the relevance of the components of the driver's door area and the passenger's side of the Laguna interior.

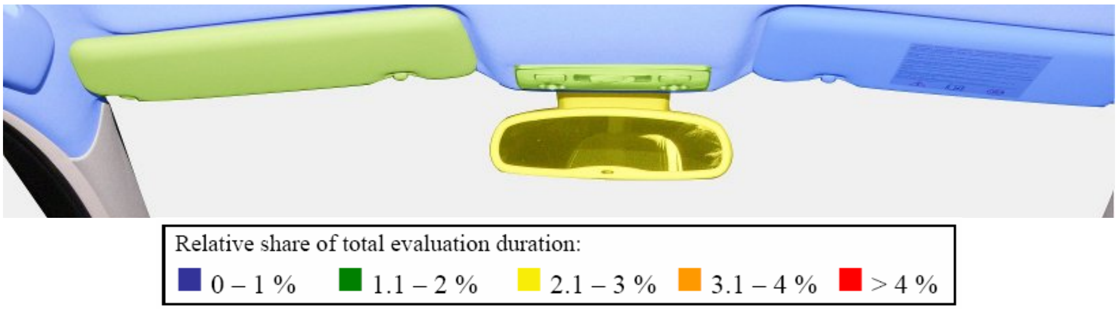


Figure 8.23 Map illustrating the relevance of the components of the ceiling of the Laguna interior.

The findings of the eye movement data of evaluation of the Laguna interior strongly resemble those of evaluation of the Clio interior. Also in the Laguna equipment the areas of greatest relevance to the participants seem to be on the one hand components that are connected with the task of driving or provide feedback about the handling performance and on the other hand devices that are related to driving comfort and entertainment. Storage facilities seem to be of medium relevance in both vehicles. In contrast to the Clio, in the Laguna interior, the display at the centre-console was one of the most extensively inspected components of the interior equipment. Whereas the display was out of action by default in the Clio interior, it was on in the Laguna. These differences in the activity of the device might account for the varying relevance of this component. However, this finding might also be due to design differences and thus reflect a dislike of the design of the central display in the Clio interior.

Considering the diverse design of the two vehicle interiors, the overall similarity of the areas of interest in both vehicles is compelling and provides an indication for consistency of the relevance of the respective components across different vehicle interiors.

8.3 Comparison of Areas of Interest of Clio and Laguna

The two stimulus cars used in this study are representatives of different vehicle classes. The Clio is a compact car whereas the Laguna is a medium-sized car. As the two vehicles differ in equipment and grade of quality of the interior design, it was expected that the various superordinate areas of the interior are evaluated to different extents across the two stimulus cars. However, the results so far argue for a similarity of the relevance of the various areas of interest in both vehicles. To find out whether extent of evaluation of the respective areas differs for the two stimulus cars a two-way repeated measures ANOVA with *Car* (Clio, Laguna) and *Area* (instrument panel, steering-wheel, centre-console, gear area, left area, passenger's side, ceiling) as within-subjects factors was conducted using the subset of those participants that provided analyzable evaluation videos of both vehicles (means are given in Table 8.7). The analysis revealed significant main effects of Car, $F(1, 15) = 11.65$, $p < .01$, $\eta_P^2 = .44$, and Area, $F(6, 90) = 17.70$, $p < .001$, $\eta_P^2 = .54$, as well as a significant interaction effect between Car and Area, $F(6, 90) = 2.57$, $p < .05$, $\eta_P^2 = .15$. As expected, this interaction effect indicates that the various areas of the interior were evaluated differently long within the cars of different vehicle classes. Simple main effects comparing viewing time values of both cars within each area were conducted. Multivariate tests revealed significant effects of vehicle for the gear area, $F(1, 15) = 8.20$, $p < .05$, $\eta_P^2 = .35$, and the passenger's side, $F(1, 15) = 6.90$, $p < .05$, $\eta_P^2 = .32$. Pairwise comparisons (Sidak corrected) indicate that the gear area was examined significantly longer in the Laguna ($M = 12.30$) than in the Clio ($M = 7.69$). The opposite was the case for the passenger's side: in the Clio ($M = 7.73$) the passenger's side was explored to a significantly greater extent than in the Laguna ($M = 5.27$).

Table 8.7 Averaged relative share of total evaluation duration of the defined superordinate areas with standard deviations (*SD*)

	Clio		Laguna	
	M	*SD*	*M*	*SD*
Instrument panel	13.73	6.25	12.75	4.77
Steering-wheel	15.94	7.24	17.40	6.78
Centre-console	21.44	8.40	25.64	10.94
Gearshift area	7.69	2.44	12.30	5.96
Left and driver's door area	12.58	4.17	11.40	4.90
Passenger's side	7.73	4.67	5.27	3.86
Ceiling	7.31	5.19	7.86	4.89

Note. Means are based on data of those 16 participants of who evaluation data of both vehicles were obtained.

The significant main effect of car suggests that the overall evaluation duration was different for the two stimulus cars. As is already known from former analyses, the Laguna interior was evaluated significantly longer than the Clio interior.

8.4 Regression Analyses

Analyses of Variance found no influence of car expertise on evaluation behavior. To further analyze the hypothesized relationship between extent of examination of the various areas of the interior equipment and car expertise, regression analyses were conducted. Stepwise multiple regressions with scores of Design and Technical expertise as dependent variable revealed that viewing time values of none of the defined areas in the Clio interior were found to be significant predictors of neither Design nor Technical expertise (Table 8.8). In the Laguna interior too, distribution of visual attention to the various interior areas could not predict Design expertise of cars. The only significant predictor of Technical expertise was found to be viewing time values of the instrument panel (Table 8.9). The negative *b*-value indicates that a rise in technical expertise score is related to a decline in viewing time values of the instrument panel.

Table 8.8 Correlation of relative share of total evaluation duration for defined areas with technical and design expertise

	Technical Expertise		Design Expertise	
Area	*N*	Pearson's *r*	*N*	Pearson's *r*
		Clio		
Instrument panel	18	.16	18	.11
Steering-wheel	18	-.12	18	-.28
Centre-console	18	-.29	18	.01
Gear area	18	-.04	18	.03
Left area	18	.38	18	-.18
Passenger's side	18	.36	18	.36
Ceiling	18	.27	18	.33
		Laguna		
Instrument panel	17	-.54*	17	-.22
Steering-wheel	17	.02	17	-.09
Centre-console	17	.24	17	.12
Gear area	17	.50*	17	.18
Left area	17	-.23	17	-.21
Passenger's side	17	-.10	17	.20
Ceiling	17	.06	17	.10

Note. $*p < .05$.

Table 8.9 Summary of stepwise Regression analysis of variables predicting technical expertise

Included Variables	*B*	*SE B*	*β*
Constant	9.85	1.73	
Instrument panel	-0.32	0.13	-.54*

Note. $R^2 = .29$ ($p < .05$). $*p < .05$.

The influence of individual differences on distribution of visual attention to the various interior areas was also investigated using stepwise regression analyses. In the Clio interior participant's age was a significant predictor of extent of examination of the left and driver's door area and the ceiling (Table 8.11 and 8.12). The older the participants were the shorter they seem to have inspected both the left area and the ceiling of the Clio interior.

Table 8.10 Correlation of demographic variables and car expertise with relative share of total evaluation duration of areas of the Clio interior

	Left area		Ceiling	
Variables	*N*	Pearson's *r*	*N*	Pearson's *r*
Age	18	-.55*	18	-.51*
Gender	18	.12	18	-.16
Design Expertise	18	-.18	18	.33
Technical Expertise	18	.38	18	.27

Table 8.11 Summary of stepwise Regression analysis for variables predicting extent of evaluation of the left area in the Clio interior

Included Variables	*B*	*SE B*	*β*
Constant	18.22	2.31	
Age	-0.14	0.05	-.55*

Note. $R^2 = .31$ ($p < .05$). *$p < .05$.

Table 8.12 Summary of stepwise Regression analysis for variables predicting extent of evaluation of the ceiling in the Clio interior

Included Variables	*B*	*SE B*	*β*
Constant	13.86	2.96	
Age	-0.16	0.07	-.51*

Note. $R^2 = .26$ ($p < .05$). *$p < .05$.

The only significant predictor of extent of evaluation of defined areas in the Laguna interior is technical expertise. Stepwise regression analyses revealed that technical expertise had a significant influence on extent of examination in the instrument panel and in the gear area (Table 8.14 and 8.15). In none of the other areas neither of the predictors reached significance. With rising technical expertise participants examined the instrument panel shorter but the gearshift area longer.

Table 8.13 Correlation of demographic variables and car expertise with relative share of total evaluation duration of areas of the Laguna interior

	Instrument panel		Gearshift area	
Variables	*N*	Pearson's *r*	*N*	Pearson's *r*
Age	17	.35	17	-.43*
Gender	17	.14	17	-.37
Design Expertise	17	-.22	17	.18
Technical Expertise	17	-.54*	17	.50*

Note. * $p <$:05.

Table 8.14 Summary of stepwise Regression analysis for variables predicting extent of evaluation of the instrument panel in the Laguna interior

Included Variables	*B*	*SE B*	*β*
Constant	17.99	2.36	
Technical Expertise	-0.91	0.37	-.54*

Note. $R^2 = .29$ ($p < .05$). *$p < .05$.

Table 8.15 Summary of stepwise Regression analysis for variables predicting extent of evaluation of the gear-shift area in the Laguna interior

Included Variables	*B*	*SE B*	*β*
Constant	6.15	3.02	
Technical Expertise	1.07	0.47	.50*

Note. $R^2 = .25$ ($p < .05$). *$p < .05$.

8.5 Driving Scenario

Apart from investigating evaluation behavior of the interior equipment in the context of a buying situation, another aim of this study was to assess extent of examination of interior parts during a simulated driving task.

At first, eye movement data of the simulated driving tasks were analyzed separately for both stimulus cars. Analysis of Variance of the Clio data with *Area* (road, instrument panel, steering-wheel, mirrors, centre-console, passengers' side) as within-subjects factor and *Scenario* (city, highway) as between-subjects factor revealed a highly significant main effect of Area, $F(5, 75) = 1{,}087.88$, $p < .001$, $\eta_P^2 = .99$, a just significant interaction effect between Area and Scenario, $F(5, 75) = 2.38$, $p = .047$, $\eta_P^2 = .14$, and a non-significant main effect of Scenario, $F(1, 15) = 2.02$, $p = .18$. The main effect of area indicates that, averaged over both driving scenarios, the respective areas were explored differently long. On average, when sitting in the Clio while watching the driving video, participants watched the road – i.e. the video – for more than 90 % of total viewing time. Post-hoc comparisons using Sidak correction for multiple comparisons indicate that the road ($M = 90.36$) was fixated significantly longer than the areas of the vehicle interior (all $p < .001$). The instrument panel ($M = 1.70$) was inspected significantly longer than the centre-console (M = 0.35) and the passenger's side ($M = 0.03$; all $p < .05$) but not significantly differently long than the steering-wheel ($M = 0.49$) and the mirrors ($M = 2.12$; all $p > .05$). The mirrors were also examined to a greater extent than the passenger's side ($p < .05$). Univariate tests, comparing viewing time values when watching the city or the highway video within each area revealed no significant simple main effects of driving scenario (all $p > .1$).

A two-way mixed ANOVA on the eye movement data of the Laguna interior with *Area* (road, instrument panel, steering-wheel, mirrors, centre-console, passenger's side) as within-subjects factor and *Scenario* (city, highway) as between-subjects factor only found a significant main effect of Area, $F(5, 90) = 3{,}129.32$, $p < .001$, $\eta_P^2 = .99$. Neither the main effect of Scenario, $F(1, 18) = 0.13$, $p = .72$, nor the interaction effect between Area and Scenario, $F(5, 90) = 1.84$, $p = .11$, reached significance. The results indicate that, regardless of which driving scenario was watched, the road ($M = 92.79$) was examined significantly longer than all of the areas of the interior equipment (all $p < .001$). Pairwise comparisons (Sidak corrected) further indicate that, averaged over both scenarios, the instrument panel ($M = 2.65$) was inspected significantly longer than the steering-wheel ($M = 0.20$) and the passenger's side ($M = 0.06$, all $p < .01$). The passenger's side was also examined to a significantly lesser extent than the mirrors ($M = 2.00$). No other pairwise comparisons between areas were significant (all $p > .05$).

When comparing eye movement data of the two driving scenarios, ignoring the vehicle the participants were sitting in while viewing the simulated driving task, Analysis of Variance revealed a highly significant main effect of Area, $F(5, 175) = 3{,}596.14$, $p < .001$, $\eta_P^2 = .99$, a significant interaction effect between Area and Scenario, $F(5, 175) = 4.03$, $p < .01$, $\eta_P^2 = .10$, and a non-significant main effect of Scenario, $F(1, 35) = 1.96$, $p < .17$. To analyze the effect of driving scenario on viewing time values in the respective areas, simple main effects were conducted. Univariate tests indicate that when watching the video of the ride in the city, participants watched the road and the traffic ($M = 94.53$) significantly longer than when watching the video of the car ride on the highway ($M = 88.86$), $F(1, 35) = 4.31$, $p < .05$, $\eta_P^2 = .11$. Extent of evaluation of the vehicle interior areas was not significantly affected by type of video during the driving task, $F_{\text{Instr.Panel}}(1, 35) = 0.57$, $p = .45$, $F_{\text{Steering-w.}}(1, 35) = 3.99$, $p = .054$, $F_{\text{Centre-cons.}}(1, 35) = 0.56$, $p = .46$, $F_{\text{Mirrors}}(1, 35) = 0.62$, $p = .44$, $F_{\text{Passenger}}(1, 35) = 1.23$, $p = .27$. These results suggest that the interior equipment was not examined significantly differently when watching either the city or the highway car journey.

The following analyses are concerned with finding out which specific components and instruments of the defined areas of the vehicle interiors were examined to what extent. Thereto, the various areas were analyzed separately. On the basis of the above presented results, indicating that type of driving scenario had no significant effect on viewing time values of the vehicle interior equipment, in the continuative analyses no distinction between driving scenarios will be made.

A two-way mixed ANOVA on the viewing time values of the Instrument panel area with *Area* (dashboard display, tachometer, speed indicator, lining) as within-subjects factor and *Vehicle* (Clio, Laguna) as between-subjects factor revealed a significant main-effect of Area, $F(3, 105) = 4.85$, $p < .005$; $\eta_P^2 = .12$. The main effect of Vehicle, $F(1, 35) = 1.88$, $p = .18$, and the interaction effect between Area and Vehicle did not reach significance, $F(3, 105) = 1.66$, $p = .18$. The latter indicates that the various subregions of the instrument panel were not observed differently long in the two stimulus cars. Post-hoc comparisons using Sidak correction for multiple comparisons revealed that, averaged over both stimulus cars, the dashboard display ($M = 0.97$) was inspected to a significantly greater extent than the tachometer ($M = 0.35$) and the lining ($M = 0.18$; all $p < .05$). The speed indicator ($M = 0.71$) did not differ in viewing time from any of the other subregions (all $p > .05$).

The interaction effect between area and vehicle was not statistically significant. The interaction plot (see Figure 12.6 in the Appendix) indicates that the respective subregions were of differing importance in the two stimulus cars, though. To test the effect of area within each stimulus car, simple main effects were conducted. Multivariate tests uncovered that viewing time values of the subregions of the instrument panel did only differ significantly in the Laguna interior, $F(3, 33) = 8.49$, $p < .001$, $\eta_P^2 = .44$. In the Clio interior, in contrast, the respective subregions were not inspected significantly differently long, $F(3, 33) = 1.52$, $p = .23$. Pairwise comparisons (Sidak corrected) revealed that only in the Laguna interior, the dashboard display ($M = 1.40$) was examined to a significantly greater extent than both the tachometer ($M = 0.32$) and the lining of the instrument panel ($M = 0.25$; all $p < .05$). The dashboard display and the speed indicator ($M = 0.75$) did not differ significantly in viewing time ($p = .62$). For the Clio interior none of the pairwise comparisons reached significance ($M_{dashdisplay} = 0.53$; $M_{speedindicator} = 0.66$, $M_{tachometer} = 0.39$, $M_{lining} = 0.10$; all $p > .05$).

Analysis of the Mirrors (rear-view mirror, left and right side mirror) only found a significant main effect of Area, $F(2, 70) = 7.96$, $p < .01$, $\eta_P^2 = .19$. Post-hoc comparisons (Sidak corrected) revealed that during the simulated driving task both the left side mirror ($M = 1.02$) and the rear-view mirror (M = 0.93) were inspected significantly longer than the right side mirror (M = 0.14; all $p < .005$). The left side mirror and the rear-view mirror were not explored differently long (p = .98). The interaction effect between Area and Vehicle, $F(2, 70) = 0.66$, p = 52, and the main effect of Vehicle, $F(1, 35) = 0.02$, p = 90, did not reach significance.

The subregions of the Steering-wheel (steering-wheel top, left and right side, left and right multifunction switch) also were explored significantly differently long during the driving tasks, $F(4, 140) = 3.30$, $p < .05$; $\eta_P^2 = .09$. The main effect of Vehicle, $F(1, 35) = 1.86$, p = 18, and the interaction effect between Area and Vehicle, $F(4, 140) = 1.32$, p = .27, were non-significant. To find out which regions of the steering-wheel were examined longer when driving, post-hoc comparisons were conducted. However, pairwise comparisons using Sidak correction for multiple comparisons revealed no significant differences between pairs of areas. Thus, a less conservative correction – Least Significant Difference – was applied. This analysis uncovered significant differences between viewing time values of the steering-wheel top and the left and right side of the steering-wheel (all $p < .5$). The top area of the steering-wheel (M = 0.20) was inspected significantly longer than the left (M = 0.01) and the right (M = 0.04) side. No other pairwise comparisons reached significance ($M_{\text{right multifunction switch}} = 0.05$, $M_{\text{left multifunction switch}} = 0.06$; all $p > .05$).

Analysis of the Centre-console area (centre-console display, control of ventilation and air-conditioning, car radio, central ventilation shafts) revealed a significant main effect of Area, $F(3, 105) = 8.97$, $p < .001$, $\eta_P^2 = .20$, a significant interaction effect between Area and Vehicle, $F(3, 105) = 7.48$, $p < .001$, $\eta_P^2 = .18$, and a non-significant main effect of Vehicle, $F(1, 35) = 2.59$, $p = .12$, Univariate tests comparing viewing time values of the two stimulus cars for each of the subregions revealed significant differences for the centre-console display, $F(1, 35) = 6.69$, $p < .05$, $\eta_P^2 = .16$. In the Clio, the display was examined for only about 0.1 % of total viewing time of the driving simulation videos, whereas in the Laguna the display was observed more than 1 % of total viewing time. Simple main effects analyses comparing viewing time values of each area within each stimulus car were also conducted. Multivariate tests and pairwise comparisons (Sidak corrected) uncovered that when sitting in the Clio during the simulated driving tasks, the respective subregions of the centre-console ($M_{\text{display}} = 0.15$, $M_{\text{vent.schaft}} = 0.12$, $M_{\text{radio}} = 0.02$, $M_{\text{acc-control}} = 0.18$) were not examined significantly differently long, $F(3, 33) = 2.67$, $p = .06$. In the Laguna, in contrast, the centre-console subregions were inspected to different extents, $F(3, 33) = 6.09$, $p < .005$, $\eta_P^2 = .36$. Pairwise comparisons (Sidak corrected) revealed that, when sitting in the Laguna, the centre-console display (*M* = 1.11) was observed significantly longer than the remaining regions of the centre-console ($M_{\text{vent.shaft}}$ = 0.002, M_{radio} = 0.01, $M_{\text{aac-control}}$ = 0.09; all $p > .005$).

Analysis of Variance of viewing time values of the Passenger's side with *Area* (passenger's door, lining at passenger's side) as within-subjects factor and *Vehicle* as between-subjects factors revealed no significant effects. Neither the main effects of Area, $F(1, 35) = 0.04$, $p = .84$, and Vehicle, $F(1, 35) = 0.26$, $p = .62$, nor the interaction effect between Area and Vehicle, $F(1, 35) = 0.04$, $p = .84$, reached significance. This indicates that the passenger's door (M = 0.03) and the lining (M = 0.03) were observed equally little during the driving tasks.

Figures 8.24 and 8.25 below illustrate the components of the vehicle interiors that participants attended to during the driving tasks. When sitting in the Clio during the simulation of the car ride, the interior parts that participants paid most attention to were the rear-view mirror, the left side mirror and the instruments of the dashboard. As indicated by Figure 8.24 the devices of the centre-console have also been inspected while watching the driving video. However, they seem to have been of minor importance as the centre-console was examined to a significantly lesser extent than the instrument panel during the driving tasks.

Figure 8.24 Map illustrating the relevance of the components of the Clio interior during driving tasks.

Figure 8.25 Map illustrating the relevance of the components of the Laguna interior during driving tasks.

In the Laguna, the areas inspected longest during the simulated car ride were the rear-view and left side mirror, the instrument panel and the central display. The dashboard display was inspected to a significantly greater extent than the other instruments of the dashboard. Interestingly, and in contrast to results of eye movement data of the Clio interior, participants attended to the display of the centre-console frequently when sitting in the Laguna during the driving tasks. The above outlined differences in the acitivity of the displays in the two vehicles are supposed to account for this finding.

Overall, results of analyses of eye movement data during the simulated driving task are little surprising and provide evidence for the proposed assumptions that components providing feedback about the state of the vehicle (dashboard instruments) and crucial for driving (mirrors) were paid most attention to. In accordance with prior research (e.g., Lansdown, 1997), the central display was also found to attract attention during the car ride simulation, though only in the Laguna interior and not in the Clio interior.

9 General Discussion

This thesis presented an exploratory study aimed at detecting relevance fields in car interiors. The study investigated the relevance of the various parts of the interior equipment of two stimulus cars when the participants evaluated the cars with the eyes of a potential customer. In a second scenario, the importance of the interior components in the context of a simulated driving task was examined. Recording of participants' eye movements allowed detection of evaluation time of the various components that is regarded as an indication of an area's importance. In the context of a purchase situation, in both vehicles the most relevant areas of the interior were on the one hand those associated with the task of driving (e.g., steering-wheel, gearshift) and providing feedback about the state of the vehicle and the handling performance (e.g., instruments of dashboard). The high relevance of these components that have high functional necessity for the operation of an automobile is little surprising. On the other hand, also devices concerned with ambient conditions (e.g., control of air-conditioning, ventilation shafts) and entertainment (e.g., car radio) received extensive exploration. These components are mainly concerned with driving comfort and their high relevance is in line with prior research indicating that vehicle comfort is of growing importance to customers (e.g., Kempfert, 1999). Storage room seems to have been of medium importance, with a particular relevance of the glove compartment, the cupholder and the places of deposit at the gear area.

The two stimulus cars are representatives of different automobile classes and differ in equipment and grade of quality of the interior design. Still, the importance of the various areas of interest of the two vehicles strongly resembles each other. This provides a first indication for consistency of the relevance fields across different vehicles and designs. However, differences in the importance of some areas between the two stimulus cars were also found indicating that variations of design could influence the relevance of a given area. For example, the gearshift area was examined to a significantly greater extent in the Laguna interior than in the Clio interior. The design of the gear area of the Laguna interior is more elaborate than that of the Clio. Furthermore, in contrast to the Clio, the Laguna features a handbrake switch instead of a lever. This might have attracted participant's particular attention.

