
Beyond Transportation: How to Keep Users Attached When They Are Neither Driving nor Owning Automated Cars?

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Abstract

The way drivers relate to cars is likely bound to change with the rise of automated vehicles and new ownership models. However, personal relationships towards products are an important part of buying decisions. Car manufacturers thus need to provide novel bonding experiences for their future customers in order to stay competitive. We introduce a vehicle attachment model based on related work from other domains. In interviews with 16 car owners we verify the approach as promising and derive four attachment types by applying the model: interviewees' personal attachments were grounded on either self-empowering reasons, memories with the car, increased status, or a loving friendship towards their car. We propose how to address the needs of these four attachment types as a first step towards emotionally irreplaceable automated and shared vehicles.

Author Keywords

Automated Cars; Car Sharing; Vehicle Attachment.

CCS Concepts

•Human-centered computing → HCI theory, concepts and models;

Introduction

Many people have a relationship and feel attached to their cars [1, 3]. However, since recent forecasts see a potential

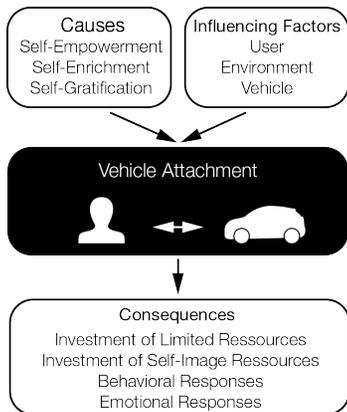


Figure 1: Adaption of mobile attachment model from Meschtscherjakov et al. [7] to vehicle attachment.

satiation for privately owned cars in developed countries [8, 15], this relationship is likely to change with the advent of car sharing and automated cars. In order to defend their place in this new economy, car manufacturers will have to focus on ways to ensure customer’s loyalty to their vehicles because the decision to use a car will then be made daily and more spontaneously. Furthermore, attachment leads to positive emotions towards products and vice versa [14]. Thus, fostering attachment to a vehicle is important to maintain an enthusiastic consumer acceptance and willingness to pay, which are regarded as crucial starting criteria for automated driving systems (ADS) [8]. *Emotional attachment* is accomplished by a strong person-to-product relationship [6], e.g., by stimulating memories with the product. As a result, a crucial precondition for a long-lasting relationship can be achieved: a feeling of irreplaceability towards the product and a more hedonistic than utilitarian user experience (UX) [4, 11]. While previous research primarily focused on brand [1, 6] or general product attachment [5, 14], there is still little known about other causes for attachment to vehicles beyond brands.

As a first step in the process, this paper aims to derive design recommendations for emotional attachment to highly automated (SAE L4/5) and shared vehicles from current attachment patterns (SAE L0/1/2). To improve the understanding of causes and consequences of attachment to vehicles we conducted semi-structured interviews using a guideline derived from a vehicle attachment model (adapted from [7]). Based on our findings we introduce attachment types, which help to inspire the design process for future ADS concepts.

Vehicle Attachment Model

To understand the concept of vehicle attachment, we build on the conceptual mobile attachment model of Meschtscherjakov et al. [7]. They explain users’ relationship to smart-

phones by describing *causes*, general *influencing factors*, and *consequences*. We try to transfer this concept to vehicle attachment by assuming similar emotions and behavior (Figure 1). Attachment to vehicles emerges when users perceive the car as part of their self-concept. The first possibility for a vehicle-self linkage route is called *self-empowerment* and refers to the utilitarian advantage, i.e. a product helps users to achieve a certain goal. Vehicles can *self-enrich* users and represent a symbolic meaning of the past, private, public, or collective self, e.g. recalling memories or status symbol. Pettersson [13] identified similar effects for ADS. Participants were proud to be early adopters of an advanced high-tech life. *Self-gratification* concern hedonic attributes such as the individual perception of a product’s aesthetics. Further influencing factors for attachment include the *users* (e.g., personality), the *environment* (e.g., advertisement) and the *vehicle* with its unique design and functions. Attachment results in the investment of limited (e.g. time and money for maintenance) and self-image resources (e.g. defending the own car against criticism), and in behavioral (e.g. proximity maintenance [16]) and emotional responses (e.g. feeling of vehicle’s irreplaceability).

