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Summary of WP Student Team

PERCEPTIONS AND PREFERENCES OF GERMAN CONSUMERS ON E-BIKE BRANDS AND PRODUCTS

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Marketing Research Field Lab

PERCEPTIONS AND PREFERENCES OF GERMAN CONSUMERS
ON E-BIKE BRANDS AND PRODUCTS

THE IMPACT OF PURCHASE MOTIVES AND PSYCHOLOGICAL FACTORS ON THE
PERCEPTION OF E-BIKE BRANDS BY GERMAN CONSUMERS

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Work project carried out under the supervision of:

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Abstract

Pedelecs, or e-bikes, have surged in popularity recently and especially during the COVID-19 pandemic. Despite its strong growth and high levels of competition and innovation, no academic marketing-related literature has yet examined the underlying dynamics in German buyers' purchasing decisions. Using established marketing research methods including perceptual mapping and conjoint analysis, this work investigates motives for purchase, public policy, perception of brands including influences of color, and the influence of brand, price, and technical attributes of e-bike models on purchasing decisions. Results indicate that the market is in threat of commoditization with buyers showing indifferences for brands and purchasing decisions dictated by prices.

Keywords

Marketing Research, E-bikes, Business-to-Consumer, Conjoint Analysis, Perceptual Map, Brand perceptions, Attribute preferences

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List of Abbreviations

BAFA	Federal Office of Economics and Export Control
BEV	Battery Electric Vehicle
e-MTB	electrified Mountain Bike
MTB	Mountain bike
SRP	Suggested Retail Price
WH	Watt-hours
ZIV	Zweirad-Industrie-Verband e.V.

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1 Introduction – Group

The golden years of the bicycle industry during the pandemic are over now – or so it seems. In March 2023, *Süddeutsche Allgemeine Zeitung*, one of Germany's largest daily newspapers, headlined *Corona boom for bikes is over* (2023). While the world stood still under COVID-19 restrictions, the bicycle industry prospered as individuals sought outdoor activities. In the first year of COVID-19, bicycle sales in Germany grew by 30% compared to 2019 (Rothengatter, 2022), and expectations for the industry were ecstatic, with the European Cycling Federation predicting annual bike sales of 30 million units by 2030 (Reibold, 2020). Even though the European market for e-bikes is still young and only started growing in the last decade (Ling et al., 2017), the e-bike is the driver of growth in the bicycle industry (Müller, 2022). Further, with a total revenue of 6.2 billion €, Germany alone contributed nearly half of the total e-bike revenue in Europe in 2022 (Dr. Mohr & Dr. Zuberer, 2023).

It is crucial to know what bike brands and retailers need to do to break the expected figure of 30 million annual unit sales by 2030 and how much of a role e-bikes will play in this. E-bikes clearly are an important trend in the personal mobility space but the recency of e-bikes becoming widely adopted, means that existing research is limited. In fact, a first literature reviews showed that marketing and business-related literature on the topic of e-bikes in Germany is close to non-existent. Therefore, more insights into the consumers' desires for e-bikes would be helpful. In such a promising market, it is important for e-bike manufacturers and brands to realize higher revenue by building products which are most desirable for consumers, yet still viable for e-bike manufacturers. E-bikes are – compared to normal bicycles – more technically complex vehicles, which leads to higher cost of production and, in turn, higher retail prices to be able to remain profitable (Contò & Bianchi, 2023). The strong industry growth and little amount of published marketing research provide a place for interesting and potentially new

insights into existing and upcoming e-bike brands in Germany and beyond. Technological advances related to electrification unlock seemingly unlimited opportunities for manufacturers but also beg the question of what consumers actually value in an e-bike.

Based on the previously mentioned aspects that emerged during the research, this work project will analyze some of the potentially most influencing aspects for buyers and owners of e-bikes in the German market. This work is built upon three research questions to cover the most important marketing-related aspects. Brands and manufacturers can build on these or adopt single findings to their existing strategies. The three research questions, which will serve as a basis for analyzing the results of the research methods, are:

- *What drives German customers to buy e-bikes?*
- *How do Germans perceive e-bike brands?*
- *How important are selected attributes for German consumers in an e-bike purchasing decision?*

In order to gain a better understanding and a clear connection between important theories of marketing, the following steps in this thesis will be highlighted. First, a market overview of the German e-bike market is provided, followed by a literature review and the preliminary research section, both of which form the basis for the methodologies used in the primary research. After detailing the survey design for the perceptual map and conjoint analyses, the results are presented in detail and discussed in comparison with the literature and the preliminary research.