Surprisingly, no influence of car expertise on extent of evaluation of the interior areas and components has been found. As research on (car) design evaluation and appreciation indicates that experts and laymen have differing preferences and interpret products differently (e.g., Hekkert et al., 2003; Hsu et al., 2002; Karlsson et al., 2003), it had been expected that car experts and laymen would have diverse requirements towards vehicle interiors and show different evaluation behavior. Admittedly, the sample size of this study was rather small, perhaps too small to detect effects of car expertise on evaluation behavior. Furthermore, the expertise of this study's experts was not very pronounced and thus the differences between car experts and laymen might not have been sufficiently strong. It might also be that in fact the relevance fields of car interiors are the same for experts and laymen. However, regression analyses found that technical expertise scores could be predicted by viewing times of the instrument panel of the Laguna interior. Interestingly, a rise in technical expertise was related to shorter examination of this area. This suggests that expertise might yield shorter evaluations of the vehicle interior. Expertise is usually associated with more knowledge about a certain domain and thus more efficient information processing and problem solving (Eysenck & Keane, 2005). In the case of car expertise this could mean that a car expert's greater knowledge about automobiles, their equipment and technology, would lead to faster processing and evaluation of the interior areas. However, the findings that experts and non-experts did not differ in terms of overall evaluation duration and that a rise in technical expertise was also associated with a rise of the extent of evaluation of the Laguna gear area contradict this assumption. By all means, further research using more participants and more profound car experts will be necessary to shed more light on this topic.

The case is similar with gender differences. Survey data (e.g., Kortus-Schultes, 2005) suggest that men and women attach importance to different parts of the interior equipment. The findings of this study indicate that, on a behavioral level, male and female participants did not pay attention to differing areas and thus suggest that men and women do not have diverse relevance fields. However, due to the limited sample size the results of this study are only exploratory. Continuative research will have to clarify the influence of gender on evaluation of vehicle interiors. As results of regression analyses indicate that participants' age influenced extent of evaluation of some areas, future research should also investigate whether customers of different age groups – e.g., twenty-somethings, middle aged, best agers – show different relevance fields.

During the simulated driving tasks, participants mainly observed the instruments of the dashboard, the mirrors and the centre-console display. Little surprisingly, these results indicate that in driving situations the most relevant fields of the interior are components providing feedback about the state of the vehicle (dashboard instruments) and crucial for driving (mirrors). The high importance of the central display is in line with prior research suggesting that in-vehicle displays attract drivers' attention during a car ride (e.g., Lansdown, 1997). However, the central display of the Laguna interior attracted participants' attention much more than the one in the Clio interior – both in the context of a purchase situation and a driving situation. Although these differences could also be due to the diverse design of the device in the two vehicles, the most likely explanation for this finding are probably differences in the activity of the display. Whereas the display was by default out of action and thus dark in the Clio, it was switched on and illuminated in the Laguna. Still, further research is needed to investigate the importance of in-vehicle displays when controlling for the activity and the design of the display.

Besides, it is questionable whether the simulation of the driving task in this study was successful and valid as several participants kept fixating the driving video without ever – like in real driving situations – checking the vehicle interior or the mirrors. The simulation consisted of a video of a car ride projected onto the wall opposing the vehicle and the driver. This might not have been enough to help the participants imagine experiencing a real test drive with the stimulus-car. Maybe, additional acoustic information and feedback (e.g., traffic noise, engine noise) could strengthen the impression of being in a real driving situation.

Though this was only a starting point of determining relevance fields in vehicle interiors, important implications can be drawn from the findings of this study. Directions for further research are for example the verification of the consistency or possible specifics of relevance fields across cars of different classes/manufacturers and investigation of the effect of expertise, gender and other individual differences (e.g., age, social status, etc.). Furthermore, this study only analyzed participants' visual evaluation of the interior. Participants' haptic exploration was studied in a separate diploma thesis by Michael Forster (in preparation). As product interactions and evaluations are usually influenced by various senses – and most notably by vision and touch (Schifferstein, 2006) – a combined analysis and mapping of customers' visual and haptic relevance fields has to be aspired.

A major purpose of the relevance maps of vehicle interiors is to provide designers guidance in the creation of the interior equipment. The vehicle manufacturing process is associated with extremely high time and monetary investments (Spiegel & Chytka, 2007). The development process of a new car model can span several years. These long product renewal intervals imply that the design has to be chosen deliberately as the vehicle has to please the customers for a long time (Carbon & Leder, 2007). In order to construct interior equipment in an optimal way despite financial constraints, designers can focus on those areas, components and devices that are most relevant to the customers.

This study also provides directions for further research in vehicle interior design. Apart from the above outlined need for deeper investigation of the nature of relevance fields and possible influencing factors, the results of this study can also be a starting point for research on the design and appreciation of specific interior components. The relevance maps provide researchers with information on the importance of the various interior components and can thus guide detailed research into a component's design and aesthetic appeal to those devices that are most relevant to customers and hence the industry. Applications in the field of marketing are possible as well. Knowing a vehicle's relevance fields, advertisers and salesmen can direct their customers' attention to the superior design or functionality of specific interior components of a vehicle on offer.

The application of eyetracking in the field of design research and evaluation in general and in particular with regard to the vehicle interior is promising and can prove relevant in many respects. For example, the complexity of car interiors is rising steadily. The equipment features more and more electronic devices and in-vehicle technology systems (e.g., Burnett & Porter, 2001). These are meant to assist the driver and make the task of driving safer and more comfortable. However, they also require attention and impose additional workload on the driver (Lansdown, 1997). Assessing these devices using eye movement measurement can aid at evaluating their usage (i.e., do drivers/customers use them at all) and usefulness (i.e., to what extent do they assist or rather distract the driver). Moreover, eyetracking can determine optimal positioning of components in order to ensure optimal visibility. This especially concerns the instruments of the dashboard and displays of in-vehicle systems like navigation systems. They require the driver to take his/her eyes off the road and thus need to be positioned and designed in a way that minimizes driver distraction. Also a combination of eyetracking with in-depth interviews revealing a user's motives for examining a given device and how he/she thinks about a device, its handling and design seems to be a promising approach for bringing the design of vehicle interiors closer to the needs, preferences and abilities of the customers.

10 References

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11 Summary in German

Fast alle Märkte sind heutzutage durch einen starken Kokurrenzkampf zwischen konkurrierenden Anbietern gekennzeichnet. Viele Produkte unterscheiden sich kaum mehr in Bezug auf Technologie, Qualität und Preis (Carbon & Leder, 2007; Veryzer, 1995). Design stellt für Unternehmen eine vielversprechende Möglichkeit dar, ihre Produkte von denen konkurrierender Anbieter abzugrenzen und einen Wettbewerbsvorteil zu erlangen (Bloch, 1995; Gemser & Leenders, 2001; Kotler & Rath, 1984). Dabei meint Design nicht nur eine ansprechende ästhetische Gestaltung des Produktes, sondern soll die Charakterista und Funktionsweisen eines Produktes optimal zur Geltung bringen, seine Handhabung für den Konsumenten erleichtern und so die Kundenzufriedenheit optimieren (Kotler & Rath, 1984; Veryzer, 1995).

Das Design eines Produktes beeinflusst seine Bewertung und Kategorisierung und damit, ob es als Kaufalternative in Betracht gezogen wird (Bloch, 1995; Leder et al., 2007). Dabei haben auch persönliche Präferenzen, vorherrschende Trends und kulturelle Faktoren einen Einfluss darauf, wie ein Design bzw. ein Produkt wahrgenommen und bewertet wird (Bloch, 1995). Deshalb sind Design- und Produktevaluationen von Kunden der Zielgruppe ausschlaggebend um den Markterfolg eines Produktes abschätzen zu können (Creusen & Schoormans, 2005; Crilly et al., 2004). Auch der Kunde selbst wird immer stärker in den Design- und Produktentwicklungsprozess einbezogen. Beobachtungen, wie KonsumentInnen in realen Situationen ein Produkt verwenden, liefern Erkenntnisse darüber, wie, wann und in welchen Kontexten KundInnen ein Produkt gebrauchen, ob sie damit zufrieden sind bzw. Anregungen für Weiterentwicklungen und neue Produktideen (Norman, 2004; Schmid, 2008).

Gerade in der Automobilindustrie, wo hinsichtlich technischer und funktioneller Qualitäten kaum mehr Unterschiede zwischen den jeweiligen Herstellern festzustellen sind, ist ein Trend hin zu an den Kundenwünschen orientiertem Design beobachtbar (Kempfert, 1999; You et al., 2006; Zec, 1998). Um am Markt bestehen zu können muss ein Automobil heutzutage nicht nur den Erwartungen der Kunden bezüglich Effizienz und Funktionalität sondern auch hinsichtlich Ausstattung, Ästhetik und Komfort entsprechen (Lin & Zhang, 2006; Zec, 1998).

Besondere Bedeutung kommt dem Design bei der Gestaltung des Autoinnenraums zu. Einerseits bietet das Interieur mehr Freiraum für eine individuelle Gestaltung, die das Fahrzeug von Konkurrenzprodukten abhebt (Karlsson et al., 2003; Leder & Carbon, 2005). Andererseits ist die Komposition des Innenraums ausschlaggebend für die Interaktion zwischen Fahrer und Fahrzeug und hat damit einen Einfluss auf das Fahrverhalten (Eby & Kantowitz, 2006; Lin & Zhang, 2006; Waller & Green, 1997).

Während sich bisherige Studien zum Autoinnenraumdesign vor allem auf die Gestaltung einzelner Komponenten konzentriert haben, zielte die vorliegende Studie darauf ab, die Wahrnehmung des Innenraums als Ganzes zu untersuchen. Mittels Blickbewegungsmessung sollte herausgefunden werden, welchen Bereichen des Interieurs die Versuchspersonen am meisten Aufmerksamkeit schenken – und das einerseits im Kontext einer potentiellen Kaufsituation und andererseits während einer simulierten Fahrsituation. Diese Studie stellt also einen ersten Versuch dar, Relevanzfelder in Autoinnenräumen zu ermitteln und in topografischen Karten zu illustrieren. Da Produkterfahrungen und –evaluierungen in der Regel mehrere Sinne betreffen, wurde mittels Videokameras zusätzlich die haptische Evaluierung des Innenraums aufgezeichnet. Die Auswertung der haptischen Daten wurde von Michael Forster (in Vorbereitung) im Rahmen seiner Diplomarbeit durchgeführt.

In beiden Stimulus-Autos (Renault Clio und Renault Laguna) wurden im Kontext einer potentiellen Kaufsituation die Global-Bereiche Mittelkonsole, Lenkrad und Armaturenbrett am längsten betrachtet. Am wenigsten wurden Beifahrer- und Deckenbereich evaluiert. Eine Detailanalyse der Bereiche zeigte, dass die Versuchspersonen vor allem Display und Instrumenten des Armaturenbrettes, Außenbereich des Lenkrads, Multifunktionsschalter am Lenkrad, Ganghebel, Autoradio, Regelung der Lüftung und Klimaanlage und Fensterheberschalter am meisten Aufmerksamkeit schenkten. Zusammenfassend deuten die Ergebnisse darauf hin, dass die relevantesten Bereiche des Autoinnenraums einerseits jene sind, die in Zusammenhang mit dem Lenken eines Fahrzeuges stehen (z. B. Lenkrad, Blinker) und die Rückmeldung über das Fahrverhalten bzw. das Fahrzeug geben (z. B. Systemanzeige, Geschwindigkeitsanzeige). Neben diesen funktionell wichtigen Instrumenten scheinen auch Komponenten, die Fahrzeugkomfort, Ambiente und Entertainment betreffen von hoher Relevanz für potentielle Kunden zu sein. Eine Analyse des zeitlichen Verlaufs der Evaluation zeigte, dass die relevantesten Bereiche auch früher fixiert bzw. gleich zu Beginn der Evaluation ausführlich betrachtet wurden, während die weniger wichtigen Areale erst im späteren Verlauf inspiziert wurden. Ein Einfluss von Auto-Expertise und Geschlecht auf die Relevanz der unterschiedlichen Bereiche bzw. Komponenten des Interieurs konnte nicht gefunden werden.

Während der Simulation einer Fahrsituation wurden von den Versuchspersonen vor allem die Instrumente des Armaturenbrettes, der linke Seitenspiegel, der Rückspiegel und das Display der Mittelkonsole kurz fixiert.

Die Ergebnisse dieser Studie bieten Anregungen für weitere Designforschung zur Gestaltung des Autoinnenraums bzw. einzelner, relevanter Instrumente und Einheiten. Außerdem kann die Kenntnis der Interieur-Relevanzfelder Designern helfen, das Fahrzeuginnere gemäß den Bedürfnissen und Präferenzen der Konsmenten zu gestalten.

12 Appendix

12.1 Materials

12.1.1 Evaluation form Clio

VpnNr.:________

Fragebogen Evaluation Clio

Sie haben sich soeben den Innenraum des Renault Clio angesehen. Wir bitten Sie nun anzugeben, wie gut Ihnen der Innenraum insgesamt bzw. einzelne Elemente des Innenraums gefallen haben. Für Ihre Antworten steht Ihnen eine 7-stufige Skala zur Verfügung. Die einzelnen Skalenwerte haben folgende Bedeutung:
1 = gefällt mir sehr gut
2 = gefällt mir gut
3 = gefällt mir etwas
4 = gefällt mir weder gut noch schlecht
5 = gefällt mir eher nicht
6 = gefällt mir nicht
7 = gefällt mir gar nicht
Bitte machen Sie jeweils in dem Kästchen ein Kreuz, das am ehesten Ihrer Zufriedenheit mit dem jeweiligen Element des Innenraums entspricht.
Zusätzlich steht Ihnen auch die Antwortalternative „Kann ich nicht beurteilen" zur Verfügung. Kreuzen Sie bitte dieses Kästchen an, wenn Sie das Gefühl haben, dass Sie sich das jeweilige Element des Innenraums nicht genau genug angesehen haben und deshalb kein Urteil darüber abgeben können.
Bitte antworten Sie möglichst spontan. Uns interessiert Ihre persönliche Meinung, d. h. es gibt keine „richtigen" oder „falschen" Antworten.
Alle Ihre Angaben werden absolut vertraulich behandelt.

Angaben zur Person:

Alter: ______ Geschlecht: ☐ weiblich
☐ männlich

Beruf: ____

	Sehr gut ①	Gut ②	Etwas ③	Weder noch ④	Eher nicht ⑤	Nicht ⑥	Gar nicht ⑦		Kann ich nicht beurteilen
Wie gut hat Ihnen der Innenraum des Clio insgesamt gefallen?									
Wie gut hat Ihnen das Lenkrad gefallen?									
Wie gut hat Ihnen der Gangschaltungshebel gefallen?									
Wie gut hat Ihnen der Handbremsenhebel gefallen?									
Wie gut hat Ihnen die Regelung der Klimaanlage gefallen?									
Wie gut hat Ihnen das Radio gefallen?									
Wie gut haben Ihnen die Fensterheberschalter gefallen?									

VpnNr.:________

	Sehr gut ①	Gut ②	Etwas ③	Weder noch ④	Eher nicht ⑤	Nicht ⑥	Gar nicht ⑦		Kann ich nicht beurteilen
Wie gut haben Ihnen die Radiobedienelemente am Lenkrad gefallen?									
Wie gut haben Ihnen die Geschwindigkeits- und Drehzahlanzeigen gefallen									
Wie hat Ihnen die Sonnenblende gefallen?									
Wie gut hat Ihnen der Rückspiegel gefallen?									
Wie gut hat Ihnen die Regelung der Innenbeleuchtung gefallen?									
Wie gut hat Ihnen der Blinkerhebel gefallen?									
Wie gut hat Ihnen der Lichtschalter gefallen?									

	Sehr angenehm ①	Angenehm ②	Etwas angenehm ③	Weder noch ④	Etwas unangenehm ⑤	Unangenehm ⑥	Sehr unangenehm ⑦		Kann ich nicht beurteilen
Wie hat sich das Lenkrad angefühlt?									
Wie hat sich der Sitz angefühlt?									
Wie hat sich der Gangschaltungshebel angefühlt?									
Wie hat sich der Fensterheberschalter angefühlt?									

Könnten Sie sich vorstellen dieses Auto zu kaufen?

Ja	Vielleicht	Weiß nicht	Eher nicht	Sicher nicht

Wenn ja, warum bzw. wenn nein, warum nicht?

12.1.2 Evaluation form Laguna

VpnNr.:________

Fragebogen Evaluation Laguna

Sie haben sich soeben den Innenraum des Renault Laguna angesehen. Wir bitten Sie nun anzugeben, wie gut Ihnen der Innenraum insgesamt bzw. einzelne Elemente des Innenraums gefallen haben. Für Ihre Antworten steht Ihnen eine 5-stufige Skala zur Verfügung. Die einzelnen Skalenwerte haben folgende Bedeutung:

1 = gefällt mir sehr gut
2 = gefällt mir gut
3 = gefällt mir etwas
4 = gefällt mir weder gut noch schlecht
5 = gefällt mir eher nicht
6 = gefällt mir nicht
7 = gefällt mir gar nicht

Bitte machen Sie jeweils in dem Kästchen ein Kreuz, das am ehesten Ihrer Zufriedenheit mit dem jeweiligen Element des Innenraums entspricht.

Zusätzlich steht Ihnen auch die Antwortalternative „Kann ich nicht beurteilen“ zur Verfügung. Kreuzen Sie bitte dieses Kästchen an, wenn Sie das Gefühl haben, dass Sie sich das jeweilige Element des Innenraums nicht genau genug angesehen haben und deshalb kein Urteil darüber abgeben können.

Bitte antworten Sie möglichst spontan. Uns interessiert Ihre persönliche Meinung, d. h. es gibt keine „richtigen“ oder „falschen“ Antworten.

Alle Ihre Angaben werden absolut vertraulich behandelt.

Angaben zur Person:

Alter: ______ Geschlecht: ☐ weiblich
☐ männlich

Beruf:____

	Sehr gut ①	Gut ②	Etwas ③	Weder noch ④	Eher nicht ⑤	Nicht ⑥	Gar nicht ⑦		Kann ich nicht beurteilen
Wie gut hat Ihnen der Innenraum des Laguna insgesamt gefallen?									
Wie gut hat Ihnen das Lenkrad gefallen?									
Wie gut hat Ihnen der Gangschaltungshebel gefallen?									
Wie gut hat Ihnen der Handbremsenhebel gefallen?									
Wie gut hat Ihnen die Regelung der Klimaanlage gefallen?									
Wie gut hat Ihnen das Radio gefallen?									
Wie gut haben Ihnen die Fensterheberschalter gefallen?									

VpnNr.:________

	Sehr gut ①	Gut ②	Etwas ③	Weder noch ④	Eher nicht ⑤	Nicht ⑥	Gar nicht ⑦		Kann ich nicht beurteilen
Wie gut haben Ihnen die Radiobedienelemente am Lenkrad gefallen?									
Wie gut haben Ihnen die Geschwindigkeits- und Drehzahlanzeigen gefallen									
Wie hat Ihnen die Sonnenblende gefallen?									
Wie gut hat Ihnen der Rückspiegel gefallen?									
Wie gut hat Ihnen die Regelung der Innenbeleuchtung gefallen?									
Wie gut hat Ihnen der Blinkerhebel gefallen?									
Wie gut hat Ihnen der Lichtschalter gefallen?									

	Sehr angenehm ①	Angenehm ②	Etwas angenehm ③	Weder noch ④	Etwas unangenehm ⑤	Unangenehm ⑥	Sehr unangenehm ⑦		Kann ich nicht beurteilen
Wie hat sich das Lenkrad angefühlt?									
Wie hat sich der Sitz angefühlt?									
Wie hat sich der Gangschaltungshebel angefühlt?									
Wie hat sich der Fensterheberschalter angefühlt?									

Könnten Sie sich vorstellen dieses Auto zu kaufen?

Ja	Vielleicht	Weiß nicht	Eher nicht	Sicher nicht

Wenn ja, warum bzw. wenn nein, warum nicht?

____

____

12.1.3 Car Questionnaire V2.0

Seite 1

von Versuchsleiter/In auszufüllen: Probandencode___________________

Datum d. Testung______________

<u>Kontaktdaten:</u>
Universität Wien
Fakultät für Psychologie
Arbeitsbereich Allgemeine Psychologie
Liebiggasse 5, 1010 Wien
Assoc.-Prof. Dr. Claus-Christian Carbon

Geschlecht: männlich weiblich

Alter_______________ (in Jahren)

Höchste abgeschlossene Ausbildung: Hauptschule (HS)

Lehre (welche?):_____________________

Allgemeinbildende höhere Schule oder Berufsbildende höhere Schule (AHS, HTL, HAK, Abitur,…)

Universitäts- oder Fachhochschulabschluss (Studienrichtung?):____________________

Sonstiges:______________________

momentan ausgeübter Beruf________________________

<u>Allgemeines & Fahrgewohnheiten</u>

B - Führerschein: ja nein

<u>Wenn nein</u>, bitte arbeiten Sie beim Abschnitt „Weitere Fragen“ weiter.

Eigenes Auto: ja nein

<u>Wenn ja</u>, welche Marke?__________________________

Welches Modell?__________________________

Welches Baujahr?__________________________

<u>Wenn nein</u>, welches Fahrzeug ist das von Ihnen meistgenutzte (Marke, Modell, Baujahr)? ______________________________

Wem gehört das von Ihnen meistgenutzte Fahrzeug?

____

Seite 2

Wie oft benützen sie das/die eigene/n oder ausgeborgte Fahrzeuge als Lenker/in pro Jahr?

täglich
mehrmals die Woche
mehrmals im Monat
mehrmals im Jahr

Wie viele Kilometer legen sie im Jahr am Steuer eines Fahrzeugs zurück?

0-1.000 km
1.000-5.000 km
5.000-10.000 km
10.000-15.000km
15.000-20.000 km
20.000 oder mehr km

Folgende Fragen beziehen sich auf das von Ihnen benutze Fahrzeug:

Mit welchem Treibstoff wird ihr Fahrzeug betrieben?

Diesel
Benzin
Erdgas
Hybrid
Sonstige: ____________________
Weiß ich nicht

Welche Getriebevariante besitzt ihr Fahrzeug?

Manuelles Schaltgetriebe
Automatik
Weiß ich nicht

Wie viel Liter Treibstoff verbraucht ihr Fahrzeug je 100 km?

__________l/100km Weiß ich nicht

Seite 3

Wie viel PS oder kW hat ihr Fahrzeug?

___________PS

___________kW

Weiß ich nicht

Welchen Antrieb besitzt Ihr Fahrzeug?

Frontantrieb

Heckantrieb

Allradantrieb

Weiß ich nicht

Wie oft im Jahr reinigen Sie ihr Fahrzeug bzw. lassen es reinigen?