To examine whether our assumption of a vehicle attachment model accords with current vehicle attachment patterns and to discuss consequences for ADS, we derived an interview guideline from the described elements of the conceptual model for a semi-structured interview study (e.g. for self-enrichment we asked, “*What do you think, which mark do you leave with your vehicle on others?*”). The study setup can be found in the side column on the following page.

Attachment Types

To identify causes and consequences of attachment to vehicles, we compared and contrasted responses from highly

Study Setup

Methods: Product Attachment Scale (PAS) to collect participants' vehicle attachment [10] and semi-structured interviews (guide is based on the vehicle attachment model)

Participants: In total, 16 people participated in our study (7 female) aged between 20 and 79 (M=31.69, SD=15.03). All of them owned a vehicle, 73% owned a used car, 20% had a new car, only one participant leased her car. Based on PAS, 37.5% (n=6) showed high attachment (> 5), 43,8% (n=7) medium (<=5 and >=3) and only 18.8% (n=3) low attachment (<3).

Data Analysis: All sessions were audio recorded. For a content analysis, participants' narratives were transcribed and translated from German, sorted and categorized by using affinity diagrams in an interactive session by the first three authors. Participants' demographic information and attachment was used for data analysis and type development.

attached interviewees with participants who had medium and low attachment scores. We categorized these causes based on Meschtscherjakov et al.'s model [7] and identified four different types of attachment based on interviewee's explanations (Figure 2):

Self-empowering attachment type: [7] argued that mobile attachment can occur when users feel empowered to achieve goals due to the device's utility. We found that all interviewees stressed the utility of their cars and its main function to take its owner from A to B regardless of their attachment. However, for the *self-empowering type*, the vehicle is not only useful but empowers her because she is to fulfill her needs, e.g. transporting a dog or elderly being mobile in the countryside. This description corresponds to Belk's findings [2] that possessions can extend the self by allowing their owner to do things they would be incapable of without. Hence, although this type is emotionally attached to the car, they indicate comparatively less consequences of attachment. E.g., this type is neither necessarily very convinced of the car nor bound to a specific brand ("I'm emotionally attached to this car but somehow not to the brand." [P15]). The car is also easily replaceable by other vehicles since owning a car in the first place is most important. This type only personalizes their car if it is necessary to fulfill their specific needs.

Memory attachment type: The importance of symbolism for attachment to objects was stressed in previous research [2, 7, 9, 12, 17]. One possibility for this symbolism is enriching the self by representing past memories [7]. In our interviews, we could identify this *memory attachment type*. For this type, the attachment to the car is not based on the monetary value of the car or enthusiasm for the brand. Instead, this type associates personal and emotional memories with the vehicle, e.g. using the car to go on holidays or to move to another city. Consequently, this type shows par-

ticularly cognitive and emotional responses as indicators of attachment. Due to the associated memories, the car is not easily replaceable for this type ("And now I'm sad that my studies are over and my car is broken at the same time and I'd really like to [...] keep it although it's nonsense from a rational point of view." [P16]). Although this type does not regard her vehicle to be the best available option, they might be thrilled about a specific feature which complements the owner's need ("My car is like me [...] motivated, persistent, doing a good job, and loyal." [P16]). In contrast, this type shows less behavioral responses and investment of resources, e.g. although the car is not replaceable, the owner would not necessarily buy the same brand or model again.