__________Mal pro Jahr

Weitere Fragen:

Ich kaufe und lese Autozeitschriften?	ja	nein
Ich sehe mir Sendungen über Autos an?	ja	nein
Ich interessiere mich für Autos?	ja	nein
Ich verfolge Neuigkeiten auf dem Automarkt aktiv?	ja	nein
Ich spreche mit Freunden und/oder Kollegen über neue Automodelle?	ja	nein
Ich achte auf Autowerbungen?	ja	nein

Reihen Sie folgende Attribute (1 – 13) nach ihrer Relevanz für Sie beim Autokauf:

☐	Verbrauch	☐	Preis
☐	Leistung (PS)	☐	Wirtschaftlichkeit
☐	Design	☐	Komfort
☐	Markentreue	☐	Ausstattung
☐	Markenimage	☐	Verarbeitung
☐	Kofferraumgröße	☐	Zuverlässigkeit
☐	Fahrzeuggröße		

Seite 4

A. funktionelle Aspekte:

1. Wie wichtig ist mir das benutzte Fahrzeug?
   Nicht wichtig sehr wichtig
2. Wie wichtig sind mir Autos generell?
   Nicht wichtig sehr wichtig
3. Ich brauche ein Auto ausschließlich um von A nach B zu kommen.
   stimme gar nicht zu stimme voll zu
4. Autofahren ist für mich mehr als reine Fortbewegung.
   stimme gar nicht zu stimme voll zu
5. Es ist mir wichtig ein umweltfreundliches Fahrzeug zu fahren.
   stimme gar nicht zu stimme voll zu
6. Es ist mir wichtig eine leistungsstarke Soundanlage im Auto zu besitzen?
   Nicht wichtig Sehr wichtig

B. Technische Aspekte:

1. Was bedeutet die Abkürzung ABS? ___________________________
2. Zu welchem Konzern gehört der Autohersteller Volvo?
   ____
3. In welcher Maßeinheit wird der Hubraum angegeben?
   ____
4. Was bedeutet die Abkürzung PDC? ___________________________
5. Aus was besteht das Logo von Audi?___________________________
6. Was bedeutet die Abkürzung PS?______________________________
7. Was bedeutet die Abkürzung ASR? ____________________________
8. Was bedeutet die Abkürzung ESP? ____________________________
9. Wo beim Auto spielt Xenon eine Rolle? _________________________
10. Welches wichtige Motorelement besitzt ein Benziner im Gegensatz zu einem Diesel? ____
11. Was bedeutet die Abkürzung TDI?____________________________
12. Nennen sie weltweit gesehen die 5 größten Autokonzerne:

____________ ____________ ____________ ____________ ____________

C. Designaspekte:

1. Bei einem Auto ist mir das Design (Interieur und Exterieur) wichtig?
   stimme gar nicht zu stimme voll zu
2. Ich würde Designaspekten vor technischen Aspekten den Vorrang lassen?
   stimme gar nicht zu stimme voll zu

Geben sie bitte zu den jeweiligen Autos auf den folgenden Bildern an, um welche eine Marke und welches Modell es sich handelt.

1		Marke: ____________________ Modell: ______________________
2		Marke: ____________________ Modell: ______________________
3		Marke: ____________________ Modell:______________________

Seite 6

4		Marke: ____________________ Modell: ______________________
5		Marke: ____________________ Modell: ______________________
6		Marke: ____________________ Modell: ______________________
7		Marke: ____________________ Modell: ______________________
8		Marke: ____________________ Modell: ______________________

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9		Marke: ____________________ Modell: ______________________
10		Marke: ____________________ Modell: ______________________
11		Marke: ____________________ Modell: ______________________
12		Marke: ____________________ Modell: ______________________
13		Marke: ____________________ Modell: ______________________

14		Marke: ____________________ Modell: ______________________
15		Marke: ____________________ Modell: ______________________
16		Marke: ____________________ Modell: ______________________

Vielen Danke für ihre Teilnahme!

12.1.4 Illustration of the Procedure of the Study by way of example of one Participant

After subject is welcomed standardized tests of vision, color vision ability, and handedness are undertaken. Subsequent to a phase of familiarization with the eye-tracking device calibration takes place.

1

Subject is accompanied to the first car – here the Renault Clio - and instructed outside the car. Subject is asked to imagine being interested in buying a new car and to evaluate the interior equipment of the present car at his pace and according to his preferences.

2

Subject is assisted in getting into the vehicle to avoid possible damage of the eyetracking helmet on the ceiling.

3

Subject first adjusts the driver's seat to his convenience ...

4

… and then starts evaluation of the car by examining the speed indicator and …

5

… the tachometer.

6

Next subject inspects the air-conditioning system's display and control.

7

Subject takes a look at the display in the centre console ….

8

… and re-fixates the dashboard.

9

Then subject inspects the steering wheel …

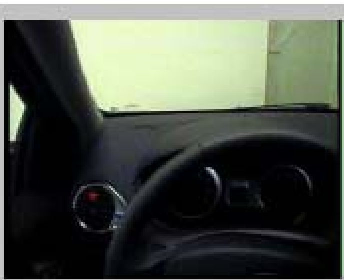
10

… visually and haptically evaluates the light switch.

11

He looks back at the tachometer,…

12



… glances at the ventilation …

13

… and then inspects the display in the centre console.

14

Afterwards the subject looks at the ventilation in the centre console …

15

… and the one at the passenger's side.

16

Subject views the passenger's seat and belt.

17

Next subject inspects the light control at the ceiling and the rear-view mirror.

18

After this he looks at the left ventilation, …

19

… the steering wheel, …

20

… and the ventilation in the centre console again.

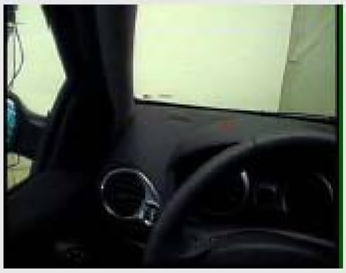
21

Subject again inspects the light switch …

22

… and afterwards the direction indicator switch.

23



He looks at the lining …

24

… and the ventilation …

25

… and looks over the dashboard once again.

26

Subject briefly glances at the control of the air-conditioning and then looks at the automotive radio.

27

After this he again inspects the speed indicator …

28

… and the dash board display.

29

Simultaneously subject tests the warning lights switch.

30

Afterwards he takes another look at the ventilation …

31

… and the display of the centre console.

32

He examines the lining at the passenger's side …

33

… and the glove compartment.

34

Subject also turns around to look at the backseat …

35

… and the passenger's seat.

36

After this he examines the dashboard display …

37

… and the steering wheel again.

38

He takes a look at the power window switch…

39

… and the lining of the driver's door.

40

Subject also looks at the pedals…

41

… and gives them a try.

42

Afterwards subject first visually inspects the cupholder …

43

… and then reaches for it and opens it.

44

Thereafter subject looks at the gearshift, …

45

… and the vehicle floor, …

46

… glances at the air-conditioning control …

47

… and again arrives at the dashboard.

48

Once again subject examines the lining …

49

… and then looks up at the ceiling light ….

50

… and the sun visors.

51

After 99 msec. subject declares the evaluation phase as completed.

Subject is asked to stay seated in the vehicle and is instructed by experimenter 1 about the next phase of the study – the driving scenario.

52

Subject is instructed that he is going to see a video of a drive at the freeway at the opposing wall and asked to imagine test-driving the present car. He is asked to behave like in a real driving situation and to concentrate on the traffic and at the same time keep an eye on the vehicle interior and make him- or herself familiar with the interior equipment.

53

Meanwhile experimenter 2 prepares the projection of the video onto the opposing wall.

54

At the onset of the video subject concentrates on the road and the car traffic.

55

Every now and then subject throws a glance at the dashboard - here the speed indicator - …

56

… and then again focuses on the traffic.

57

Subject checks the left side mirror…

58

… and re-fixates the road.

59

Subject once more quickly examines the speed indicator.

60

Right after that he focuses on the road again.

61

Subject also briefly checks the rearview mirror…

62

… and focuses on the road again.

63

He checks the left side mirror…

64

… and re-fixates the road.

65

Subject once again checks the speed indicator…

66

… and right afterwards follows the traffic again.

67

After another glance at the speed indicator…

68

…subject shortly focuses on the road…

69

…checks the left side mirror again…

70

… and re-fixates the road.

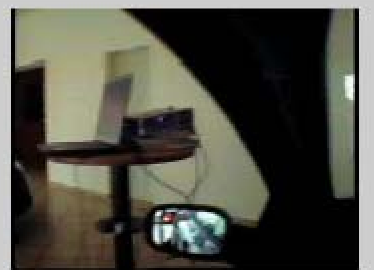
71

After a while subject glances at the speed indicator…

72

…and looks back at the road again.

73



He again checks the left side mirror…

74

… and re-fixates the road.

75

Subject once more examines the speed indicator…

76

and focuses on the road again.

77

After a last check of the rear-view mirror…

78

… subject monitors the road and the car traffic for the remainder of the video.

79

After having finished the driving scenario subject is assisted in getting out of the vehicle.

80

Subject is guided to a writing desk and asked to fill in a couple of questionnaires about the just evaluated car.
Whilst this, subject is offered light refreshments.

81

In the meantime the experimenters are preparing the other vehicle – here the Renault Laguna – for the test.

82

After subject has completed the questionnaires calibration is checked and recalibrated if necessary.

83

Subject is guided to the second vehicle – here the Renault Laguna – and once again is asked to imagine being interested in buying a new car and to examine the interior and its components according to his preferences.

84

Subject is again assisted in entering the vehicle

85

After adjusting the driver's seat, subject inspects the dash board.

86

Thereafter he visually …

87

… and haptically evaluates the steering wheel.

88

Subject takes a short look at the air-conditioning control …

89

… and once more attends the steering wheel.

90

Thereupon subject visually and haptically examines the gear shift.

91

Afterwards he looks at the air-conditioning control, …

92

… the centre console display…

93

… and then extensively views the air-conditioning again.

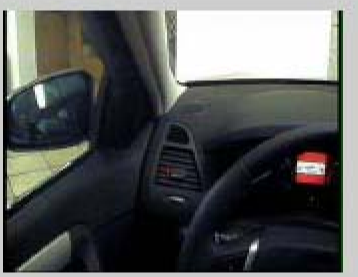
94

Subsequently subject visually and haptically evaluates the light switch, …

95

… as well as the direction indicator switch.

96



After this subject looks at the ventilation …

97

… and then inspects the power window switch, …

98

… visually and haptically.

99

Thereafter he examines the lining of the driver's door, …

100

… the left side mirror, …

101

… and the lining in front at the driver's side…

102

… and on the passenger's side.

103

Subject inspects the light control at the ceiling, …

104

… the sun visor at the passenger's side, …

105

… and looks at and folds down the one at the driver's side.

106

Thereafter subject glances at the rear-view mirror, …

107

… and the left side mirror.

108

Subject inspects handbrake switch and box underneath the arm-rest.

109

After this he looks at the pedals and gives them a try.

110

Subject then inspects the keycard holder …

111

… and glances at the centre console display again.

112

He then extensively inspects the display at the dashboard, …

113

… the tachometer, and ….

114

… the speed indicator.

115

Subject glances at the centre console display, …

116

… the lining at the passenger's side, …

117

… and the doorway of the passenger's door.

118

Thereupon subject inspects the backseat ….

119

… and the passenger's seat.

120

He also examines the passenger's belt …

121

… and the glove compartment.

122

Afterwards the subject attends the centre console again, more precisely the ventilation, …

123

… the warning lights switch, …

124

… the silver box, …

125

… and the air-conditioning control, that he evaluates haptically as well.

126

Subject glances at the display of the centre console, …

127

… the light switch, …

128

… the power window switch, …

129

… the left side mirror.

130

Subject then once again examines the dashboard, ….

131

… the steering wheel, …

132

… the direction indicator switch,…

133

... and the light switch.

134

Thereafter he briefly looks at the air-conditioning control, …

135

… and inspects the display again.

136

Subject again examines the lining at the passenger's side, ….

137

… the dashboard, …

138

… and the display at the centre console and then terminates the evaluation of the second car.

139

The participant is asked to imagine testdriving this car. He is instructed that he is again going to see a video of a car drive and asked to behave like in a real driving situation.

140

The second driving scenario the subject watches is a ride through the city centre of Linz.

141

Subject checks rear the view mirror

142

… and looks back at the road.

143

After a glance at the side mirror…

144

… he monitors the traffic again.

145

He checks the rear-view mirror ….

146

… and then attends the road again.

147

Subject glances at the dashboard…

148

… and afterwards concentrates on the car traffic again.

149

He once again briefly checks the dashboard…

150

… and refixates the road.

151

After another short glance in the rear-view mirror and the dashboard…

152

… subject further concentrates on the traffic until the end of the video.

153

Subject is assisted in getting out of the vehicle and is then delivered from the eyetracking helmet.

154

Finally, subject is asked to fill in further questionnaires, namely an evaluation form on the just examined car and an extensive questionnaire concerning general knowledge about and interest in cars.

155

12.2 Statistical Analysis

12.2.1 Extract from Data Sheet

VPNr	Clio		timestamp	missing values	minute	sekunde	frames	framesgesamt		frame diff	Drehzahlmess	Geschwindigk	Systemanzeig	Lenkrad Mitte
6			00:00:46:18		00	46	18	1168		20	0	1	0	0
6			00:00:47:13		00	47	13	1188		189	1	0	0	0
6			00:00:55:02		00	55	02	1377		6	0	0	0	0
6			00:00:55:08		00	55	08	1383		16	0	0	0	0
6			00:00:55:24		00	55	24	1399		10	0	0	0	0
6			00:00:56:09		00	56	09	1409		37	0	0	0	0
6			00:00:57:21		00	57	21	1446		7	0	0	0	0
6			00:00:58:03		00	58	03	1453		30	0	0	0	0
6			00:00:59:08	missing value	00	59	08	1483		20				
6			00:01:00:03		01	00	03	1503		7	0	0	0	0
6			00:01:00:10		01	00	10	1510		11	0	0	0	0
6			00:01:00:21		01	00	21	1521		6	0	0	0	0
6			00:01:01:02		01	01	02	1527		21	0	1	0	0
6			00:01:01:23		01	01	23	1548		8	0	0	1	0
6			00:01:02:06		01	02	06	1556		41	0	0	0	1
6			00:01:03:22		01	03	22	1597		69	0	0	0	0
6			00:01:06:16		01	06	16	1666		13	0	0	0	0
6			00:01:07:04		01	07	04	1679		38	1	0	0	0
6			00:01:08:17		01	08	17	1717		17	0	0	0	0
6			00:01:09:09		01	09	09	1734		8	0	0	0	0
6			00:01:09:17		01	09	17	1742		40	0	0	0	0
6			00:01:11:07		01	11	07	1782		12	0	0	0	0
6			00:01:11:19		01	11	19	1794		21	0	0	0	0
6			00:01:12:15		01	12	15	1815		49	0	0	0	0
6			00:01:14:14		01	14	14	1864		50	0	0	0	0
6			00:01:16:14		01	16	14	1914		41	0	0	0	0
6			00:01:18:05		01	18	05	1955		28	0	0	0	0
6			00:01:19:08		01	19	08	1983		6	0	0	0	0
6			00:01:19:14		01	19	14	1989		16	0	0	0	0
6			00:01:20:05		01	20	05	2005		69	0	0	0	0
6			00:01:22:24		01	22	24	2074		40	0	0	0	0
6			00:01:24:14		01	24	14	2114		16	0	0	0	0
6			00:01:25:05		01	25	05	2130		112	0	0	0	1
6			00:01:29:17		01	29	17	2242		48	0	0	0	0
6			00:01:31:15		01	31	15	2290		40	0	0	0	0
6			00:01:33:05		01	33	05	2330		26	0	0	0	0
6			00:01:34:06		01	34	06	2356		79	0	0	1	0
6			00:01:37:10	missing value	01	37	10	2435		31				
6			00:01:38:16		01	38	16	2466		57	0	0	0	0

12.2.2 Grouping of Design and Technical expertise

Table 12.1 Median for scores in Design and Technical expertise of participants who evaluated the Laguna interior

		Design Expertise	Technik Expertise
N	Valid	17	17
	Missing	36	36
Median		14,0000	6,0000

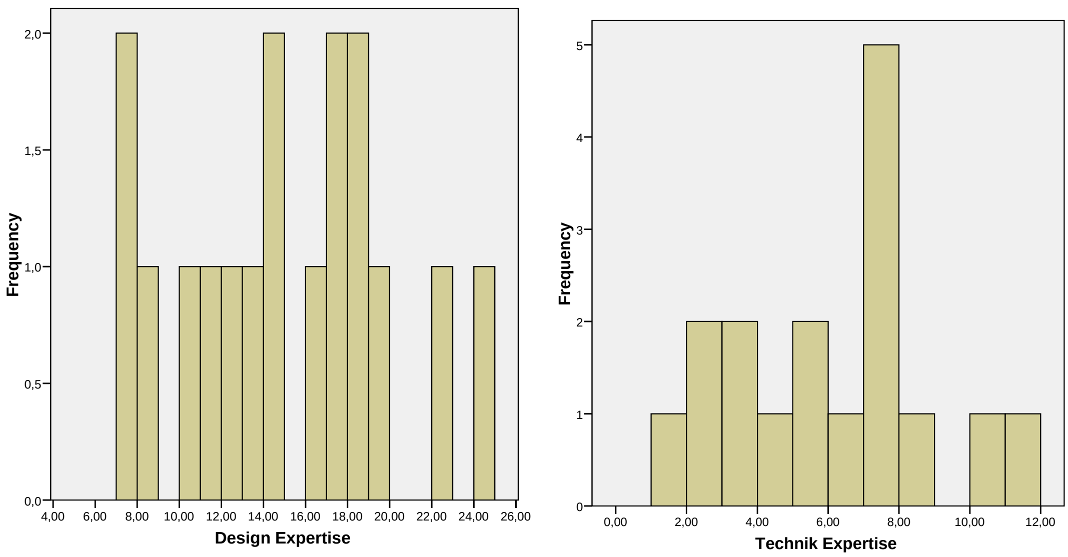


Figure 12.1 Histogram of scores in Design and Technical expertise

Table 12.2 Descriptive Statistics of Design laymen and experts who evaluated the Laguna interior

	Gruppe Design Expertise	N	Mean	Std. Deviation	Std. Error Mean
Design Expertise	Design Laie	9	10,7778	2,89516	,96505
	Design Experte	8	19,1875	2,91471	1,03051

Table 12.3 Independent samples T-Test comparing scores in Design expertise of laymen and experts

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Design Expertise	Equal variances assumed	,110	,744	-5,959	15	,000	-8,40972	1,41124	-11,41770	-5,40174
	Equal variances not assumed			-5,957	14,741	,000	-8,40972	1,41183	-11,42358	-5,39587

Table 12.4 Descriptive Statistics of Technical laymen and experts who evaluated the Laguna interior

	Gruppe Technik Expertise	N	Mean	Std. Deviation	Std. Error Mean
Technik Expertise	Technik Laie	9	3,7222	1,56347	,52116
	Technik Experte	8	8,1875	1,48655	,52557

Table 12.5 Independent samples T-Test comparing scores in Design expertise of laymen and experts

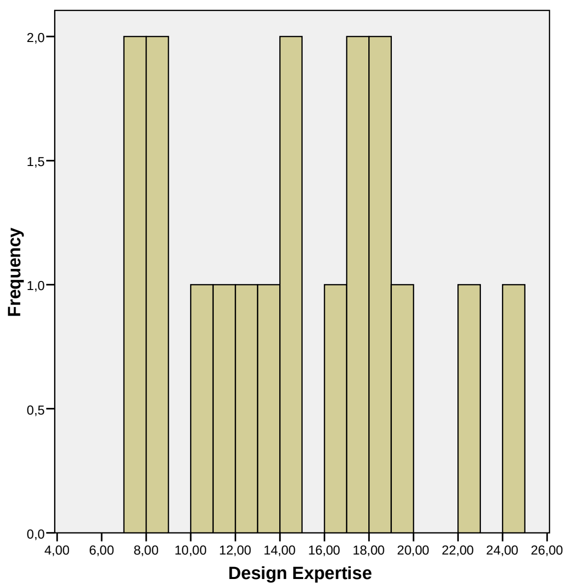
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Technik Expertise	Equal variances assumed	,335	,572	-6,014	15	,000	-4,46528	,74250	-6,04788	-2,88267
	Equal variances not assumed			-6,033	14,915	,000	-4,46528	,74016	-6,04366	-2,88689

Table 12.6 Median for scores in Design expertise of participants who evaluated the Clio interior

N	Valid	18
	Missing	36
Median		14,0000

Table 12.7 Median for scores in Technical expertise of participants who evaluated the Laguna interior

N	Valid	18
	Missing	36
Median		5,7500



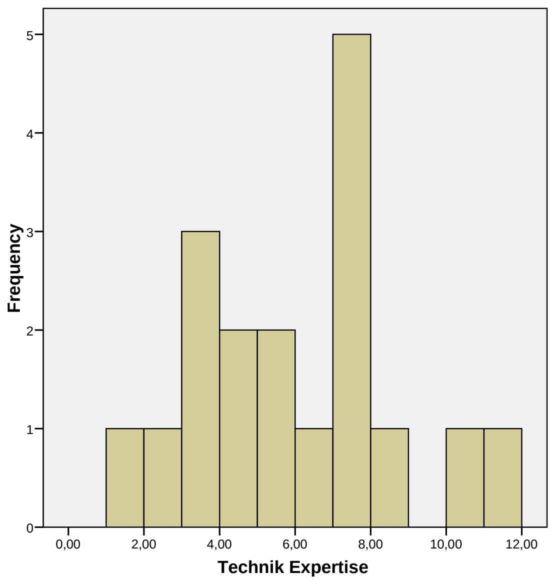


Figure 12.2 Histogram of scores in Design and Technical expertise

Table 12.8 Descriptive Statistics of Design laymen and experts who evaluated the Clio interior

	Gruppe Design Expertise	N	Mean	Std. Deviation	Std. Error Mean
Design Expertise	Design Laie	10	10.5000	2.86744	.90676
	Design Experte	8	19.1875	2.91471	1.03051

Table 12.9 Independent samples T-Test comparing scores in Design expertise of laymen and experts

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Design Expertise	Equal variances assumed	.162	.693	-6.341	16	.000	-8.68750	1.37000	-11.59177	-5.78323
	Equal variances not assumed			-6.329	15.029	.000	-8.68750	1.37265	-11.61274	-5.76226

Table 12.10 Descriptive Statistics of Technical laymen and experts who evaluated the Clio interior

	Gruppe Technik Expertise	N	Mean	Std. Deviation	Std. Error Mean
Technik Expertise	Technik Laie	9	3.6111	1.31762	.43921
	Technik Experte	9	7.9444	1.57012	.52337

Table 12.11 Independent samples T-Test comparing scores in Technical expertise of laymen and experts

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Technik Expertise	Equal variances assumed	.004	.949	-6.342	16	.000	-4.33333	.68324	-5.78174	-2.88492
	Equal variances not assumed			-6.342	15.532	.000	-4.33333	.68324	-5.78530	-2.88137

12.2.3 Paired-samples T-Test on evaluation duration

Table 12.12 Descriptive Statistics for total evaluation duration in Clio and Laguna

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Evaluationsdauer Clio	151.5750	16	60.43014	15.10754
	Evaluationsdauer Laguna	183.3200	16	74.00865	18.50216

Table 12.13 Paired samples T-Test comparing total evaluation duration in Clio and Laguna