Status attachment type: Apart from representing the owner's past self, objects can also enrich the private or public self [7]. In our interviews, these two symbolic meanings overlapped for attachment to vehicles, which we called the *status attachment type*. However, it is possible that these two attachment causes can be differentiated when investigating a bigger sample. This type assumes that her car gives an impression of its owner's positive characteristics ("[Others think] that I'm a cool sporty guy." [P9]). The quality of the car and the brand are important for this type. Moreover, they expect to have advantages due to their car ("The car allowed me to do things which others couldn't." [P12] / "I can tell that it attracts attention and people are looking" [P9]). This type's attachment is particularly manifested by the investment of self-image resources and behavioral responses. They would not accept criticism and totally recommend their car to others. To increase comfort and luxury, they have often personalized their car to their specific needs. Since they are convinced of their cars, they would tend to buy a similar model again ("I would probably buy the same model but the newer one." [P12]) but they do not have any difficulties to replace their car with a newer model (low emotional responses).



Figure 2: Attachment types, derived from semi-structured interviews based on the vehicle attachment model.

Friendship attachment type: This type showed a very strong emotional attachment, which is based on gratification through pleasure and enjoyment [7, 9, 14]. This enjoyment is expressed by strong enthusiasm about the car (“I’m in love with my car [...] I’d totally recommend it because it [...] has a character, it’s not a standard car.” [P10]). Additionally, this type describes her car in an emotional way and attributes human characteristics to it. However, the attachment is based on a preference for specific features of the car and not necessarily due to the price or status of the car. Also the car is particularly fitting to the owner (“I have a typical woman’s car because I’m a typical woman.” [P10]). Several attachment consequences can be observed, for example the investment of limited resources to keep the car clean and personalize it to its owner’s needs (behavioral responses). This type also shows emotional responses, for example the car is unique for the owner (“[My car] cannot be replaced at all, it’s my companion.” [P10]).

Discussion and Future Work

The interviews contributed to an initial understanding of current vehicle attachment. We use these findings to suggest ideas how the different attachment types can be addressed by mobility service providers when personally driving and owning a car will be the exception.

Since utility ranks first for the **self-empowering type**, automated and shared cars can still satisfy her needs. However, manufacturers might have difficulties to maintain them as customers due to a lack of brand attachment. To address this type, reliable and trustworthy availability of vehicles is of highest importance [7]. Attachment due to memories is likely to decrease in shared cars. However, the **memory type’s** attachment could be fostered by automatically showing users pictures of past adventures or reminding them of previous trips with the car. Another possibility could be to personalize the car so that the user always gets the im-

pression of a “personal car”. The **status type** might have difficulties to identify with an automated car since attributes like sporty or powerful apply less without driving by themselves. To overcome this obstacle different driving styles and individualization to stand out should be integrated [7]. Having the opportunity to use new and varied models of shared cars could satisfy this type’s needs. However, we recommend that car manufacturers offer luxury and comfort car sharing to maintain status differences, similar to different airline’s offerings [7]. The **friendship type** could profit from virtual assistants which allow for personal interaction and could enable deeper emotional relationships by showing personality. If cars are not personally owned anymore, this type’s attachment could decrease due to the loss of a one-to-one relationship. To maintain attachment, this type could benefit from personalization, which is conveyed between the cars they use.

The retrieved types are not mutually exclusive but there might be overlaps between different causes. A bigger and more diverse sample is necessary to validate the derived types and to get a more in-depth understanding of vehicle attachment and its difference to other products and modes of transportation attachment. A bigger sample could also provide insight into relationships between individual differences and attachment, e.g. regarding age or driving experience. Furthermore, the effect of culture on vehicle attachment has to be investigated in future studies. Our future work aims to evaluate the presented service ideas for ADS and their effects on user experience and acceptance.

Conclusion

In conclusion, we suggest that among other user-centered factors, attachment to vehicles plays an important role when designing for future ADSs. They are a first step to help designers understand users’ motivations, to develop valid personas and create to future concepts for vehicle attachment.

REFERENCES

1. René Algesheimer, Utpal M Dholakia, and Andreas Herrmann. 2005. The social influence of brand community: Evidence from European car clubs. *Journal of Marketing* 69, 3 (2005), 19–34.
2. Russell W Belk. 1988. Possessions and the extended self. *Journal of Consumer Research* 15, 2 (1988), 139–168.
3. Nicole Carriere. 2013. Survey Reveals Relationships with Cars Mimic Relationships with People: A new AutoTrader.com survey explores the emotional reasons why people's relationships with their cars are longer than ever before. (2013). Last visited on 18/07/16.
4. Ravindra Chitturi, Rajagopal Raghunathan, and Vijay Mahajan. 2008. Delight by Design: The Role of Hedonic Versus Utilitarian Benefits. *Journal of Marketing* 72, 3 (2008), 48–63. DOI : <http://dx.doi.org/10.1509/jmkg.72.3.48>
5. Susan Schultz Kleine and Stacey Menzel Baker. 2004. An integrative review of material possession attachment. *Academy of Marketing Science Review* 1, 1 (2004), 1–39.
6. Lucia Malär, Harley Krohmer, Wayne D Hoyer, and Bettina Nyffenegger. 2011. Emotional brand attachment and brand personality: The relative importance of the actual and the ideal self. *Journal of Marketing* 75, 4 (2011), 35–52. DOI : <http://dx.doi.org/10.1509/jmkg.75.4.35>
7. Alexander Meschtscherjakov, David Wilfinger, and Manfred Tscheligi. 2014. Mobile attachment causes and consequences for emotional bonding with mobile phones. In *CHI Conference on Human Factors in Computing Systems, CHI'14, Toronto, ON, Canada - April 26 - May 01, 2014*. 2317–2326. DOI : <http://dx.doi.org/10.1145/2556288.2557295>
8. Detlev Mohr, Hans-Werner Kaas, Paul Gao, Dominik Wee, and Timo Möller. 2016. Automotive Revolution – Perspective Towards 2030. (2016). <http://www.mckinsey.com/industries/automotive-and-assembly/our-insights/disruptive-trends-that-will-transform-the-auto-industry>
9. Ruth Mugge. 2008. *Emotional bonding with products: investigating product attachment from a design perspective*. VDM, Verlag Dr. Müller.
10. Ruth Mugge, Hendrik NJ Schifferstein, and Jan PL Schoormans. 2005a. A longitudinal study of product attachment and its determinants. *ACR European Advances* (2005).
11. Ruth Mugge, Jan P. L. Schoormans, and Hendrik N. J. Schifferstein. 2005b. Design Strategies to Postpone Consumers' Product Replacement: The Value of a Strong Person-Product Relationship. *The Design Journal* 8, 2 (2005), 38–48. DOI : <http://dx.doi.org/10.2752/146069205789331637>
12. C Whan Park, Deborah J MacInnis, and Joseph R Priester. 2006. Beyond attitudes: Attachment and consumer behavior. (2006).
13. Ingrid Pettersson. 2017. Travelling from fascination to new meanings: Understanding user expectations through a case study of autonomous cars. *International Journal of Design* 11, 2 (2017).
14. Hendrik NJ Schifferstein and Elly PH Zwartkruis-Pelgrim. 2008. Consumer-product attachment: Measurement and design implications. *International Journal of Design* 2, 3 (2008).

15. Michael Sivak. 2013. Has motorization in the U.S. peaked? (2013). <https://deepblue.lib.umich.edu/bitstream/handle/2027.42/98098/102947.pdf>
16. Phil Turner and Susan Turner. 2013. Emotional and aesthetic attachment to digital artefacts. *Cognition, Technology & Work* 15, 4 (2013), 403–414.
17. Kai Wehmeyer. 2008. User-device attachment? Scale development and initial test. *International Journal of Mobile Communications* 6, 3 (2008), 280–295.