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Evaluationsdauer Clio - Evaluationsdauer Laguna	-31.74500	52.52872	13.13218	-59.73558	-3.75442	-2.417	15	.029

Calculation of effect size r:

$r = \sqrt{t^2 / (t^2 + df)}$

$= \sqrt{-2.417^2 / (-2.417^2 + 15)}$

$= .53$

12.2.4 Analyses of Variance – Clio

General Linear Model – Areas of Interest:

Table 12.14 ANOVA for area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	2891.085	6	481.847	12.233	.000	.418
	Greenhouse-Geisser	2891.085	3.581	807.354	12.233	.000	.418
	Huynh-Feldt	2891.085	4.654	621.159	12.233	.000	.418
	Lower-bound	2891.085	1.000	2891.085	12.233	.003	.418
Error(area)	Sphericity Assumed	4017.836	102	39.391			
	Greenhouse-Geisser	4017.836	60.876	66.000			
	Huynh-Feldt	4017.836	79.124	50.779			
	Lower-bound	4017.836	17.000	236.343			

General linear Model – Area Instrument panel:

Table 12.15 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	197.171	3	65.724	16.766	.000	.497
	Greenhouse-Geisser	197.171	2.221	88.756	16.766	.000	.497
	Huynh-Feldt	197.171	2.570	76.708	16.766	.000	.497
	Lower-bound	197.171	1.000	197.171	16.766	.001	.497
Error(area)	Sphericity Assumed	199.925	51	3.920			
	Greenhouse-Geisser	199.925	37.765	5.294			
	Huynh-Feldt	199.925	43.697	4.575			
	Lower-bound	199.925	17.000	11.760			

General Linear Model – Area Steering-wheel:

Table 12.16 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	453.062	5	90.612	12.950	.000	.432
	Greenhouse-Geisser	453.062	2.716	166.828	12.950	.000	.432
	Huynh-Feldt	453.062	3.282	138.037	12.950	.000	.432
	Lower-bound	453.062	1.000	453.062	12.950	.002	.432
Error(area)	Sphericity Assumed	594.745	85	6.997			
	Greenhouse-Geisser	594.745	46.168	12.882			
	Huynh-Feldt	594.745	55.797	10.659			
	Lower-bound	594.745	17.000	34.985			

Table 12.17 Descriptive Statistics for Area x Gender

	Geschlecht	Mean	Std. Deviation	N
Lenkrad Mitte	männlich	3.008973	1.9115909	11
	weiblich	2.211214	1.2034074	7
	Total	2.698733	1.6795201	18
Multifunktionshebel links	männlich	2.048827	1.4027496	11
	weiblich	5.030729	4.3901180	7
	Total	3.208456	3.1933087	18
Multifunktionshebel rechts	männlich	5.044336	4.1131234	11
	weiblich	8.542300	4.7014412	7
	Total	6.404656	4.5641890	18
Radioregelung bei Lenkrad	männlich	.668082	1.1298955	11
	weiblich	1.549829	2.3824217	7
	Total	1.010983	1.7175241	18
Schlüsselloch	männlich	.084827	.1893897	11
	weiblich	.000000	.0000000	7
	Total	.051839	.1513598	18
lenkrad	männlich	4.779291	3.2404228	11
	weiblich	2.610200	2.3017260	7
	Total	3.935756	3.0381671	18

Table 12.18 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	472.802	5	94.560	15.394	.000	.490
	Greenhouse-Geisser	472.802	2.747	172.133	15.394	.000	.490
	Huynh-Feldt	472.802	3.580	132.083	15.394	.000	.490
	Lower-bound	472.802	1.000	472.802	15.394	.001	.490
area * sex	Sphericity Assumed	103.341	5	20.668	3.365	.008	.174
	Greenhouse-Geisser	103.341	2.747	37.623	3.365	.030	.174
	Huynh-Feldt	103.341	3.580	28.870	3.365	.019	.174
	Lower-bound	103.341	1.000	103.341	3.365	.085	.174
Error(area)	Sphericity Assumed	491.404	80	6.143			
	Greenhouse-Geisser	491.404	43.948	11.182			
	Huynh-Feldt	491.404	57.273	8.580			
	Lower-bound	491.404	16.000	30.713			

Table 12.19 ANOVA for Gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	902.495	1	902.495	82.555	.000	.838
sex	13.244	1	13.244	1.211	.287	.070
Error	174.914	16	10.932			

Table 12.20 Univariate Tests of Simple main effects of Gender within Area

area		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
1	Contrast	2.722	1	2.722	.963	.341	.057
	Error	45.231	16	2.827			
2	Contrast	38.037	1	38.037	4.498	.050	.219
	Error	135.316	16	8.457			
3	Contrast	52.342	1	52.342	2.775	.115	.148
	Error	301.799	16	18.862			
4	Contrast	3.326	1	3.326	1.137	.302	.066
	Error	46.822	16	2.926			
5	Contrast	.031	1	.031	1.373	.258	.079
	Error	.359	16	.022			
6	Contrast	20.127	1	20.127	2.354	.144	.128
	Error	136.791	16	8.549			

Each F tests the simple effects of Geschlecht within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

Table 12.21 Pairwise Comparisons of Simple main effects analysis

area	(I) Geschlecht	(J) Geschlecht	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
						Lower Bound	Upper Bound
1	männlich	weiblich	.798	.813	.341	-.926	2.521
	weiblich	männlich	-.798	.813	.341	-2.521	.926
2	männlich	weiblich	-2.982*	1.406	.050	-5.963	-.001
	weiblich	männlich	2.982*	1.406	.050	.001	5.963
3	männlich	weiblich	-3.498	2.100	.115	-7.949	.954
	weiblich	männlich	3.498	2.100	.115	-.954	7.949
4	männlich	weiblich	-.882	.827	.302	-2.635	.872
	weiblich	männlich	.882	.827	.302	-.872	2.635
5	männlich	weiblich	.085	.072	.258	-.069	.238
	weiblich	männlich	-.085	.072	.258	-.238	.069
6	männlich	weiblich	2.169	1.414	.144	-.828	5.166
	weiblich	männlich	-2.169	1.414	.144	-5.166	.828

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Sidak.

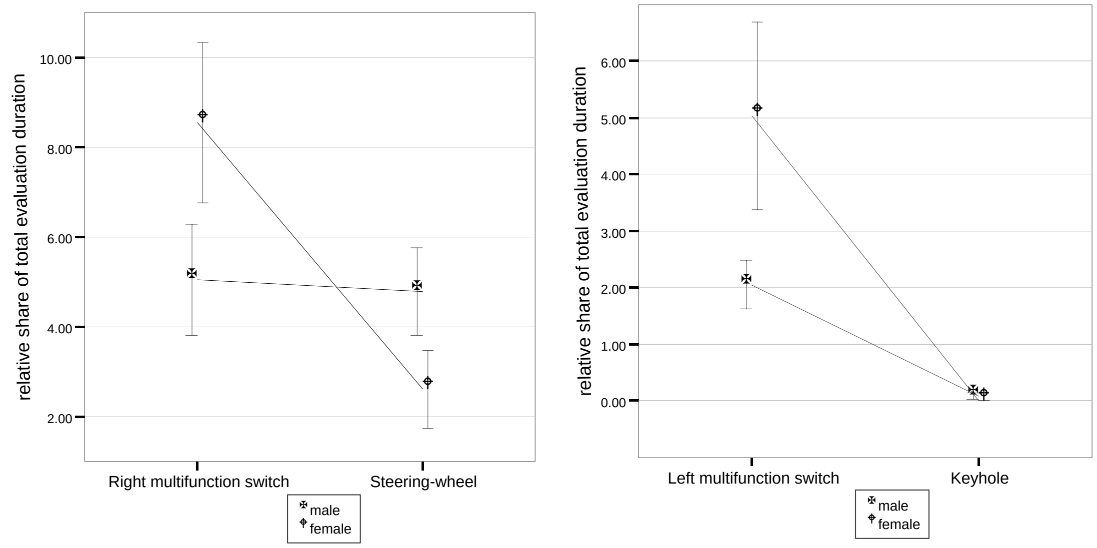


Figure 12.3 Graphs showing interaction between area and gender when comparing viewing time values of the right multifunction switch to the steering-wheel and when comparing viewing time values of the left multifunction switch to the keyhole. Dots show mean relative share of total evaluation duration. Error Bars show mean +/- one SE (of the mean).

General Linear Model – Area Centre-console:

Table 12.22 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	270.700	6	45.117	13.228	.000	.438
	Greenhouse-Geisser	270.700	3.347	80.873	13.228	.000	.438
	Huynh-Feldt	270.700	4.267	63.447	13.228	.000	.438
	Lower-bound	270.700	1.000	270.700	13.228	.002	.438
Error(area)	Sphericity Assumed	347.897	102	3.411			
	Greenhouse-Geisser	347.897	56.903	6.114			
	Huynh-Feldt	347.897	72.531	4.797			
	Lower-bound	347.897	17.000	20.465			

General Linear Model – Area Gearshift and Handbrake:

Table 12.23 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	64.297	3	21.432	7.967	.000	.319
	Greenhouse-Geisser	64.297	2.181	29.476	7.967	.001	.319
	Huynh-Feldt	64.297	2.515	25.569	7.967	.001	.319
	Lower-bound	64.297	1.000	64.297	7.967	.012	.319
Error(area)	Sphericity Assumed	137.200	51	2.690			
	Greenhouse-Geisser	137.200	37.082	3.700			
	Huynh-Feldt	137.200	42.749	3.209			
	Lower-bound	137.200	17.000	8.071			

General Linear Model – Area left and Driver's Door:

Table 12.24 Descriptive Statistics

	Mean	Std. Deviation	N
Regelung Scheinwerfer	.974161	1.2528763	18
Lüftung links	2.538706	1.9720254	18
Fensterheberschalter	1.514711	.8490869	18
Regelung Seitenspiegel links	3.087044	1.5028414	18
Fahrertür	1.183111	1.2848064	18
Türgriff Fahrertür	1.540811	1.4745743	18
Fahrersitz und Gurt	.271833	.7933174	18
Seitenspiegel links	1.118650	1.5250502	18
Fach in Fahrertür	.298872	.5535629	18

Table 12.25 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	125.423	8	15.678	9.077	.000	.348
	Greenhouse-Geisser	125.423	4.836	25.933	9.077	.000	.348
	Huynh-Feldt	125.423	6.993	17.937	9.077	.000	.348
	Lower-bound	125.423	1.000	125.423	9.077	.008	.348
Error(area)	Sphericity Assumed	234.896	136	1.727			
	Greenhouse-Geisser	234.896	82.218	2.857			
	Huynh-Feldt	234.896	118.873	1.976			
	Lower-bound	234.896	17.000	13.817			

General Linear Model – Area Passenger's Side:

Table 12.26 Descriptive Statistics

	Mean	Std. Deviation	N
Lüftung rechts	.463739	.4570969	18
Beifahrersitz	1.328283	1.3840137	18
Gurt Beifahrersitz	.393306	.8311041	18
Handschuhfach	3.233528	2.9380353	18
Beifahrertür	.915050	.6577385	18
verklbeifaber2	.553856	.4140152	18
Beifahrerbereich unten	.741728	.5774363	18

Table 12.27 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	107.432	6	17.905	11.352	.000	.400
	Greenhouse-Geisser	107.432	1.820	59.013	11.352	.000	.400
	Huynh-Feldt	107.432	2.027	53.001	11.352	.000	.400
	Lower-bound	107.432	1.000	107.432	11.352	.004	.400
Error(area)	Sphericity Assumed	160.878	102	1.577			
	Greenhouse-Geisser	160.878	30.948	5.198			
	Huynh-Feldt	160.878	34.458	4.669			
	Lower-bound	160.878	17.000	9.463			

General Linear Model – Area Ceiling:

Table 12.28 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	101.988	5	20.398	8.681	.000	.338
	Greenhouse-Geisser	101.988	2.936	34.734	8.681	.000	.338
	Huynh-Feldt	101.988	3.616	28.205	8.681	.000	.338
	Lower-bound	101.988	1.000	101.988	8.681	.009	.338
Error(area)	Sphericity Assumed	199.724	85	2.350			
	Greenhouse-Geisser	199.724	49.917	4.001			
	Huynh-Feldt	199.724	61.470	3.249			
	Lower-bound	199.724	17.000	11.748			

12.2.5 Analysis of Variance – Laguna

General Linear Model – Areas of Interest:

Table 12.29 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	4663.116	6	777.186	16.945	.000	.514
	Greenhouse-Geisser	4663.116	2.860	1630.533	16.945	.000	.514
	Huynh-Feldt	4663.116	3.548	1314.388	16.945	.000	.514
	Lower-bound	4663.116	1.000	4663.116	16.945	.001	.514
Error(area)	Sphericity Assumed	4403.093	96	45.866			
	Greenhouse-Geisser	4403.093	45.758	96.226			
	Huynh-Feldt	4403.093	56.764	77.568			
	Lower-bound	4403.093	16.000	275.193			

General Linear Model – Influence of Car Expertise:

Table 12.30 Descriptive Statistics

	Gruppe Technik Expertise	Mean	Std. Deviation	N
Bereich Armaturenbrett	Technik Laie	14.56477	4.9642037	9
	Technik Experte	10.60464	3.3494734	8
	Total	12.70118	4.6239855	17
Bereich Lenkrad	Technik Laie	16.65972	6.2411535	9
	Technik Experte	17.45013	7.6638715	8
	Total	17.03168	6.7333424	17
Bereich Mittelkonsole	Technik Laie	22.12282	12.17845	9
	Technik Experte	30.57170	7.2051499	8
	Total	26.09876	10.75944	17
Bereich Gang, Handbremse	Technik Laie	10.44436	6.8907205	9
	Technik Experte	14.49834	3.4770080	8
	Total	12.35211	5.7775936	17
Bereich links, Fahrerseite	Technik Laie	13.01951	5.4050705	9
	Technik Experte	9.549925	3.2802002	8
	Total	11.38676	4.7435540	17
Bereich Beifahrer	Technik Laie	5.712467	3.2445240	9
	Technik Experte	5.483775	4.9290666	8
	Total	5.604847	3.9883179	17
Bereich oben	Technik Laie	8.283611	5.6892506	9
	Technik Experte	6.838588	3.9395155	8
	Total	7.603600	4.8504043	17

Table 12.31 ANOVA for Technical expertise

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	20888.019	1	20888.019	10081.29	.000	.999
grtech	10.621	1	10.621	5.126	.039	.255
Error	31.079	15	2.072			

Table 12.32 Means for Technical expertise

Gruppe Technik Expertise	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Technik Laie	12.972	.181	12.586	13.359
Technik Experte	13.571	.192	13.161	13.981

General Linear Model – Area Instrument panel:

Table 12.33 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	354.579	4	88.645	16.322	.000	.505
	Greenhouse-Geisser	354.579	1.665	212.991	16.322	.000	.505
	Huynh-Feldt	354.579	1.835	193.262	16.322	.000	.505
	Lower-bound	354.579	1.000	354.579	16.322	.001	.505
Error(area)	Sphericity Assumed	347.586	64	5.431			
	Greenhouse-Geisser	347.586	26.636	13.049			
	Huynh-Feldt	347.586	29.355	11.841			
	Lower-bound	347.586	16.000	21.724			

General Linear Model – Area Steering-wheel:

Table 12.34 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	428.599	8	53.575	8.376	.000	.344
	Greenhouse-Geisser	428.599	2.843	150.732	8.376	.000	.344
	Huynh-Feldt	428.599	3.522	121.689	8.376	.000	.344
	Lower-bound	428.599	1.000	428.599	8.376	.011	.344
Error(area)	Sphericity Assumed	818.698	128	6.396			
	Greenhouse-Geisser	818.698	45.495	17.995			
	Huynh-Feldt	818.698	56.353	14.528			
	Lower-bound	818.698	16.000	51.169			

General Linear Model – Area Centre-console:

Table 12.35 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	872.945	8	109.118	15.876	.000	.498
	Greenhouse-Geisser	872.945	3.404	256.441	15.876	.000	.498
	Huynh-Feldt	872.945	4.436	196.808	15.876	.000	.498
	Lower-bound	872.945	1.000	872.945	15.876	.001	.498
Error(area)	Sphericity Assumed	879.752	128	6.873			
	Greenhouse-Geisser	879.752	54.465	16.153			
	Huynh-Feldt	879.752	70.968	12.396			
	Lower-bound	879.752	16.000	54.985			

General Linear Model – Area Gearshift and Handbrake:

Table 12.36 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	121.820	4	30.455	5.545	.001	.257
	Greenhouse-Geisser	121.820	2.782	43.796	5.545	.003	.257
	Huynh-Feldt	121.820	3.426	35.557	5.545	.001	.257
	Lower-bound	121.820	1.000	121.820	5.545	.032	.257
Error(area)	Sphericity Assumed	351.510	64	5.492			
	Greenhouse-Geisser	351.510	44.505	7.898			
	Huynh-Feldt	351.510	54.816	6.413			
	Lower-bound	351.510	16.000	21.969			

General Linear Model – Area left and Driver's Door:

Table 12.37 Descriptive Statistics

	Mean	Std. Deviation	N
Fahrertür inkl. Verkleidungen, Fenster, Türöffnung, Lautsprecher	1.334265	1.2687441	17
Lüftung links	.839694	.9604642	17
Regelung Scheinwerfer	.579682	1.2212357	17
Fensterheberschalter	4.235900	2.0510155	17
Türgriff Fahrertür	.576288	.8435791	17
Seitenspiegel links	1.220612	2.0407392	17
Gurt Fahrersitz	.252041	.5429052	17
Fahrersitz	1.508247	2.4298369	17
Fach in Fahrertür	.840041	2.2138727	17

Table 12.38 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	190.803	8	23.850	8.790	.000	.355
	Greenhouse-Geisser	190.803	2.993	63.749	8.790	.000	.355
	Huynh-Feldt	190.803	3.758	50.771	8.790	.000	.355
	Lower-bound	190.803	1.000	190.803	8.790	.009	.355
Error(area)	Sphericity Assumed	347.304	128	2.713			
	Greenhouse-Geisser	347.304	47.889	7.252			
	Huynh-Feldt	347.304	60.130	5.776			
	Lower-bound	347.304	16.000	21.706			

General Linear Model – Area Passenger's Side:

Table 12.39 Descriptive Statistics

	Mean	Std. Deviation	N
Beifahrertür inkl. Verkleidung zw. Windschutzscheibe u. Beifahrertür und Türöffnung	.670788	1.0177777	17
Lüftung rechts	.430424	.3698723	17
Verkleidung vorne Beifahrerseite	.470582	.4470549	17
Beifahrersitz	1.401376	1.4684475	17
Beifahrerbereich unten	.284771	.3633942	17
Gurt Beifahrersitz	.461900	.5462953	17
Handschuhfach	1.885035	1.9968472	17

Table 12.40 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	37.069	6	6.178	6.533	.000	.290
	Greenhouse-Geisser	37.069	2.561	14.477	6.533	.002	.290
	Huynh-Feldt	37.069	3.090	11.996	6.533	.001	.290
	Lower-bound	37.069	1.000	37.069	6.533	.021	.290
Error(area)	Sphericity Assumed	90.790	96	.946			
	Greenhouse-Geisser	90.790	40.969	2.216			
	Huynh-Feldt	90.790	49.442	1.836			
	Lower-bound	90.790	16.000	5.674			

General Linear Model – Area Ceiling:

Table 12.41 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	107.250	5	21.450	7.109	.000	.308
	Greenhouse-Geisser	107.250	1.600	67.020	7.109	.006	.308
	Huynh-Feldt	107.250	1.750	61.274	7.109	.004	.308
	Lower-bound	107.250	1.000	107.250	7.109	.017	.308
Error(area)	Sphericity Assumed	241.388	80	3.017			
	Greenhouse-Geisser	241.388	25.604	9.428			
	Huynh-Feldt	241.388	28.005	8.619			
	Lower-bound	241.388	16.000	15.087			

12.2.6 Variation of Evaluation Behavior over Time – Clio

General Linear Model – Areas of Interest:

Table 12.42 ANOVA for Time and Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	4.643	4	1.161	1.301	.278	.071
	Greenhouse-Geisser	4.643	2.396	1.938	1.301	.286	.071
	Huynh-Feldt	4.643	2.816	1.649	1.301	.285	.071
	Lower-bound	4.643	1.000	4.643	1.301	.270	.071
Error(time)	Sphericity Assumed	60.668	68	.892			
	Greenhouse-Geisser	60.668	40.730	1.490			
	Huynh-Feldt	60.668	47.872	1.267			
	Lower-bound	60.668	17.000	3.569			
area	Sphericity Assumed	578.410	6	96.402	12.232	.000	.418
	Greenhouse-Geisser	578.410	3.578	161.662	12.232	.000	.418
	Huynh-Feldt	578.410	4.649	124.411	12.232	.000	.418
	Lower-bound	578.410	1.000	578.410	12.232	.003	.418
Error(area)	Sphericity Assumed	803.853	102	7.881			
	Greenhouse-Geisser	803.853	60.824	13.216			
	Huynh-Feldt	803.853	79.036	10.171			
	Lower-bound	803.853	17.000	47.285			
time * area	Sphericity Assumed	307.956	24	12.831	1.670	.026	.089
	Greenhouse-Geisser	307.956	8.857	34.771	1.670	.102	.089
	Huynh-Feldt	307.956	19.332	15.930	1.670	.039	.089
	Lower-bound	307.956	1.000	307.956	1.670	.214	.089
Error(time*area)	Sphericity Assumed	3134.360	408	7.682			
	Greenhouse-Geisser	3134.360	150.565	20.817			
	Huynh-Feldt	3134.360	328.636	9.537			
	Lower-bound	3134.360	17.000	184.374			

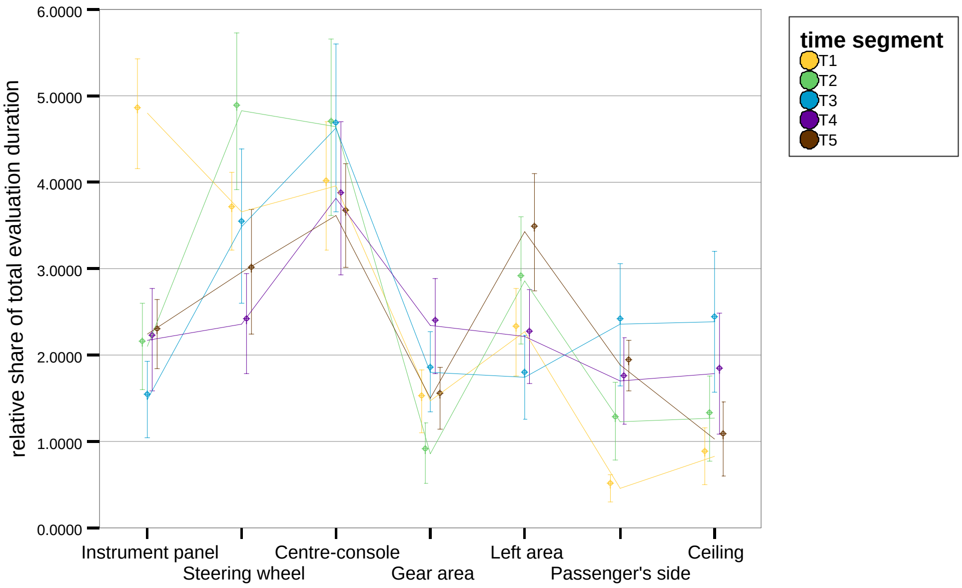


Figure 12.4 Graph displaying interaction between area and time. Dots show means. Error bars show mean +/- 1.0 SE.

General Linear Model – Area Instrument panel:

Table 12.43 Means for Time*Area

time	area	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	1.535	.408	.675	2.396
	2	1.606	.250	1.078	2.135
	3	1.505	.326	.817	2.193
	4	.151	.062	.020	.281
2	1	.567	.167	.215	.919
	2	.685	.217	.229	1.142
	3	.816	.315	.151	1.480
	4	.034	.019	-.006	.075
3	1	.374	.145	.067	.680
	2	.220	.070	.072	.368
	3	.854	.401	.009	1.699
	4	.040	.029	-.022	.101
4	1	.770	.389	-.052	1.591
	2	.666	.244	.151	1.181
	3	.703	.208	.264	1.143
	4	.040	.026	-.015	.096
5	1	.605	.161	.265	.945
	2	.550	.179	.172	.929
	3	.923	.221	.458	1.388
	4	.162	.071	.012	.312

Areas:
1 = tachometer
2 = speed indicator
3 = dashboard display
4 = lining

Table 12.44 ANOVA for Time and Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	29.754	4	7.438	7.314	.000	.301
	Greenhouse-Geisser	29.754	3.659	8.132	7.314	.000	.301
	Huynh-Feldt	29.754	4.000	7.438	7.314	.000	.301
	Lower-bound	29.754	1.000	29.754	7.314	.015	.301
Error(time)	Sphericity Assumed	69.157	68	1.017			
	Greenhouse-Geisser	69.157	62.197	1.112			
	Huynh-Feldt	69.157	68.000	1.017			
	Lower-bound	69.157	17.000	4.068			
area	Sphericity Assumed	39.434	3	13.145	16.766	.000	.497
	Greenhouse-Geisser	39.434	2.221	17.751	16.766	.000	.497
	Huynh-Feldt	39.434	2.570	15.342	16.766	.000	.497
	Lower-bound	39.434	1.000	39.434	16.766	.001	.497
Error(area)	Sphericity Assumed	39.985	51	.784			
	Greenhouse-Geisser	39.985	37.765	1.059			
	Huynh-Feldt	39.985	43.697	.915			
	Lower-bound	39.985	17.000	2.352			
time * area	Sphericity Assumed	11.456	12	.955	1.069	.388	.059
	Greenhouse-Geisser	11.456	3.498	3.275	1.069	.375	.059
	Huynh-Feldt	11.456	4.515	2.538	1.069	.381	.059
	Lower-bound	11.456	1.000	11.456	1.069	.316	.059
Error(time*area)	Sphericity Assumed	182.124	204	.893			
	Greenhouse-Geisser	182.124	59.460	3.063			
	Huynh-Feldt	182.124	76.748	2.373			
	Lower-bound	182.124	17.000	10.713			

Table 12.45 Means of Time

time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	1.199	.158	.865	1.533
2	.526	.126	.259	.792
3	.372	.112	.136	.608
4	.545	.148	.232	.858
5	.560	.100	.350	.771

General Linear Model – Area Steering-wheel:

Table 12.46 Means for Time*Area

time	area	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	1.028	.173	.663	1.392
	2	.330	.137	.040	.619
	3	.879	.232	.391	1.368
	4	.014	.012	-.011	.038
	5	.023	.023	-.025	.071
	6	1.393	.313	.732	2.054
2	1	.434	.096	.231	.637
	2	.658	.280	.067	1.249
	3	2.396	.826	.653	4.139
	4	.434	.285	-.167	1.036
	5	.005	.005	-.005	.015
	6	.899	.275	.318	1.479
3	1	.590	.218	.131	1.049
	2	1.092	.432	.180	2.003
	3	1.308	.438	.384	2.232
	4	.214	.122	-.043	.471
	5	.000	.000	.000	.000
	6	.288	.097	.083	.493
4	1	.202	.065	.065	.340
	2	.619	.478	-.390	1.629
	3	.563	.287	-.043	1.168
	4	.314	.280	-.276	.904
	5	.024	.024	-.027	.074
	6	.641	.184	.254	1.029
5	1	.445	.135	.161	.729
	2	.510	.169	.153	.867
	3	1.259	.554	.090	2.427
	4	.035	.025	-.017	.087
	5	.000	.000	.000	.000
	6	.715	.177	.341	1.089

Areas:
1 = steering-wheel centre
2 = left multifunction switch
3 = right multifunction switch
4 = control of car radio
5 = keyhole
6 = outer regions of st.-wheel

Table 12.47 ANOVA for Time and Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	10.070	4	2.518	1.729	.154	.092
	Greenhouse-Geisser	10.070	2.922	3.446	1.729	.174	.092
	Huynh-Feldt	10.070	3.594	2.802	1.729	.161	.092
	Lower-bound	10.070	1.000	10.070	1.729	.206	.092
Error(time)	Sphericity Assumed	99.027	68	1.456			
	Greenhouse-Geisser	99.027	49.676	1.993			
	Huynh-Feldt	99.027	61.100	1.621			
	Lower-bound	99.027	17.000	5.825			
area	Sphericity Assumed	90.612	5	18.122	12.950	.000	.432
	Greenhouse-Geisser	90.612	2.716	33.365	12.950	.000	.432
	Huynh-Feldt	90.612	3.282	27.607	12.950	.000	.432
	Lower-bound	90.612	1.000	90.612	12.950	.002	.432
Error(area)	Sphericity Assumed	118.949	85	1.399			
	Greenhouse-Geisser	118.949	46.168	2.576			
	Huynh-Feldt	118.949	55.797	2.132			
	Lower-bound	118.949	17.000	6.997			
time * area	Sphericity Assumed	51.142	20	2.557	1.825	.017	.097
	Greenhouse-Geisser	51.142	4.556	11.225	1.825	.124	.097
	Huynh-Feldt	51.142	6.430	7.954	1.825	.096	.097
	Lower-bound	51.142	1.000	51.142	1.825	.194	.097
Error(time*area)	Sphericity Assumed	476.291	340	1.401			
	Greenhouse-Geisser	476.291	77.453	6.149			
	Huynh-Feldt	476.291	109.302	4.358			
	Lower-bound	476.291	17.000	28.017			

General Linear Model – Area Centre-console:

Table 12.48 Means for Time*Area

time	area	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	1.205	.354	.458	1.952
	2	.096	.049	-.006	.199
	3	.348	.115	.106	.591
	4	.734	.209	.293	1.174
	5	.626	.146	.319	.933
	6	.620	.138	.329	.911
	7	.328	.110	.095	.561
2	1	1.389	.482	.372	2.407
	2	.199	.124	-.063	.461
	3	.255	.125	-.009	.518
	4	1.019	.341	.299	1.739
	5	.763	.227	.285	1.242
	6	.634	.181	.252	1.015
	7	.380	.134	.097	.664
3	1	1.597	.447	.654	2.541
	2	.088	.070	-.060	.236
	3	.414	.171	.054	.774
	4	.450	.224	-.023	.923
	5	.514	.138	.222	.805
	6	.626	.164	.280	.973
	7	.941	.270	.370	1.511
4	1	.864	.227	.384	1.344
	2	.438	.321	-.240	1.116
	3	.124	.058	.002	.246
	4	.574	.197	.159	.988
	5	.950	.246	.430	1.469
	6	.609	.203	.180	1.039
	7	.265	.064	.129	.401
5	1	.660	.160	.323	.997
	2	.167	.076	.006	.329
	3	.083	.030	.020	.147
	4	.387	.174	.020	.754
	5	.577	.165	.228	.927
	6	.946	.239	.442	1.450
	7	.802	.302	.165	1.439

Areas:
1 = car radio
2 = warnlinglights switch
3 = control of ventilation
4 = control of air-conditioning
5 = air-conditioning display
6 = central ventilation shaft
7 = central display

Table 12.49 ANOVA for Time and Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	2.289	4	.572	.308	.872	.018
	Greenhouse-Geisser	2.289	3.457	.662	.308	.846	.018
	Huynh-Feldt	2.289	4.000	.572	.308	.872	.018
	Lower-bound	2.289	1.000	2.289	.308	.586	.018
Error(time)	Sphericity Assumed	126.306	68	1.857			
	Greenhouse-Geisser	126.306	58.766	2.149			
	Huynh-Feldt	126.306	68.000	1.857			
	Lower-bound	126.306	17.000	7.430			
area	Sphericity Assumed	54.143	6	9.024	13.227	.000	.438
	Greenhouse-Geisser	54.143	3.347	16.175	13.227	.000	.438
	Huynh-Feldt	54.143	4.267	12.690	13.227	.000	.438
	Lower-bound	54.143	1.000	54.143	13.227	.002	.438
Error(area)	Sphericity Assumed	69.590	102	.682			
	Greenhouse-Geisser	69.590	56.904	1.223			
	Huynh-Feldt	69.590	72.533	.959			
	Lower-bound	69.590	17.000	4.094			
time * area	Sphericity Assumed	26.145	24	1.089	1.591	.039	.086
	Greenhouse-Geisser	26.145	7.410	3.528	1.591	.140	.086
	Huynh-Feldt	26.145	13.699	1.909	1.591	.084	.086
	Lower-bound	26.145	1.000	26.145	1.591	.224	.086
Error(time*area)	Sphericity Assumed	279.328	408	.685			
	Greenhouse-Geisser	279.328	125.964	2.218			
	Huynh-Feldt	279.328	232.876	1.199			
	Lower-bound	279.328	17.000	16.431			

General Linear Model – Area Gearshift:

Table 12.50 Means for Time*Area

time	area	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
1	1	1.178	.336	.470	1.886
	2	.104	.092	-.089	.297
	3	.188	.100	-.023	.399
	4	.000	.000	.000	.000
2	1	.446	.169	.090	.802
	2	.302	.204	-.128	.731
	3	.079	.058	-.043	.200
	4	.041	.041	-.045	.126
3	1	.201	.082	.029	.373
	2	.790	.424	-.104	1.685
	3	.704	.227	.224	1.183
	4	.115	.115	-.127	.357
4	1	.442	.179	.065	.820
	2	.797	.368	.020	1.573
	3	.878	.266	.316	1.440
	4	.226	.132	-.053	.504
5	1	.387	.182	.004	.771
	2	.663	.289	.052	1.273
	3	.456	.215	.003	.909
	4	.000	.000	.000	.000

Areas:
1 = gearshift
2 = cupholder
3 = handbrake lever
4 = cigarette lighter

Table 12.51 ANOVA for Time and Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	5.212	4	1.303	1.386	.248	.075
	Greenhouse-Geisser	5.212	3.308	1.576	1.386	.255	.075
	Huynh-Feldt	5.212	4.000	1.303	1.386	.248	.075
	Lower-bound	5.212	1.000	5.212	1.386	.255	.075
Error(time)	Sphericity Assumed	63.922	68	.940			
	Greenhouse-Geisser	63.922	56.233	1.137			
	Huynh-Feldt	63.922	68.000	.940			
	Lower-bound	63.922	17.000	3.760			
area	Sphericity Assumed	12.859	3	4.286	7.967	.000	.319
	Greenhouse-Geisser	12.859	2.181	5.895	7.967	.001	.319
	Huynh-Feldt	12.859	2.515	5.114	7.967	.001	.319
	Lower-bound	12.859	1.000	12.859	7.967	.012	.319
Error(area)	Sphericity Assumed	27.440	51	.538			
	Greenhouse-Geisser	27.440	37.083	.740			
	Huynh-Feldt	27.440	42.749	.642			
	Lower-bound	27.440	17.000	1.614			
time * area	Sphericity Assumed	20.777	12	1.731	2.062	.021	.108
	Greenhouse-Geisser	20.777	4.783	4.344	2.062	.082	.108
	Huynh-Feldt	20.777	6.884	3.018	2.062	.054	.108
	Lower-bound	20.777	1.000	20.777	2.062	.169	.108
Error(time*area)	Sphericity Assumed	171.271	204	.840			
	Greenhouse-Geisser	171.271	81.313	2.106			
	Huynh-Feldt	171.271	117.022	1.464			
	Lower-bound	171.271	17.000	10.075			

General Linear Model – Area left and Driver's Door:

Table 12.52 Means for Time*Area

time	leftarea	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
1	1	.064	.055	-.053	.181
	2	.567	.196	.153	.981
	3	.271	.116	.027	.515
	4	.699	.294	.078	1.320
	5	.221	.084	.043	.399
	6	.082	.054	-.033	.197
	7	.078	.078	-.087	.244
	8	.287	.090	.098	.476
	9	.000	.000	.000	.000
2	1	.247	.117	-.001	.495
	2	.610	.220	.147	1.074
	3	.477	.185	.086	.868
	4	.861	.251	.333	1.390
	5	.155	.088	-.031	.340
	6	.511	.331	-.188	1.210
	7	.000	.000	.000	.000
	8	.003	.003	-.003	.008
	9	.000	.000	.000	.000
3	1	.147	.099	-.062	.357
	2	.619	.333	-.083	1.322
	3	.156	.076	-.003	.316
	4	.211	.090	.021	.400
	5	.140	.078	-.025	.305
	6	.273	.157	-.058	.603
	7	.085	.085	-.094	.263
	8	.062	.038	-.017	.142
	9	.055	.055	-.061	.171
4	1	.249	.117	.003	.495
	2	.124	.055	.009	.239
	3	.283	.120	.030	.536
	4	.313	.132	.034	.591
	5	.531	.266	-.030	1.092
	6	.040	.028	-.019	.099
	7	.119	.084	-.059	.296
	8	.411	.287	-.194	1.016
	9	.147	.115	-.095	.389
5	1	.266	.153	-.056	.589
	2	.618	.249	.092	1.144
	3	.328	.127	.060	.595
	4	1.003	.349	.267	1.738
	5	.494	.176	.122	.866
	6	.213	.089	.025	.401
	7	.017	.017	-.019	.054
	8	.420	.121	.165	.675
	9	.070	.070	-.077	.217

Areas:
1 = control of headlights
2 = left ventilation shaft
3 = power window switch
4 = control of side mirror
5 = door handle
6 = left side mirror
7 = compartment in door
8 = driver's door
9 = driver's seat and belt

Table 12.53 ANOVA for Time and Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	3.389	4	.847	1.047	.390	.058
	Greenhouse-Geisser	3.389	3.427	.989	1.047	.385	.058
	Huynh-Feldt	3.389	4.000	.847	1.047	.390	.058
	Lower-bound	3.389	1.000	3.389	1.047	.321	.058
Error(time)	Sphericity Assumed	55.037	68	.809			
	Greenhouse-Geisser	55.037	58.255	.945			
	Huynh-Feldt	55.037	68.000	.809			
	Lower-bound	55.037	17.000	3.237			
leftarea	Sphericity Assumed	25.085	8	3.136	9.077	.000	.348
	Greenhouse-Geisser	25.085	4.836	5.187	9.077	.000	.348
	Huynh-Feldt	25.085	6.993	3.587	9.077	.000	.348
	Lower-bound	25.085	1.000	25.085	9.077	.008	.348
Error(leftarea)	Sphericity Assumed	46.979	136	.345			
	Greenhouse-Geisser	46.979	82.219	.571			
	Huynh-Feldt	46.979	118.874	.395			
	Lower-bound	46.979	17.000	2.763			
time * leftarea	Sphericity Assumed	18.247	32	.570	1.314	.119	.072
	Greenhouse-Geisser	18.247	8.719	2.093	1.314	.236	.072
	Huynh-Feldt	18.247	18.711	.975	1.314	.173	.072
	Lower-bound	18.247	1.000	18.247	1.314	.268	.072
Error(time*leftarea)	Sphericity Assumed	236.103	544	.434			
	Greenhouse-Geisser	236.103	148.226	1.593			
	Huynh-Feldt	236.103	318.092	.742			
	Lower-bound	236.103	17.000	13.888			

General Linear Model – Area Passenger's Side:

Table 12.54 Means for Time*Area

time	area	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	.016	.012	-.008	.041
	2	.102	.059	-.023	.226
	3	.000	.000	.000	.000
	4	.162	.068	.019	.305
	5	.038	.021	-.006	.082
	6	.050	.021	.006	.095
	7	.086	.043	-.004	.176
2	1	.052	.022	.005	.100
	2	.353	.173	-.012	.717
	3	.177	.105	-.044	.398
	4	.402	.220	-.061	.866
	5	.042	.019	.003	.081
	6	.057	.052	-.053	.166
	7	.156	.088	-.031	.342
3	1	.106	.053	-.006	.218
	2	.243	.105	.021	.465
	3	.000	.000	.000	.000
	4	1.626	.662	.230	3.022
	5	.113	.045	.019	.207
	6	.177	.076	.017	.337
	7	.089	.028	.030	.148
4	1	.084	.036	.008	.159
	2	.509	.300	-.124	1.143
	3	.000	.000	.000	.000
	4	.671	.212	.224	1.119
	5	.245	.089	.057	.432
	6	.123	.059	.000	.246
	7	.068	.032	.000	.136
5	1	.206	.078	.041	.370
	2	.122	.066	-.017	.260
	3	.216	.128	-.054	.487
	4	.372	.133	.092	.651
	5	.304	.080	.136	.472
	6	.508	.108	.281	.735
	7	.155	.041	.068	.243

Areas:
1 = right ventilation shaft
2 = passenger's seat
3 = passenger's belt
4 = glove compartment
5 = bottom area
6 = passenger's door
7 = lining

Table 12.55 ANOVA for Time and Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	5.330	4	1.333	2.516	.049	.129
	Greenhouse-Geisser	5.330	2.505	2.128	2.516	.081	.129
	Huynh-Feldt	5.330	2.972	1.793	2.516	.069	.129
	Lower-bound	5.330	1.000	5.330	2.516	.131	.129
Error(time)	Sphericity Assumed	36.017	68	.530			
	Greenhouse-Geisser	36.017	42.579	.846			
	Huynh-Feldt	36.017	50.528	.713			
	Lower-bound	36.017	17.000	2.119			
area	Sphericity Assumed	21.487	6	3.581	11.352	.000	.400
	Greenhouse-Geisser	21.487	1.820	11.803	11.352	.000	.400
	Huynh-Feldt	21.487	2.027	10.600	11.352	.000	.400
	Lower-bound	21.487	1.000	21.487	11.352	.004	.400
Error(area)	Sphericity Assumed	32.176	102	.315			
	Greenhouse-Geisser	32.176	30.948	1.040			
	Huynh-Feldt	32.176	34.458	.934			
	Lower-bound	32.176	17.000	1.893			
time * area	Sphericity Assumed	25.643	24	1.068	2.694	.000	.137
	Greenhouse-Geisser	25.643	2.429	10.559	2.694	.069	.137
	Huynh-Feldt	25.643	2.863	8.957	2.694	.059	.137
	Lower-bound	25.643	1.000	25.643	2.694	.119	.137
Error(time*area)	Sphericity Assumed	161.842	408	.397			
	Greenhouse-Geisser	161.842	41.287	3.920			
	Huynh-Feldt	161.842	48.668	3.325			
	Lower-bound	161.842	17.000	9.520			

Table 12.56 Means for Time

time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	.065	.022	.018	.112
2	.177	.064	.043	.311
3	.336	.100	.125	.548
4	.243	.071	.092	.394
5	.269	.042	.180	.357

General Linear Model – Area Ceiling:

Table 12.57 Means for Time*Area

time	ceiling	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	.168	.095	-.034	.369
	2	.392	.182	.008	.777
	3	.233	.210	-.209	.676
	4	.041	.029	-.019	.101
	5	.000	.000	.000	.000
	6	.000	.000	.000	.000
2	1	.439	.222	-.029	.906
	2	.289	.154	-.036	.613
	3	.384	.233	-.108	.876
	4	.138	.085	-.040	.317
	5	.022	.015	-.010	.055
	6	.000	.000	.000	.000
3	1	.743	.422	-.147	1.633
	2	.774	.307	.127	1.421
	3	.638	.323	-.044	1.320
	4	.234	.137	-.056	.523
	5	.000	.000	.000	.000
	6	.000	.000	.000	.000
4	1	.436	.306	-.210	1.082
	2	.481	.201	.058	.905
	3	.646	.292	.030	1.261
	4	.139	.077	-.022	.300
	5	.000	.000	.000	.000
	6	.092	.064	-.043	.226
5	1	.181	.175	-.187	.549
	2	.209	.108	-.019	.438
	3	.485	.410	-.380	1.350
	4	.096	.062	-.034	.226
	5	.061	.029	-.001	.123
	6	.000	.000	.000	.000

Areas:
1 = ceiling light
2 = rear-view mirror
3 = driver's sun visor
4 = passenger's sun visor
5 = passenger's ceiling area
6 = driver's ceiling area

Table 12.58 ANOVA for Time and Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	4.747	4	1.187	1.108	.360	.061
	Greenhouse-Geisser	4.747	2.559	1.855	1.108	.350	.061
	Huynh-Feldt	4.747	3.051	1.556	1.108	.355	.061
	Lower-bound	4.747	1.000	4.747	1.108	.307	.061
Error(time)	Sphericity Assumed	72.826	68	1.071			
	Greenhouse-Geisser	72.826	43.501	1.674			
	Huynh-Feldt	72.826	51.866	1.404			
	Lower-bound	72.826	17.000	4.284			
ceiling	Sphericity Assumed	20.398	5	4.080	8.681	.000	.338
	Greenhouse-Geisser	20.398	2.936	6.947	8.681	.000	.338
	Huynh-Feldt	20.398	3.616	5.641	8.681	.000	.338
	Lower-bound	20.398	1.000	20.398	8.681	.009	.338
Error(ceiling)	Sphericity Assumed	39.945	85	.470			
	Greenhouse-Geisser	39.945	49.917	.800			
	Huynh-Feldt	39.945	61.470	.650			
	Lower-bound	39.945	17.000	2.350			
time * ceiling	Sphericity Assumed	5.420	20	.271	.464	.978	.027
	Greenhouse-Geisser	5.420	6.008	.902	.464	.834	.027
	Huynh-Feldt	5.420	9.658	.561	.464	.906	.027
	Lower-bound	5.420	1.000	5.420	.464	.505	.027
Error(time*ceiling)	Sphericity Assumed	198.525	340	.584			
	Greenhouse-Geisser	198.525	102.144	1.944			
	Huynh-Feldt	198.525	164.181	1.209			
	Lower-bound	198.525	17.000	11.678			

12.2.7 Variation of Evaluation Behavior over Time – Laguna

General Linear Model –Areas of Interest:

Table 12.59 ANOVA for Time and Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	.101	4	.025	.121	.975	.007
	Greenhouse-Geisser	.101	3.055	.033	.121	.950	.007
	Huynh-Feldt	.101	3.857	.026	.121	.972	.007
	Lower-bound	.101	1.000	.101	.121	.733	.007
Error(time)	Sphericity Assumed	13.383	64	.209			
	Greenhouse-Geisser	13.383	48.877	.274			
	Huynh-Feldt	13.383	61.715	.217			
	Lower-bound	13.383	16.000	.836			
area	Sphericity Assumed	931.001	6	155.167	16.878	.000	.513
	Greenhouse-Geisser	931.001	2.860	325.535	16.878	.000	.513
	Huynh-Feldt	931.001	3.548	262.416	16.878	.000	.513
	Lower-bound	931.001	1.000	931.001	16.878	.001	.513
Error(area)	Sphericity Assumed	882.568	96	9.193			
	Greenhouse-Geisser	882.568	45.759	19.287			
	Huynh-Feldt	882.568	56.765	15.548			
	Lower-bound	882.568	16.000	55.160			
time * area	Sphericity Assumed	371.015	24	15.459	1.488	.067	.085
	Greenhouse-Geisser	371.015	8.144	45.556	1.488	.166	.085
	Huynh-Feldt	371.015	17.369	21.360	1.488	.096	.085
	Lower-bound	371.015	1.000	371.015	1.488	.240	.085
Error(time*area)	Sphericity Assumed	3990.714	384	10.392			
	Greenhouse-Geisser	3990.714	130.307	30.626			
	Huynh-Feldt	3990.714	277.909	14.360			
	Lower-bound	3990.714	16.000	249.420			

Table 12.60 Multivariate Tests of Simple main effects analysis of Area within Time

time		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
1	Pillai's trace	.970	58.567[a]	6.000	11.000	.000	.970
	Wilks' lambda	.030	58.567[a]	6.000	11.000	.000	.970
	Hotelling's trace	31.946	58.567[a]	6.000	11.000	.000	.970
	Roy's largest root	31.946	58.567[a]	6.000	11.000	.000	.970
2	Pillai's trace	.716	4.618[a]	6.000	11.000	.014	.716
	Wilks' lambda	.284	4.618[a]	6.000	11.000	.014	.716
	Hotelling's trace	2.519	4.618[a]	6.000	11.000	.014	.716
	Roy's largest root	2.519	4.618[a]	6.000	11.000	.014	.716
3	Pillai's trace	.612	2.890[a]	6.000	11.000	.061	.612
	Wilks' lambda	.388	2.890[a]	6.000	11.000	.061	.612
	Hotelling's trace	1.576	2.890[a]	6.000	11.000	.061	.612
	Roy's largest root	1.576	2.890[a]	6.000	11.000	.061	.612
4	Pillai's trace	.590	2.639[a]	6.000	11.000	.078	.590
	Wilks' lambda	.410	2.639[a]	6.000	11.000	.078	.590
	Hotelling's trace	1.440	2.639[a]	6.000	11.000	.078	.590
	Roy's largest root	1.440	2.639[a]	6.000	11.000	.078	.590
5	Pillai's trace	.466	1.603[a]	6.000	11.000	.235	.466
	Wilks' lambda	.534	1.603[a]	6.000	11.000	.235	.466
	Hotelling's trace	.874	1.603[a]	6.000	11.000	.235	.466
	Roy's largest root	.874	1.603[a]	6.000	11.000	.235	.466

Each F tests the multivariate simple effects of area within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

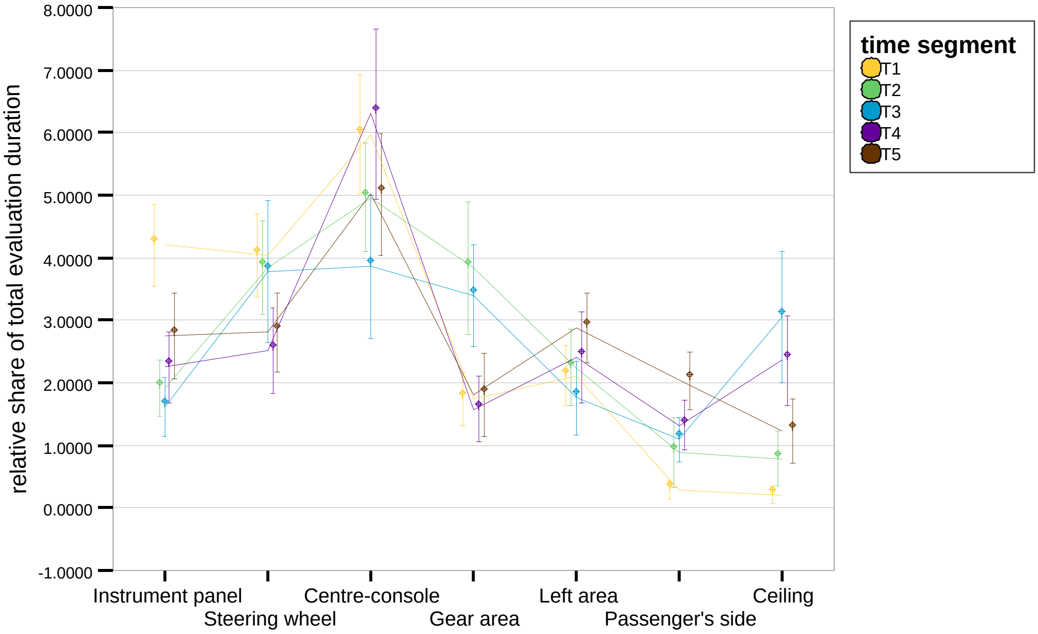


Figure 12.5 Graph displaying interaction between areas and time. Dots show means. Error bars show mean +/- 1.0 SE

General Linear Model – Area Instrument panel:

Table 12.61 Means for Time*Area

time	area	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
1	1	.995	.206	.558	1.432
	2	.687	.145	.380	.994
	3	2.051	.429	1.143	2.960
	4	.375	.090	.184	.566
	5	.088	.035	.013	.162
2	1	.586	.211	.139	1.033
	2	.239	.081	.066	.411
	3	.935	.256	.393	1.477
	4	.050	.026	-.005	.105
	5	.096	.062	-.035	.228
3	1	.357	.114	.116	.598
	2	.465	.236	-.035	.965
	3	.594	.209	.151	1.036
	4	.085	.065	-.054	.223
	5	.115	.042	.026	.203
4	1	.718	.374	-.075	1.510
	2	.192	.070	.043	.341
	3	1.109	.305	.462	1.756
	4	.117	.053	.005	.228
	5	.110	.051	.001	.218
5	1	.438	.123	.178	.698
	2	.334	.103	.116	.552
	3	1.537	.590	.286	2.789
	4	.244	.109	.013	.476
	5	.186	.057	.065	.307

Areas:
1 = tachometer
2 = speed indicator
3 = dashboard display
4 = fuel gauge
5 = lining

Table 12.62 ANOVA for Time and Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	14.029	4	3.507	2.973	.026	.157
	Greenhouse-Geisser	14.029	2.865	4.896	2.973	.044	.157
	Huynh-Feldt	14.029	3.556	3.945	2.973	.032	.157
	Lower-bound	14.029	1.000	14.029	2.973	.104	.157
Error(time)	Sphericity Assumed	75.492	64	1.180			
	Greenhouse-Geisser	75.492	45.844	1.647			
	Huynh-Feldt	75.492	56.899	1.327			
	Lower-bound	75.492	16.000	4.718			
area	Sphericity Assumed	70.916	4	17.729	16.322	.000	.505
	Greenhouse-Geisser	70.916	1.665	42.598	16.322	.000	.505
	Huynh-Feldt	70.916	1.835	38.652	16.322	.000	.505
	Lower-bound	70.916	1.000	70.916	16.322	.001	.505
Error(area)	Sphericity Assumed	69.517	64	1.086			
	Greenhouse-Geisser	69.517	26.636	2.610			
	Huynh-Feldt	69.517	29.356	2.368			
	Lower-bound	69.517	16.000	4.345			
time * area	Sphericity Assumed	15.973	16	.998	1.725	.042	.097
	Greenhouse-Geisser	15.973	4.247	3.761	1.725	.151	.097
	Huynh-Feldt	15.973	5.972	2.675	1.725	.124	.097
	Lower-bound	15.973	1.000	15.973	1.725	.208	.097
Error(time*area)	Sphericity Assumed	148.180	256	.579			
	Greenhouse-Geisser	148.180	67.945	2.181			
	Huynh-Feldt	148.180	95.552	1.551			
	Lower-bound	148.180	16.000	9.261			

Table 12.63 Means for Time

time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	.839	.132	.559	1.120
2	.381	.089	.192	.570
3	.323	.094	.124	.522
4	.449	.112	.211	.687
5	.548	.137	.258	.838

Table 12.64 Pairwise Comparisons for Time – LSD corrected

(I) time	(J) time	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	.458*	.159	.011	.121	.795
	3	.516*	.166	.007	.164	.868
	4	.390	.200	.069	-.034	.814
	5	.291	.227	.218	-.190	.773
2	1	-.458*	.159	.011	-.795	-.121
	3	.058	.142	.687	-.242	.359
	4	-.068	.118	.574	-.319	.183
	5	-.167	.150	.284	-.486	.152
3	1	-.516*	.166	.007	-.868	-.164
	2	-.058	.142	.687	-.359	.242
	4	-.126	.165	.456	-.476	.223
	5	-.225	.171	.207	-.587	.137
4	1	-.390	.200	.069	-.814	.034
	2	.068	.118	.574	-.183	.319
	3	.126	.165	.456	-.223	.476
	5	-.099	.141	.494	-.398	.201
5	1	-.291	.227	.218	-.773	.190
	2	.167	.150	.284	-.152	.486
	3	.225	.171	.207	-.137	.587
	4	.099	.141	.494	-.201	.398

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

General Linear Model – Area Steering-wheel:

Table 12.65 Means for Time*Area

time	area	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
1	1	.666	.181	.282	1.050
	2	.310	.106	.086	.534
	3	.094	.053	-.019	.207
	4	1.034	.323	.351	1.718
	5	1.034	.245	.515	1.553
	6	.050	.047	-.051	.150
	7	.000	.000	.000	.000
	8	.391	.116	.144	.638
	9	.449	.130	.174	.725
2	1	.239	.084	.060	.417
	2	.094	.038	.013	.175
	3	.042	.034	-.029	.113
	4	.751	.288	.141	1.361
	5	1.985	.705	.489	3.480
	6	.260	.127	-.009	.529
	7	.000	.000	.000	.000
	8	.288	.102	.073	.504
	9	.182	.060	.055	.310
3	1	.332	.150	.015	.649
	2	.106	.051	-.002	.215
	3	.027	.019	-.013	.067
	4	1.301	.668	-.114	2.716
	5	.856	.404	8.03E-005	1.712
	6	.618	.584	-.619	1.855
	7	.000	.000	.000	.000
	8	.242	.094	.043	.441
	9	.297	.169	-.061	.654
4	1	.307	.140	.010	.604
	2	.204	.094	.004	.403
	3	.252	.155	-.077	.580
	4	.498	.294	-.126	1.121
	5	.362	.132	.083	.641
	6	.638	.626	-.690	1.965
	7	.077	.077	-.086	.240
	8	.042	.029	-.019	.103
	9	.139	.058	.015	.263
5	1	.309	.094	.110	.509
	2	.165	.039	.083	.247
	3	.073	.032	.006	.140
	4	.387	.116	.140	.634
	5	1.324	.502	.261	2.388
	6	.296	.152	-.026	.617
	7	.000	.000	.000	.000
	8	.114	.080	-.056	.284
	9	.140	.044	.046	.234

Areas:
1 = steering-wheel centre
2 = steering-wheel top
3 = steering-wheel bottom
4 = left multifunction switch
5 = right multifunction switch
6 = control of car radio
7 = adjustability of steering-w.
8 = right side of steering-wheel
9 = left side of steering-wheel

Table 12.66 ANOVA for Time and Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	3.515	4	.879	.708	.590	.042
	Greenhouse-Geisser	3.515	3.193	1.101	.708	.560	.042
	Huynh-Feldt	3.515	4.000	.879	.708	.590	.042
	Lower-bound	3.515	1.000	3.515	.708	.413	.042
Error(time)	Sphericity Assumed	79.478	64	1.242			
	Greenhouse-Geisser	79.478	51.091	1.556			
	Huynh-Feldt	79.478	64.000	1.242			
	Lower-bound	79.478	16.000	4.967			
area	Sphericity Assumed	85.720	8	10.715	8.376	.000	.344
	Greenhouse-Geisser	85.720	2.843	30.146	8.376	.000	.344
	Huynh-Feldt	85.720	3.522	24.338	8.376	.000	.344
	Lower-bound	85.720	1.000	85.720	8.376	.011	.344
Error(area)	Sphericity Assumed	163.739	128	1.279			
	Greenhouse-Geisser	163.739	45.495	3.599			
	Huynh-Feldt	163.739	56.354	2.906			
	Lower-bound	163.739	16.000	10.234			
time * area	Sphericity Assumed	40.579	32	1.268	1.335	.107	.077
	Greenhouse-Geisser	40.579	4.908	8.269	1.335	.259	.077
	Huynh-Feldt	40.579	7.341	5.528	1.335	.237	.077
	Lower-bound	40.579	1.000	40.579	1.335	.265	.077
Error(time*area)	Sphericity Assumed	486.262	512	.950			
	Greenhouse-Geisser	486.262	78.522	6.193			
	Huynh-Feldt	486.262	117.456	4.140			
	Lower-bound	486.262	16.000	30.391			

General Linear Model – Area Centre-console:

Table 12.67 ANOVA for Time and Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	6.967	4	1.742	.838	.506	.050
	Greenhouse-Geisser	6.967	2.863	2.433	.838	.476	.050
	Huynh-Feldt	6.967	3.553	1.961	.838	.496	.050
	Lower-bound	6.967	1.000	6.967	.838	.374	.050
Error(time)	Sphericity Assumed	133.084	64	2.079			
	Greenhouse-Geisser	133.084	45.815	2.905			
	Huynh-Feldt	133.084	56.854	2.341			
	Lower-bound	133.084	16.000	8.318			
area	Sphericity Assumed	174.567	8	21.821	15.877	.000	.498
	Greenhouse-Geisser	174.567	3.404	51.284	15.877	.000	.498
	Huynh-Feldt	174.567	4.435	39.359	15.877	.000	.498
	Lower-bound	174.567	1.000	174.567	15.877	.001	.498
Error(area)	Sphericity Assumed	175.920	128	1.374			
	Greenhouse-Geisser	175.920	54.463	3.230			
	Huynh-Feldt	175.920	70.964	2.479			
	Lower-bound	175.920	16.000	10.995			
time * area	Sphericity Assumed	33.643	32	1.051	.700	.892	.042
	Greenhouse-Geisser	33.643	6.214	5.414	.700	.655	.042
	Huynh-Feldt	33.643	10.590	3.177	.700	.732	.042
	Lower-bound	33.643	1.000	33.643	.700	.415	.042
Error(time*area)	Sphericity Assumed	768.841	512	1.502			
	Greenhouse-Geisser	768.841	99.423	7.733			
	Huynh-Feldt	768.841	169.443	4.537			
	Lower-bound	768.841	16.000	48.053			

Table 12.68 Means for Time*Area

time	area	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
1	1	1.637	.395	.799	2.475
	2	.330	.139	.036	.624
	3	.079	.062	-.052	.211
	4	1.321	.484	.295	2.347
	5	1.610	.579	.383	2.837
	6	.185	.069	.039	.331
	7	.004	.004	-.004	.011
	8	.566	.164	.217	.914
	9	.237	.060	.110	.364
2	1	1.355	.525	.243	2.468
	2	.229	.076	.068	.390
	3	.066	.033	-.004	.135
	4	1.629	.489	.592	2.666
	5	.816	.396	-.024	1.657
	6	.206	.066	.066	.345
	7	.000	.000	.000	.000
	8	.583	.170	.223	.943
	9	.081	.042	-.008	.171
3	1	.802	.456	-.165	1.769
	2	.426	.210	-.020	.872
	3	.063	.046	-.035	.160
	4	1.203	.610	-.091	2.498
	5	.597	.358	-.163	1.357
	6	.188	.087	.005	.372
	7	.025	.025	-.028	.079
	8	.402	.134	.117	.686
	9	.147	.041	.059	.234
4	1	1.311	.481	.291	2.330
	2	.544	.237	.042	1.046
	3	.224	.136	-.065	.513
	4	1.667	.819	-.070	3.404
	5	.539	.176	.166	.911
	6	.233	.106	.009	.457
	7	.076	.053	-.036	.189
	8	1.517	.546	.359	2.674
	9	.186	.046	.088	.283
5	1	1.190	.412	.316	2.063
	2	.246	.116	-.001	.493
	3	.025	.025	-.028	.079
	4	1.063	.399	.218	1.908
	5	.977	.243	.462	1.491
	6	.166	.074	.009	.324
	7	.376	.245	-.145	.896
	8	.667	.186	.272	1.062
	9	.303	.089	.115	.491

Areas:
1 = control of heating
2 = warninglights switch
3 = starter button
4 = car radio
5 = central display
6 = keycard holder
7 = cupholder
8 = lining
9 = ventilation shafts

General Linear Model – Area Gearshift:

Table 12.69 Means for Time*Area

time	area	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	1.124	.339	.404	1.843
	2	.115	.070	-.033	.262
	3	.273	.184	-.118	.664
	4	.090	.065	-.048	.227
	5	.141	.110	-.092	.373
2	1	1.613	.551	.444	2.782
	2	.946	.383	.135	1.757
	3	1.148	.490	.109	2.187
	4	.041	.041	-.046	.127
	5	.084	.084	-.094	.262
3	1	.347	.172	-.019	.712
	2	.640	.363	-.129	1.409
	3	1.006	.471	.007	2.005
	4	.099	.062	-.031	.230
	5	1.301	.599	.031	2.570
4	1	.248	.113	.009	.488
	2	.501	.324	-.185	1.186
	3	.669	.335	-.040	1.378
	4	.041	.041	-.046	.129
	5	.119	.066	-.021	.259
5	1	.417	.139	.122	.712
	2	.164	.105	-.058	.386
	3	.521	.264	-.038	1.081
	4	.169	.080	2.42E-005	.337
	5	.537	.292	-.083	1.157

Areas:
1 = gearshift
2 = silver box
3 = handbrake switch
4 = compartment behind gearshift
5 = arm-rest

General Linear Model – Area left and Driver's Door:

Table 12.70 Means for Time*Area

time	area	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	.260	.114	.018	.503
	2	.010	.006	-.002	.022
	3	.912	.339	.193	1.632
	4	.191	.154	-.135	.516
	5	.031	.031	-.035	.097
	6	.000	.000	.000	.000
	7	.238	.076	.077	.400
	8	.468	.285	-.135	1.072
2	1	.217	.122	-.042	.476
	2	.181	.181	-.202	.564
	3	1.095	.396	.256	1.935
	4	.036	.036	-.041	.114
	5	.163	.077	-.001	.326
	6	.000	.000	.000	.000
	7	.156	.077	-.008	.319
	8	.387	.301	-.251	1.026
3	1	.091	.046	-.006	.188
	2	.064	.044	-.028	.156
	3	.337	.199	-.085	.759
	4	.180	.101	-.033	.393
	5	.531	.390	-.297	1.359
	6	.265	.265	-.296	.825
	7	.263	.147	-.050	.575
	8	.023	.023	-.026	.072
4	1	.156	.100	-.056	.368
	2	.122	.095	-.080	.324
	3	.880	.470	-.117	1.877
	4	.064	.033	-.005	.134
	5	.060	.045	-.034	.155
	6	.431	.255	-.110	.971
	7	.201	.099	-.008	.411
	8	.491	.255	-.049	1.031
5	1	.116	.066	-.025	.257
	2	.203	.147	-.109	.515
	3	1.011	.402	.158	1.864
	4	.105	.059	-.021	.231
	5	.435	.179	.056	.814
	6	.145	.119	-.108	.397
	7	.476	.171	.115	.838
	8	.390	.331	-.312	1.093

Areas:
1 = left ventilation shaft
2 = control of headlights
3 = powerwindow switch
4 = door handle
5 = left side mirror
6 = compartment in door
7 = driver's door
8 = driver's seat and belt

Table 12.71 ANOVA for Time and Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	1.456	4	.364	.445	.775	.027
	Greenhouse-Geisser	1.456	3.428	.425	.445	.747	.027
	Huynh-Feldt	1.456	4.000	.364	.445	.775	.027
	Lower-bound	1.456	1.000	1.456	.445	.514	.027
Error(time)	Sphericity Assumed	52.309	64	.817			
	Greenhouse-Geisser	52.309	54.841	.954			
	Huynh-Feldt	52.309	64.000	.817			
	Lower-bound	52.309	16.000	3.269			
area	Sphericity Assumed	34.623	7	4.946	7.937	.000	.332
	Greenhouse-Geisser	34.623	2.794	12.390	7.937	.000	.332
	Huynh-Feldt	34.623	3.446	10.048	7.937	.000	.332
	Lower-bound	34.623	1.000	34.623	7.937	.012	.332
Error(area)	Sphericity Assumed	69.797	112	.623			
	Greenhouse-Geisser	69.797	44.709	1.561			
	Huynh-Feldt	69.797	55.132	1.266			
	Lower-bound	69.797	16.000	4.362			
time * area	Sphericity Assumed	14.918	28	.533	.781	.783	.047
	Greenhouse-Geisser	14.918	6.682	2.232	.781	.599	.047
	Huynh-Feldt	14.918	11.977	1.246	.781	.670	.047
	Lower-bound	14.918	1.000	14.918	.781	.390	.047
Error(time*area)	Sphericity Assumed	305.688	448	.682			
	Greenhouse-Geisser	305.688	106.917	2.859			
	Huynh-Feldt	305.688	191.634	1.595			
	Lower-bound	305.688	16.000	19.105			

General Linear Model – Area Passenger's Side:

Table 12.72 Means for Time*Area

				95% Confidence Interval	
time	area	Mean	Std. Error	Lower Bound	Upper Bound
1	1	.030	.021	-.015	.075
	2	.028	.026	-.027	.082
	3	.018	.018	-.020	.055
	4	.042	.021	-.003	.086
	5	.012	.012	-.013	.037
	6	.131	.109	-.099	.362
	7	.017	.012	-.008	.042
2	1	.053	.024	.003	.103
	2	.113	.061	-.017	.243
	3	.016	.012	-.008	.041
	4	.003	.003	-.003	.009
	5	.047	.033	-.022	.116
	6	.565	.504	-.504	1.633
	7	.090	.037	.012	.169
3	1	.078	.029	.018	.139
	2	.021	.013	-.007	.050
	3	.438	.216	-.020	.896
	4	.041	.019	5.99E-005	.081
	5	.155	.066	.016	.295
	6	.256	.098	.048	.463
	7	.100	.042	.011	.189
4	1	.135	.053	.022	.247
	2	.140	.056	.021	.258
	3	.306	.209	-.136	.748
	4	.018	.016	-.016	.053
	5	.093	.065	-.045	.231
	6	.503	.190	.101	.905
	7	.123	.081	-.049	.296
5	1	.135	.042	.046	.224
	2	.169	.088	-.018	.356
	3	.623	.243	.109	1.137
	4	.181	.082	.007	.355
	5	.155	.085	-.024	.334
	6	.431	.222	-.041	.902
	7	.340	.170	-.020	.700

Areas:
1 = right ventilation shaft
2 = lining
3 = passenger's seat
4 = bottom area
5 = passenger's seat-belt
6 = glove compartment
7 = passenger's door

Table 12.73 ANOVA for Time and Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	3.984	4	.996	2.526	.049	.136
	Greenhouse-Geisser	3.984	2.812	1.417	2.526	.073	.136
	Huynh-Feldt	3.984	3.473	1.147	2.526	.059	.136
	Lower-bound	3.984	1.000	3.984	2.526	.132	.136
Error(time)	Sphericity Assumed	25.237	64	.394			
	Greenhouse-Geisser	25.237	44.989	.561			
	Huynh-Feldt	25.237	55.566	.454			
	Lower-bound	25.237	16.000	1.577			
area	Sphericity Assumed	7.414	6	1.236	6.533	.000	.290
	Greenhouse-Geisser	7.414	2.561	2.895	6.533	.002	.290
	Huynh-Feldt	7.414	3.090	2.399	6.533	.001	.290
	Lower-bound	7.414	1.000	7.414	6.533	.021	.290
Error(area)	Sphericity Assumed	18.158	96	.189			
	Greenhouse-Geisser	18.158	40.969	.443			
	Huynh-Feldt	18.158	49.442	.367			
	Lower-bound	18.158	16.000	1.135			
time * area	Sphericity Assumed	5.085	24	.212	.730	.821	.044
	Greenhouse-Geisser	5.085	3.110	1.635	.730	.544	.044
	Huynh-Feldt	5.085	3.947	1.288	.730	.573	.044
	Lower-bound	5.085	1.000	5.085	.730	.405	.044
Error(time*area)	Sphericity Assumed	111.437	384	.290			
	Greenhouse-Geisser	111.437	49.762	2.239			
	Huynh-Feldt	111.437	63.146	1.765			
	Lower-bound	111.437	16.000	6.965			

Table 12.74 Means for Time

			95% Confidence Interval	
time	Mean	Std. Error	Lower Bound	Upper Bound
1	.040	.022	-.007	.086
2	.127	.081	-.044	.297
3	.156	.050	.050	.262
4	.188	.057	.068	.308
5	.291	.066	.150	.431

General Linear Model – Area Ceiling:

Table 12.75 Means for Time*Area

				95% Confidence Interval	
time	area	Mean	Std. Error	Lower Bound	Upper Bound
1	1	.047	.031	-.018	.112
	2	.139	.097	-.066	.344
	3	.000	.000	.000	.000
	4	.022	.015	-.009	.054
	5	.000	.000	.000	.000
	6	.000	.000	.000	.000
2	1	.318	.218	-.144	.779
	2	.143	.143	-.160	.446
	3	.033	.027	-.024	.089
	4	.279	.113	.039	.520
	5	.004	.004	-.005	.014
	6	.000	.000	.000	.000
3	1	.811	.334	.102	1.520
	2	.850	.355	.098	1.602
	3	.121	.094	-.078	.320
	4	1.217	.576	-.003	2.438
	5	.039	.027	-.018	.097
	6	.000	.000	.000	.000
4	1	.274	.182	-.112	.659
	2	.840	.374	.048	1.632
	3	.331	.160	-.007	.670
	4	.597	.357	-.161	1.355
	5	.144	.113	-.096	.383
	6	.168	.168	-.189	.525
5	1	.266	.149	-.049	.581
	2	.044	.034	-.028	.116
	3	.081	.071	-.071	.232
	4	.807	.380	.000	1.614
	5	.028	.020	-.014	.069
	6	.000	.000	.000	.000

Areas:
1 = ceiling light
2 = driver's sun visor
3 = passenger's sun visor
4 = rear-view mirror
5 = passenger's ceiling area
6 = driver's ceiling area

Table 12.76 ANOVA for Time*Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	15.191	4	3.798	2.953	.027	.156
	Greenhouse-Geisser	15.191	2.233	6.804	2.953	.060	.156
	Huynh-Feldt	15.191	2.612	5.816	2.953	.050	.156
	Lower-bound	15.191	1.000	15.191	2.953	.105	.156
Error(time)	Sphericity Assumed	82.321	64	1.286			
	Greenhouse-Geisser	82.321	35.725	2.304			
	Huynh-Feldt	82.321	41.790	1.970			
	Lower-bound	82.321	16.000	5.145			
area	Sphericity Assumed	21.450	5	4.290	7.109	.000	.308
	Greenhouse-Geisser	21.450	1.600	13.404	7.109	.006	.308
	Huynh-Feldt	21.450	1.750	12.255	7.109	.004	.308
	Lower-bound	21.450	1.000	21.450	7.109	.017	.308
Error(area)	Sphericity Assumed	48.277	80	.603			
	Greenhouse-Geisser	48.277	25.604	1.886			
	Huynh-Feldt	48.277	28.005	1.724			
	Lower-bound	48.277	16.000	3.017			
time * area	Sphericity Assumed	17.770	20	.889	1.526	.071	.087
	Greenhouse-Geisser	17.770	4.513	3.937	1.526	.198	.087
	Huynh-Feldt	17.770	6.506	2.732	1.526	.172	.087
	Lower-bound	17.770	1.000	17.770	1.526	.235	.087
Error(time*area)	Sphericity Assumed	186.333	320	.582			
	Greenhouse-Geisser	186.333	72.213	2.580			
	Huynh-Feldt	186.333	104.088	1.790			
	Lower-bound	186.333	16.000	11.646			

Table 12.77 Means for Time

			95% Confidence Interval	
time	Mean	Std. Error	Lower Bound	Upper Bound
1	.035	.022	-.012	.081
2	.130	.073	-.026	.285
3	.506	.175	.135	.877
4	.392	.119	.139	.645
5	.204	.086	.022	.387

Table 12.78 Pairwise Comparisons for Time

					95% Confidence Interval for Difference[a]	
(I) time	(J) time	Mean Difference (I-J)	Std. Error	Sig.[a]	Lower Bound	Upper Bound
1	2	-.095	.073	.212	-.250	.060
	3	-.472*	.181	.019	-.856	-.088
	4	-.358*	.128	.013	-.629	-.086
	5	-.170	.088	.073	-.357	.018
2	1	.095	.073	.212	-.060	.250
	3	-.377	.207	.087	-.815	.061
	4	-.263	.149	.097	-.578	.053
	5	-.075	.113	.516	-.313	.164
3	1	.472*	.181	.019	.088	.856
	2	.377	.207	.087	-.061	.815
	4	.114	.221	.612	-.354	.582
	5	.302	.217	.184	-.159	.763
4	1	.358*	.128	.013	.086	.629
	2	.263	.149	.097	-.053	.578
	3	-.114	.221	.612	-.582	.354
	5	.188	.128	.160	-.082	.458
5	1	.170	.088	.073	-.018	.357
	2	.075	.113	.516	-.164	.313
	3	-.302	.217	.184	-.763	.159
	4	-.188	.128	.160	-.458	.082

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

12.2.8 First Fixations on Areas of Interest

Table 12.79 ANOVA for Area in Clio

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	24055.256	6	4009.209	12.561	.000	.425
	Greenhouse-Geisser	24055.256	3.023	7956.563	12.561	.000	.425
	Huynh-Feldt	24055.256	3.751	6413.845	12.561	.000	.425
	Lower-bound	24055.256	1.000	24055.256	12.561	.002	.425
Error(area)	Sphericity Assumed	32555.267	102	319.169			
	Greenhouse-Geisser	32555.267	51.396	633.414			
	Huynh-Feldt	32555.267	63.759	510.600			
	Lower-bound	32555.267	17.000	1915.016			

Table 12.80 ANOVA for Area in Laguna

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	63754.757	6	10625.793	14.628	.000	.478
	Greenhouse-Geisser	63754.757	2.520	25303.531	14.628	.000	.478
	Huynh-Feldt	63754.757	3.029	21047.577	14.628	.000	.478
	Lower-bound	63754.757	1.000	63754.757	14.628	.001	.478
Error(area)	Sphericity Assumed	69732.660	96	726.382			
	Greenhouse-Geisser	69732.660	40.314	1729.756			
	Huynh-Feldt	69732.660	48.465	1438.818			
	Lower-bound	69732.660	16.000	4358.291			

12.2.9 Comparison of Clio and Laguna Interior

Table 12.81 ANOVA for Car and Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
car	Sphericity Assumed	43.774	1	43.774	11.645	.004	.437
	Greenhouse-Geisser	43.774	1.000	43.774	11.645	.004	.437
	Huynh-Feldt	43.774	1.000	43.774	11.645	.004	.437
	Lower-bound	43.774	1.000	43.774	11.645	.004	.437
Error(car)	Sphericity Assumed	56.387	15	3.759			
	Greenhouse-Geisser	56.387	15.000	3.759			
	Huynh-Feldt	56.387	15.000	3.759			
	Lower-bound	56.387	15.000	3.759			
area	Sphericity Assumed	6589.908	6	1098.318	17.698	.000	.541
	Greenhouse-Geisser	6589.908	2.789	2363.075	17.698	.000	.541
	Huynh-Feldt	6589.908	3.490	1888.147	17.698	.000	.541
	Lower-bound	6589.908	1.000	6589.908	17.698	.001	.541
Error(area)	Sphericity Assumed	5585.286	90	62.059			
	Greenhouse-Geisser	5585.286	41.831	133.522			
	Huynh-Feldt	5585.286	52.352	106.687			
	Lower-bound	5585.286	15.000	372.352			
car * area	Sphericity Assumed	354.146	6	59.024	2.574	.024	.146
	Greenhouse-Geisser	354.146	3.100	114.258	2.574	.063	.146
	Huynh-Feldt	354.146	3.999	88.554	2.574	.047	.146
	Lower-bound	354.146	1.000	354.146	2.574	.129	.146
Error(car*area)	Sphericity Assumed	2063.530	90	22.928			
	Greenhouse-Geisser	2063.530	46.493	44.384			
	Huynh-Feldt	2063.530	59.988	34.399			
	Lower-bound	2063.530	15.000	137.569			

Table 12.82 Means for Car

			95% Confidence Interval	
car	Mean	Std. Error	Lower Bound	Upper Bound
1	12.346	.275	11.760	12.931
2	13.230	.155	12.899	13.561

Table 12.83 Multivariate Tests of Simple main effects of Car within Area

area		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
1	Pillai's trace	.015	.233[a]	1.000	15.000	.637	.015
	Wilks' lambda	.985	.233[a]	1.000	15.000	.637	.015
	Hotelling's trace	.016	.233[a]	1.000	15.000	.637	.015
	Roy's largest root	.016	.233[a]	1.000	15.000	.637	.015
2	Pillai's trace	.072	1.156[a]	1.000	15.000	.299	.072
	Wilks' lambda	.928	1.156[a]	1.000	15.000	.299	.072
	Hotelling's trace	.077	1.156[a]	1.000	15.000	.299	.072
	Roy's largest root	.077	1.156[a]	1.000	15.000	.299	.072
3	Pillai's trace	.174	3.168[a]	1.000	15.000	.095	.174
	Wilks' lambda	.826	3.168[a]	1.000	15.000	.095	.174
	Hotelling's trace	.211	3.168[a]	1.000	15.000	.095	.174
	Roy's largest root	.211	3.168[a]	1.000	15.000	.095	.174
4	Pillai's trace	.354	8.203[a]	1.000	15.000	.012	.354
	Wilks' lambda	.646	8.203[a]	1.000	15.000	.012	.354
	Hotelling's trace	.547	8.203[a]	1.000	15.000	.012	.354
	Roy's largest root	.547	8.203[a]	1.000	15.000	.012	.354
5	Pillai's trace	.043	.668[a]	1.000	15.000	.426	.043
	Wilks' lambda	.957	.668[a]	1.000	15.000	.426	.043
	Hotelling's trace	.045	.668[a]	1.000	15.000	.426	.043
	Roy's largest root	.045	.668[a]	1.000	15.000	.426	.043
6	Pillai's trace	.315	6.903[a]	1.000	15.000	.019	.315
	Wilks' lambda	.685	6.903[a]	1.000	15.000	.019	.315
	Hotelling's trace	.460	6.903[a]	1.000	15.000	.019	.315
	Roy's largest root	.460	6.903[a]	1.000	15.000	.019	.315
7	Pillai's trace	.033	.505[a]	1.000	15.000	.488	.033
	Wilks' lambda	.967	.505[a]	1.000	15.000	.488	.033
	Hotelling's trace	.034	.505[a]	1.000	15.000	.488	.033
	Roy's largest root	.034	.505[a]	1.000	15.000	.488	.033

Each F tests the multivariate simple effects of car within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

Table 12.84 Pairwise Comparisons of Simple main effects of Car within Area

area	(I) car	(J) car	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
						Lower Bound	Upper Bound
1	1	2	.978	2.028	.637	-3.345	5.301
	2	1	-.978	2.028	.637	-5.301	3.345
2	1	2	-1.452	1.351	.299	-4.332	1.427
	2	1	1.452	1.351	.299	-1.427	4.332
3	1	2	-4.209	2.365	.095	-9.250	.831
	2	1	4.209	2.365	.095	-.831	9.250
4	1	2	-4.605*	1.608	.012	-8.032	-1.178
	2	1	4.605*	1.608	.012	1.178	8.032
5	1	2	1.181	1.445	.426	-1.898	4.261
	2	1	-1.181	1.445	.426	-4.261	1.898
6	1	2	2.462*	.937	.019	.465	4.459
	2	1	-2.462*	.937	.019	-4.459	-.465
7	1	2	-.543	.764	.488	-2.172	1.086
	2	1	.543	.764	.488	-1.086	2.172

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Sidak.

12.2.10 Driving Scenario

Comparison of Driving Scenarios:

Table 12.85 Descriptive Statistics

	driving scenario	Mean	Std. Deviation	N
Road and traffic	city	94.52500	4.2234314	17
	highway	88.85563	10.54903	20
	Total	91.46047	8.6524154	37
Instrument panel	city	1.927476	1.8320671	17
	highway	2.512835	2.6984593	20
	Total	2.243886	2.3285911	37
Steering wheel	city	.112376	.1190016	17
	highway	.546105	.8869231	20
	Total	.346824	.6851860	37
Centre-console	city	.501712	.8719941	17
	highway	.768445	1.2341929	20
	Total	.645892	1.0770480	37
Mirrors	city	1.741365	1.9418807	17
	highway	2.364345	2.7147486	20
	Total	2.078111	2.3800567	37
Passenger's lining and door	city	.076506	.2145365	17
	highway	.021250	.0558763	20
	Total	.046638	.1512717	37

Table 12.86 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	251760.379	5	50352.076	3596.140	.000	.990
	Greenhouse-Geisser	251760.379	1.313	191784.015	3596.140	.000	.990
	Huynh-Feldt	251760.379	1.382	182111.769	3596.140	.000	.990
	Lower-bound	251760.379	1.000	251760.379	3596.140	.000	.990
area * scenario	Sphericity Assumed	282.183	5	56.437	4.031	.002	.103
	Greenhouse-Geisser	282.183	1.313	214.959	4.031	.040	.103
	Huynh-Feldt	282.183	1.382	204.118	4.031	.038	.103
	Lower-bound	282.183	1.000	282.183	4.031	.052	.103
Error(area)	Sphericity Assumed	2450.297	175	14.002			
	Greenhouse-Geisser	2450.297	45.946	53.331			
	Huynh-Feldt	2450.297	48.386	50.641			
	Lower-bound	2450.297	35.000	70.008			

Table 12.87 ANOVA for Scenario

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	57612.819	1	57612.819	5054.354	.000	.993
scenario	22.300	1	22.300	1.956	.171	.053
Error	398.953	35	11.399			

Table 12.88 Univariate Tests of Simple main effects of Scenario within Area

area		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
1	Contrast	295.357	1	295.357	4.308	.045	.110
	Error	2399.757	35	68.564			
2	Contrast	3.149	1	3.149	.574	.454	.016
	Error	192.055	35	5.487			
3	Contrast	1.729	1	1.729	3.988	.054	.102
	Error	15.173	35	.434			
4	Contrast	.654	1	.654	.557	.461	.016
	Error	41.107	35	1.174			
5	Contrast	3.566	1	3.566	.623	.435	.017
	Error	200.362	35	5.725			
6	Contrast	.028	1	.028	1.234	.274	.034
	Error	.796	35	.023			

Each F tests the simple effects of driving scenario within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

Comparison of Driving Scenarios in Clio:

Table 12.89 Descriptive Statistics

	driving scenario	Mean	Std. Deviation	N
Road and traffic	city	94.47246	3.2026549	8
	highway	86.23791	14.50910	9
	Total	90.11299	11.30016	17
Instrument panel	city	1.984588	2.0505713	8
	highway	1.411222	1.2215061	9
	Total	1.681041	1.6348329	17
Steering wheel	city	.137588	.1600851	8
	highway	.843922	1.1831006	9
	Total	.511529	.9182263	17
Centre-console	city	.600163	1.0078984	8
	highway	.104311	.2138133	9
	Total	.337653	.7296433	17
Mirrors	city	1.850463	1.3174732	8
	highway	2.385589	3.0184362	9
	Total	2.133765	2.3217804	17
Passenger's lining and door	city	.057838	.1236818	8
	highway	.010100	.0303000	9
	Total	.032565	.0880613	17

Table 12.90 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	112931.665	5	22586.333	1087.878	.000	.986
	Greenhouse-Geisser	112931.665	1.147	98438.466	1087.878	.000	.986
	Huynh-Feldt	112931.665	1.263	89380.261	1087.878	.000	.986
	Lower-bound	112931.665	1.000	112931.665	1087.878	.000	.986
area * scenario	Sphericity Assumed	246.527	5	49.305	2.375	.047	.137
	Greenhouse-Geisser	246.527	1.147	214.889	2.375	.139	.137
	Huynh-Feldt	246.527	1.263	195.115	2.375	.135	.137
	Lower-bound	246.527	1.000	246.527	2.375	.144	.137
Error(area)	Sphericity Assumed	1557.137	75	20.762			
	Greenhouse-Geisser	1557.137	17.208	90.487			
	Huynh-Feldt	1557.137	18.952	82.160			
	Lower-bound	1557.137	15.000	103.809			

Table 12.91 ANOVA for Scenario

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	25508.152	1	25508.152	1111.786	.000	.987
scenario	46.428	1	46.428	2.024	.175	.119
Error	344.151	15	22.943			

Comparison of Driving Scenarios in Laguna:

Table 12.92 Descriptive Statistics

	driving scenario	Mean	Std. Deviation	N
Road and traffic	city	94.57170	5.1666874	9
	highway	90.99739	5.6401813	11
	Total	92.60583	5.5956438	20
Instrument panel	city	1.876711	1.7399831	9
	highway	3.414155	3.2643108	11
	Total	2.722305	2.7384019	20
Steering wheel	city	.089967	.0685447	9
	highway	.302436	.4792526	11
	Total	.206825	.3669129	20
Centre-console	city	.414200	.7833022	9
	highway	1.311827	1.4614414	11
	Total	.907895	1.2618907	20
Mirrors	city	1.644389	2.4496021	9
	highway	2.346964	2.5909900	11
	Total	2.030805	2.4876545	20
Passenger's lining and door	city	.093100	.2793000	9
	highway	.030373	.0706697	11
	Total	.058600	.1910479	20

Table 12.93 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	138642.921	5	27728.584	3129.316	.000	.994
	Greenhouse-Geisser	138642.921	1.440	96273.541	3129.316	.000	.994
	Huynh-Feldt	138642.921	1.618	85662.434	3129.316	.000	.994
	Lower-bound	138642.921	1.000	138642.921	3129.316	.000	.994
area * scenario	Sphericity Assumed	81.547	5	16.309	1.841	.113	.093
	Greenhouse-Geisser	81.547	1.440	56.626	1.841	.185	.093
	Huynh-Feldt	81.547	1.618	50.385	1.841	.182	.093
	Lower-bound	81.547	1.000	81.547	1.841	.192	.093
Error(area)	Sphericity Assumed	797.482	90	8.861			
	Greenhouse-Geisser	797.482	25.922	30.765			
	Huynh-Feldt	797.482	29.133	27.374			
	Lower-bound	797.482	18.000	44.305			

Table 12.94 ANOVA for Scenario

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	32047.731	1	32047.731	61491.59	.000	1.000
scenario	.068	1	.068	.130	.722	.007
Error	9.381	18	.521			

Analysis of Interior Areas – Instrument panel:

Table 12.95 Descriptive Statistics

	Vehicle	Mean	Std. Deviation	N
Dashboard display	Clio	.533406	.6224358	17
	Laguna	1.398915	1.9605846	20
	Total	1.001249	1.5466491	37
Speed indicator	Clio	.664129	.9979955	17
	Laguna	.750200	1.2594993	20
	Total	.710654	1.1321615	37
Tachometer	Clio	.385765	.6623189	17
	Laguna	.318965	.6308292	20
	Total	.349657	.6372822	37
Lining of instrument panel	Clio	.097753	.1541990	17
	Laguna	.254210	.5634269	20
	Total	.182324	.4293705	37

Table 12.96 ANOVA for Vehicle

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	44.543	1	44.543	33.665	.000	.490
vehicle	2.491	1	2.491	1.882	.179	.051
Error	46.310	35	1.323			

Table 12.97 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	13.851	3	4.617	4.848	.003	.122
	Greenhouse-Geisser	13.851	1.805	7.675	4.848	.013	.122
	Huynh-Feldt	13.851	1.951	7.098	4.848	.011	.122
	Lower-bound	13.851	1.000	13.851	4.848	.034	.122
area * vehicle	Sphericity Assumed	4.727	3	1.576	1.655	.181	.045
	Greenhouse-Geisser	4.727	1.805	2.619	1.655	.201	.045
	Huynh-Feldt	4.727	1.951	2.422	1.655	.199	.045
	Lower-bound	4.727	1.000	4.727	1.655	.207	.045
Error(area)	Sphericity Assumed	99.990	105	.952			
	Greenhouse-Geisser	99.990	63.168	1.583			
	Huynh-Feldt	99.990	68.299	1.464			
	Lower-bound	99.990	35.000	2.857			

Table 12.98 Pairwise Comparisons for Area

(I) area	(J) area	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	.259	.325	.966	-.648	1.166
	3	.614*	.190	.016	.083	1.145
	4	.790*	.259	.026	.067	1.514
2	1	-.259	.325	.966	-1.166	.648
	3	.355	.208	.458	-.226	.935
	4	.531	.204	.079	-.038	1.101
3	1	-.614*	.190	.016	-1.145	-.083
	2	-.355	.208	.458	-.935	.226
	4	.176	.129	.694	-.182	.535
4	1	-.790*	.259	.026	-1.514	-.067
	2	-.531	.204	.079	-1.101	.038
	3	-.176	.129	.694	-.535	.182

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Sidak.

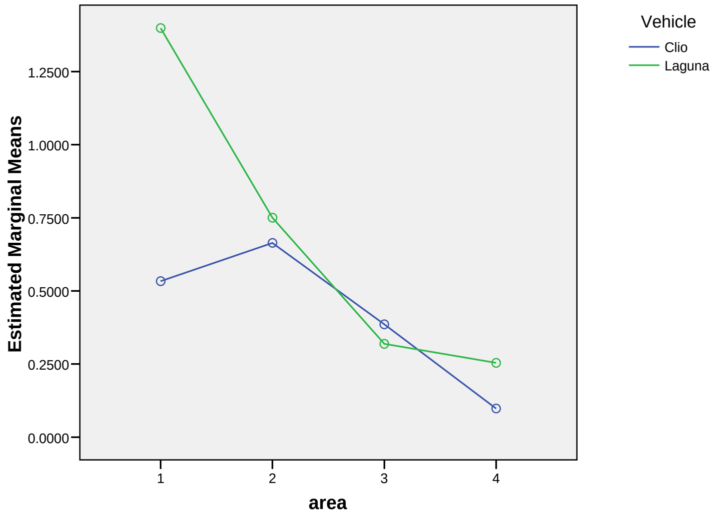


Figure 12.6 Graph displaying interaction between Instrument panel area and Vehicle

Table 12.99 Multivariate Tests of Simple main effects analysis of Area within Vehicle

Vehicle		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Clio	Pillai's trace	.122	1.523[a]	3.000	33.000	.227	.122
	Wilks' lambda	.878	1.523[a]	3.000	33.000	.227	.122
	Hotelling's trace	.138	1.523[a]	3.000	33.000	.227	.122
	Roy's largest root	.138	1.523[a]	3.000	33.000	.227	.122
Laguna	Pillai's trace	.436	8.492[a]	3.000	33.000	.000	.436
	Wilks' lambda	.564	8.492[a]	3.000	33.000	.000	.436
	Hotelling's trace	.772	8.492[a]	3.000	33.000	.000	.436
	Roy's largest root	.772	8.492[a]	3.000	33.000	.000	.436

Each F tests the multivariate simple effects of area within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

Table 12.100 Pairwise Comparisons of Simple main effects of Area within Vehicle

Vehicle	(I) area	(J) area	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a] Lower Bound	Upper Bound
Clio	1	2	-.131	.478	1.000	-1.464	1.202
		3	.148	.280	.996	-.633	.928
		4	.436	.381	.837	-.628	1.499
	2	1	.131	.478	1.000	-1.202	1.464
		3	.278	.306	.937	-.575	1.132
		4	.566	.300	.343	-.271	1.404
	3	1	-.148	.280	.996	-.928	.633
		2	-.278	.306	.937	-1.132	.575
		4	.288	.189	.587	-.239	.816
	4	1	-.436	.381	.837	-1.499	.628
		2	-.566	.300	.343	-1.404	.271
		3	-.288	.189	.587	-.816	.239
Laguna	1	2	.649	.441	.623	-.580	1.878
		3	1.080*	.258	.001	.360	1.799
		4	1.145*	.352	.015	.164	2.125
	2	1	-.649	.441	.623	-1.878	.580
		3	.431	.282	.582	-.356	1.218
		4	.496	.277	.401	-.276	1.268
	3	1	-1.080*	.258	.001	-1.799	-.360
		2	-.431	.282	.582	-1.218	.356
		4	.065	.174	.999	-.422	.551
	4	1	-1.145*	.352	.015	-2.125	-.164
		2	-.496	.277	.401	-1.268	.276
		3	-.065	.174	.999	-.551	.422

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Sidak.

Analysis of Interior Areas – Steering-wheel:

Table 12.101 Descriptive Statistics

	Vehicle	Mean	Std. Deviation	N
Steering-wheel top	Clio	.282124	.6116944	17
	Laguna	.117840	.1636191	20
	Total	.193322	.4328003	37
Left side of steering-wheel	Clio	.010676	.0440202	17
	Laguna	.010570	.0472705	20
	Total	.010619	.0451725	37
Right side of steering-wheel	Clio	.007118	.0293468	17
	Laguna	.074075	.2229892	20
	Total	.043311	.1666447	37
Right multifunction switch	Clio	.090076	.3165876	17
	Laguna	.004350	.0194538	20
	Total	.043738	.2159196	37
Left multifunction switch	Clio	.121541	.4029843	17
	Laguna	.000000	.0000000	20
	Total	.055843	.2755846	37

Table 12.102 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	.804	4	.201	3.300	.013	.086
	Greenhouse-Geisser	.804	1.809	.444	3.300	.048	.086
	Huynh-Feldt	.804	1.957	.411	3.300	.044	.086
	Lower-bound	.804	1.000	.804	3.300	.078	.086
area * vehicle	Sphericity Assumed	.322	4	.080	1.321	.265	.036
	Greenhouse-Geisser	.322	1.809	.178	1.321	.273	.036
	Huynh-Feldt	.322	1.957	.164	1.321	.273	.036
	Lower-bound	.322	1.000	.322	1.321	.258	.036
Error(area)	Sphericity Assumed	8.527	140	.061			
	Greenhouse-Geisser	8.527	63.322	.135			
	Huynh-Feldt	8.527	68.480	.125			
	Lower-bound	8.527	35.000	.244			

Table 12.103 ANOVA for Vehicle

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	.948	1	.948	10.342	.003	.228
vehicle	.171	1	.171	1.861	.181	.050
Error	3.210	35	.092			

Analysis of Interior Areas – Centre-console:

Table 12.104 Descriptive Statistics

	Vehicle	Mean	Std. Deviation	N
Centre-console display	Clio	.148235	.2556422	17
	Laguna	1.114000	1.5182414	20
	Total	.670270	1.2180642	37
Central ventilation shafts	Clio	.115294	.2633941	17
	Laguna	.002000	.0089443	20
	Total	.054054	.1848041	37
Car radio	Clio	.018824	.0776114	17
	Laguna	.010000	.0447214	20
	Total	.014054	.0612581	37
Control of centilation and air-conditioning	Clio	.181176	.5325632	17
	Laguna	.086000	.3104564	20
	Total	.129730	.4233628	37

Table 12.105 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	8.981	3	2.994	8.973	.000	.204
	Greenhouse-Geisser	8.981	1.199	7.490	8.973	.003	.204
	Huynh-Feldt	8.981	1.253	7.165	8.973	.003	.204
	Lower-bound	8.981	1.000	8.981	8.973	.005	.204
area * vehicle	Sphericity Assumed	7.486	3	2.495	7.479	.000	.176
	Greenhouse-Geisser	7.486	1.199	6.242	7.479	.006	.176
	Huynh-Feldt	7.486	1.253	5.972	7.479	.006	.176
	Lower-bound	7.486	1.000	7.486	7.479	.010	.176
Error(area)	Sphericity Assumed	35.031	105	.334			
	Greenhouse-Geisser	35.031	41.971	.835			
	Huynh-Feldt	35.031	43.872	.798			
	Lower-bound	35.031	35.000	1.001			

Table 12.106 ANOVA for Vehicle

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	6.449	1	6.449	12.954	.001	.270
vehicle	1.287	1	1.287	2.585	.117	.069
Error	17.426	35	.498			

Table 12.107 Multivariate Tests of Simple main effects of Area within Vehicle

Vehicle		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Clio	Pillai's trace	.195	2.670[a]	3.000	33.000	.064	.195
	Wilks' lambda	.805	2.670[a]	3.000	33.000	.064	.195
	Hotelling's trace	.243	2.670[a]	3.000	33.000	.064	.195
	Roy's largest root	.243	2.670[a]	3.000	33.000	.064	.195
Laguna	Pillai's trace	.356	6.088[a]	3.000	33.000	.002	.356
	Wilks' lambda	.644	6.088[a]	3.000	33.000	.002	.356
	Hotelling's trace	.553	6.088[a]	3.000	33.000	.002	.356
	Roy's largest root	.553	6.088[a]	3.000	33.000	.002	.356

Each F tests the multivariate simple effects of area within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

Table 12.108 Pairwise Comparisons of Simple main effects of Area within Vehicle

Vehicle	(I) area	(J) area	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
						Lower Bound	Upper Bound
Clio	1	2	.033	.275	1.000	-.733	.799
		3	.129	.274	.998	-.634	.893
		4	-.033	.262	1.000	-.763	.697
	2	1	-.033	.275	1.000	-.799	.733
		3	.096*	.033	.039	.003	.190
		4	-.066	.080	.961	-.290	.158
	3	1	-.129	.274	.998	-.893	.634
		2	-.096*	.033	.039	-.190	-.003
		4	-.162	.095	.459	-.428	.103
	4	1	.033	.262	1.000	-.697	.763
		2	.066	.080	.961	-.158	.290
		3	.162	.095	.459	-.103	.428
Laguna	1	2	1.112*	.253	.001	.406	1.818
		3	1.104*	.252	.001	.400	1.808
		4	1.028*	.241	.001	.355	1.701
	2	1	-1.112*	.253	.001	-1.818	-.406
		3	-.008	.031	1.000	-.094	.078
		4	-.084	.074	.841	-.290	.122
	3	1	-1.104*	.252	.001	-1.808	-.400
		2	.008	.031	1.000	-.078	.094
		4	-.076	.088	.950	-.321	.169
	4	1	-1.028*	.241	.001	-1.701	-.355
		2	.084	.074	.841	-.122	.290
		3	.076	.088	.950	-.169	.321

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Sidak.

Analysis of Interior Areas – Mirrors:

Table 12.109 Descriptive Statistics

	Vehicle	Mean	Std. Deviation	N
Left side mirror	Clio	.889100	.9570181	17
	Laguna	1.143395	1.6887285	20
	Total	1.026557	1.3887709	37
Rear-view mirror	Clio	1.080318	1.6470760	17
	Laguna	.778150	1.2485637	20
	Total	.916984	1.4324036	37
Right side mirror	Clio	.164359	.2523488	17
	Laguna	.109255	.2217387	20
	Total	.134573	.2345784	37

Table 12.110 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	17.263	2	8.631	7.963	.001	.185
	Greenhouse-Geisser	17.263	1.890	9.134	7.963	.001	.185
	Huynh-Feldt	17.263	2.000	8.631	7.963	.001	.185
	Lower-bound	17.263	1.000	17.263	7.963	.008	.185
area * vehicle	Sphericity Assumed	1.429	2	.714	.659	.521	.018
	Greenhouse-Geisser	1.429	1.890	.756	.659	.512	.018
	Huynh-Feldt	1.429	2.000	.714	.659	.521	.018
	Lower-bound	1.429	1.000	1.429	.659	.422	.018
Error(area)	Sphericity Assumed	75.873	70	1.084			
	Greenhouse-Geisser	75.873	66.146	1.147			
	Huynh-Feldt	75.873	70.000	1.084			
	Lower-bound	75.873	35.000	2.168			

Table 12.111 ANOVA for Vehicle

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	53.125	1	53.125	27.367	.000	.439
vehicle	.032	1	.032	.017	.898	.000
Error	67.943	35	1.941			

Table 12.112 Pairwise Comparisons for Area

(I) area	(J) area	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a] Lower Bound	Upper Bound
1	2	.087	.271	.984	-.591	.765
	3	.879*	.227	.001	.310	1.449
2	1	-.087	.271	.984	-.765	.591
	3	.792*	.228	.004	.220	1.365
3	1	-.879*	.227	.001	-1.449	-.310
	2	-.792*	.228	.004	-1.365	-.220

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Sidak.

Analysis of Interior Areas – Passenger's Side:

Table 12.113 Descriptive Statistics

	Vehicle	Mean	Std. Deviation	N
Lining at passenger's side	Clio	.025882	.0582086	17
	Laguna	.040000	.1030074	20
	Total	.033514	.0845976	37
Passenger's door	Clio	.018824	.0776114	17
	Laguna	.040000	.1788854	20
	Total	.030270	.1402871	37

Table 12.114 ANOVA for Area

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
area	Sphericity Assumed	.000	1	.000	.044	.835	.001
	Greenhouse-Geisser	.000	1.000	.000	.044	.835	.001
	Huynh-Feldt	.000	1.000	.000	.044	.835	.001
	Lower-bound	.000	1.000	.000	.044	.835	.001
area * vehicle	Sphericity Assumed	.000	1	.000	.044	.835	.001
	Greenhouse-Geisser	.000	1.000	.000	.044	.835	.001
	Huynh-Feldt	.000	1.000	.000	.044	.835	.001
	Lower-bound	.000	1.000	.000	.044	.835	.001
Error(area)	Sphericity Assumed	.181	35	.005			
	Greenhouse-Geisser	.181	35.000	.005			
	Huynh-Feldt	.181	35.000	.005			
	Lower-bound	.181	35.000	.005			

Table 12.115 ANOVA for Vehicle

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	.071	1	.071	3.210	.082	.084
vehicle	.006	1	.006	.257	.615	.007
Error	.779	35	.022			

12.2.11 Regression Analyses

Clio

Table 12.116 Regression for Left area

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.554[a]	.307	.264	3.3783007	.307	7.090	1	16	.017	1.661

a. Predictors: (Constant), Alter

b. Dependent Variable: Bereich links, Fahrertür

Table 12.117 Correlations for Left area and Predictors

		Bereich links, Fahrertür	Alter	Geschlecht	Design Expertise	Technik Expertise
Pearson Correlation	Bereich links, Fahrertür	1.000	-.554	.122	-.183	.379
	Alter	-.554	1.000	-.143	.081	-.309
	Geschlecht	.122	-.143	1.000	-.782	-.665
	Design Expertise	-.183	.081	-.782	1.000	.684
	Technik Expertise	.379	-.309	-.665	.684	1.000
Sig. (1-tailed)	Bereich links, Fahrertür	.	.009	.315	.234	.061
	Alter	.009	.	.286	.374	.106
	Geschlecht	.315	.286	.	.000	.001
	Design Expertise	.234	.374	.000	.	.001
	Technik Expertise	.061	.106	.001	.001	.
N	Bereich links, Fahrertür	18	18	18	18	18
	Alter	18	18	18	18	18
	Geschlecht	18	18	18	18	18
	Design Expertise	18	18	18	18	18
	Technik Expertise	18	18	18	18	18

Table 12.118 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations		
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part
1	(Constant)	18.217	2.305		7.904	.000	13.331	23.103			
	Alter	-.139	.052	-.554	-2.663	.017	-.250	-.028	-.554	-.554	-.554

a. Dependent Variable: Bereich links, Fahrertür

Table 12.119 Correlations for Ceiling and Predictors

		Bereich oben	Alter	Geschlecht	Design Expertise	Technik Expertise
Pearson Correlation	Bereich oben	1.000	-.508	-.164	.325	.268
	Alter	-.508	1.000	-.143	.081	-.309
	Geschlecht	-.164	-.143	1.000	-.782	-.665
	Design Expertise	.325	.081	-.782	1.000	.684
	Technik Expertise	.268	-.309	-.665	.684	1.000
Sig. (1-tailed)	Bereich oben	.	.016	.257	.094	.141
	Alter	.016	.	.286	.374	.106
	Geschlecht	.257	.286	.	.000	.001
	Design Expertise	.094	.374	.000	.	.001
	Technik Expertise	.141	.106	.001	.001	.
N	Bereich oben	18	18	18	18	18
	Alter	18	18	18	18	18
	Geschlecht	18	18	18	18	18
	Design Expertise	18	18	18	18	18
	Technik Expertise	18	18	18	18	18

Table 12.120 Regression for Ceiling

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.508[a]	.258	.212	4.3313479	.258	5.568	1	16	.031	2.610

a. Predictors: (Constant), Alter

b. Dependent Variable: Bereich oben

Table 12.121 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations		
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part
1	(Constant)	13.864	2.955		4.692	.000	7.600	20.129			
	Alter	-.158	.067	-.508	-2.360	.031	-.300	-.016	-.508	-.508	-.508

a. Dependent Variable: Bereich oben

Laguna

Table 12.122 Correlations for Technical expertise and Areas

		Technik Expertise	Bereich Armaturenbrett	Bereich Lenkrad	Bereich Mittelkonsole	Bereich Gang, Handbremse	Bereich links, Fahrerseite	Bereich Beifahrer	Bereich oben
Pearson Correlation	Technik Expertise	1.000	-.537	.023	.239	.504	-.226	-.095	.057
	Bereich Armaturenbrett	-.537	1.000	-.186	.030	-.665	-.043	-.185	-.231
	Bereich Lenkrad	.023	-.186	1.000	-.015	.065	-.246	-.474	-.361
	Bereich Mittelkonsole	.239	.030	-.015	1.000	-.241	-.767	-.209	-.685
	Bereich Gang, Handbremse	.504	-.665	.065	-.241	1.000	.114	-.034	.306
	Bereich links, Fahrerseite	-.226	-.043	-.246	-.767	.114	1.000	.188	.589
	Bereich Beifahrer	-.095	-.185	-.474	-.209	-.034	.188	1.000	.189
	Bereich oben	.057	-.231	-.361	-.685	.306	.589	.189	1.000
Sig. (1-tailed)	Technik Expertise	.	.013	.465	.178	.020	.192	.358	.413
	Bereich Armaturenbrett	.013	.	.237	.455	.002	.435	.239	.186
	Bereich Lenkrad	.465	.237	.	.477	.402	.170	.027	.078
	Bereich Mittelkonsole	.178	.455	.477	.	.176	.000	.210	.001
	Bereich Gang, Handbremse	.020	.002	.402	.176	.	.332	.449	.116
	Bereich links, Fahrerseite	.192	.435	.170	.000	.332	.	.235	.006
	Bereich Beifahrer	.358	.239	.027	.210	.449	.235	.	.234
	Bereich oben	.413	.186	.078	.001	.116	.006	.234	.
N	Technik Expertise	17	17	17	17	17	17	17	17
	Bereich Armaturenbrett	17	17	17	17	17	17	17	17
	Bereich Lenkrad	17	17	17	17	17	17	17	17
	Bereich Mittelkonsole	17	17	17	17	17	17	17	17
	Bereich Gang, Handbremse	17	17	17	17	17	17	17	17
	Bereich links, Fahrerseite	17	17	17	17	17	17	17	17
	Bereich Beifahrer	17	17	17	17	17	17	17	17
	Bereich oben	17	17	17	17	17	17	17	17

Table 12.123 Regression for Technical expertise

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.537[a]	.288	.241	2.38091	.288	6.075	1	15	.026	1.840

a. Predictors: (Constant), Bereich Armaturenbrett

b. Dependent Variable: Technik Expertise

Table 12.124 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	9.853	1.734		5.683	.000	6.158	13.549
	Bereich Armaturenbrett	-.317	.129	-.537	-2.465	.026	-.592	-.043

a. Dependent Variable: Technik Expertise

Table 12.125 Correlations for Instrument panel and predictors

		Bereich Armaturenbrett	Alter	Geschlecht	Design Expertise	Technik Expertise
Pearson Correlation	Bereich Armaturenbrett	1.000	.353	.144	-.215	-.537
	Alter	.353	1.000	.090	-.160	-.510
	Geschlecht	.144	.090	1.000	-.760	-.671
	Design Expertise	-.215	-.160	-.760	1.000	.690
	Technik Expertise	-.537	-.510	-.671	.690	1.000
Sig. (1-tailed)	Bereich Armaturenbrett	.	.082	.291	.203	.013
	Alter	.082	.	.366	.270	.018
	Geschlecht	.291	.366	.	.000	.002
	Design Expertise	.203	.270	.000	.	.001
	Technik Expertise	.013	.018	.002	.001	.
N	Bereich Armaturenbrett	17	17	17	17	17
	Alter	17	17	17	17	17
	Geschlecht	17	17	17	17	17
	Design Expertise	17	17	17	17	17
	Technik Expertise	17	17	17	17	17

Table 12.126 Regression for Instrument panel

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.537[a]	.288	.241	4.0289160	.288	6.075	1	15	.026	2.214

a. Predictors: (Constant), Technik Expertise

b. Dependent Variable: Bereich Armaturenbrett

Table 12.127 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	17.992	2.359		7.629	.000	12.965	23.019
	Technik Expertise	-.909	.369	-.537	-2.465	.026	-1.694	-.123

a. Dependent Variable: Bereich Armaturenbrett

Table 12.128 Correlations for Gear area and predictors

		Bereich Gang, Handbremse	Alter	Geschlecht	Design Expertise	Technik Expertise
Pearson Correlation	Bereich Gang, Handbremse	1.000	-.433	-.366	.184	.504
	Alter	-.433	1.000	.090	-.160	-.510
	Geschlecht	-.366	.090	1.000	-.760	-.671
	Design Expertise	.184	-.160	-.760	1.000	.690
	Technik Expertise	.504	-.510	-.671	.690	1.000
Sig. (1-tailed)	Bereich Gang, Handbremse	.	.041	.075	.240	.020
	Alter	.041	.	.366	.270	.018
	Geschlecht	.075	.366	.	.000	.002
	Design Expertise	.240	.270	.000	.	.001
	Technik Expertise	.020	.018	.002	.001	.
N	Bereich Gang, Handbremse	17	17	17	17	17
	Alter	17	17	17	17	17
	Geschlecht	17	17	17	17	17
	Design Expertise	17	17	17	17	17
	Technik Expertise	17	17	17	17	17

Table 12.129 Regression for Gear area

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.504[a]	.254	.204	5.1549199	.254	5.099	1	15	.039	1.646

a. Predictors: (Constant), Technik Expertise

b. Dependent Variable: Bereich Gang, Handbremse

Table 12.130 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	6.150	3.018		2.038	.060	-.282	12.582
	Technik Expertise	1.065	.472	.504	2.258	.039	.060	2.070

a. Dependent Variable: Bereich Gang, Handbremse

12.3 Curriculum Vitae

Lebenslauf

Andrea Berger
Stiegengasse 5/18, 1060 Wien
E-Mail: andrea.berger@univie.ac.at

Persönliche Daten

Geburtsdatum	01. März 1983
Geburtsort	Schärding (OÖ)
Staatsbürgerschaft	Österreich

Ausbildung

Seit WS 2002/03	Diplomstudium Psychologie an der Universität Wien WS 2004/05 Abschluss des 1. Studienabschnitts Diplomarbeit im Bereich Allgemeine Psychologie Studienjahr 2006/07 Leistungsstipendium für hervorragenden Studienerfolg
1997 – 2002	HBLA für wirtschaftliche Berufe Ried Juni 2002 Matura mit ausgezeichnetem Erfolg

Berufserfahrung

Seit Oktober 2008	Stadthalle Wien Publikumsdienst, VIP-Service
Seit WS 2006/07	Studienassistentin an der Fachbereichsbibliothek für Psychologie Anleitung der StudentInnen bei wissenschaftlicher Informations- und Literatursuche bzw. –beschaffung und bei der kritische Bewertung von Informationen
Studienjahr 2007/08 und 2008/09	Tutorin der LV „Proseminar Bildungspsychologie: Bildung und Internet“
Sommer 2006	4-wöchiges Psychologisches Praktikum LKH Schärding
Juni 2006	Interviewertätigkeit im Projekt „Wiener Linien – V43 Kundenbefragung Infostellen und Kundendienst“

Sommer 2005	6-wöchiges Psychologisches Praktikum sowhat, Institut f. Menschen mit Essstörungen in Wien Telefonischer Erstkontakt mit neuen KlientInnen, telefonische Betreuung der KlientInnen, Protokollierung bei Erstgesprächen, organisatorische und administrative Tätigkeiten

Diverse Ferialjobs im gastgewerblichen Bereich

Auslandserfahrung:

Sommer 2001	4-wöchiges Praktikum als Rezeptionistin in Bad Füssing, D
Sommer 2000	12-wöchiges Praktikum als Restaurant-Fachfrau in London, GB

Besondere Kenntnisse

Fremdsprachen	Englisch (fließend) Französisch (Grundkenntnisse) Italienisch (Grundkenntnisse)
PC- Kenntnisse	Mircrosoft Office (Word, PowerPoint, Excel), SPSS, Gimp, Adobe Premiere Pro CS3
Eyetracking	SMI iViewHeadMounted

Führerschein B