Overall, the results show a tendency among buyers to follow the guiding principle of *form follows function*, with brand loyalty being lower than it is, for instance, in the automotive or luxury industry. Buyers slightly favor upgrading to the next price level to prevent potential quality compromises with a budget model. Preferences and perceptions on e-bikes seem to be impacted by ownership, as the appreciation of attributes seems to change after a purchase of an e-bike.

2 Product and Market Overview – Group

2.1 Definition and Taxonomy of E-Bikes – Group

Electric bicycles have surged in popularity over the last ten years (Statista, 2023) and are often seen as an alternative to cars and traditional bicycles (Van Cauwenberg et al., 2022). While traditional bicycles rely entirely on the rider’s physical effort for propulsion, these newer types of bikes integrate electric motors to assist riders in moving forward, greatly transforming the cycling experience.

A fundamental classification based on the nature of the propulsion offered by the vehicle distinguishes between throttle-controlled *e-bikes* and pedal-assist bikes – known officially as *pedelecs*. Pedelecs operate by providing electric assistance only when the rider pedals, enhancing the overall cycling experience without entirely replacing human effort. Conversely, throttle-controlled bike models feature a mechanism where riders can engage the electric motor without pedaling and are thus classified as their own distinct type of personal mobility vehicle according to German law. Hence, they are subject to different regulations and policies than pedelecs (Fishman & Cherry, 2016). German law also distinguishes pedelecs depending on the speed at which riders are assisted. Speed-Pedelecs – or *S-Pedelecs* – offer electric support up to 45 km/h, while conventional pedelecs are treated just like bicycles with electric support up to only 25 km/h in speed (Cherry & Fishman, 2021). Due to the difference in speeds and the related implications on safety, S-Pedelec riders are required to possess a driver’s license and are prohibited from riding on certain types of streets and paths.

Of the three subcategories presented, pedelecs are by far the most widely adopted and most commonly referred to as e-bikes in the German language despite not being the technically correct term (Marincek et al., 2020). This is so common that not just consumers but also brands use the word e-bike to refer to pedelecs (Gazelle GmbH, 2023b). Considering the differences in regulation, target group, and potential use cases, this research focuses solely on conventional

pedelecs, which electrically support riders up to a maximum speed of 25 km/h only while pedaling. Because of the public's clear, albeit inaccurate, association of the term e-bike with pedelecs, the group uses the term e-bike instead of pedelec in the experiments to facilitate participants' understanding. It is also because of this, that in the following sections, the terms e-bike and pedelec are used interchangeably.

3 Literature Review – Group & Individual

3.1 Overview of Academic Literature – Group

A large part of the scholarly attention that e-bikes receive is coming from Asia, which is likely to be explained by the fact that China is by far the most established global market for e-bikes, both in sales numbers and societal acceptance (Zuev et al., 2019; Ling et al., 2017). In the late 2000s and the early 2010s, 20 to 30 million e-bikes were sold annually in the Chinese market (Ling et al., 2015). Compared to Chinese sales of e-bikes, only 310,000 e-bikes were sold in Germany in 2011 (Dudenhöffer, 2015). Because of their wide distribution and the high interest in e-bikes in China, research on e-bikes has continued to grow since the early 2000s (Melia & Bartle, 2022).

In their literature review, Zhou et al. analyzed over 2,000 articles published between 1976 and 2023 to visualize the evolution of academic research on e-bikes over time. Their work identifies three stages of e-bike research: (1) the *initial development stage of e-bikes* from 1976 to 2010, (2) the *stable development stage of e-bikes* from 2011 to 2014, and (3), the *rapid development stage of e-bikes* since 2015 (Zhou et al., 2023).

Research in stage one revolved heavily around the e-bike as a technical product, with the most frequently used keywords being *Fuel cell*, *Electric bike*, and *Battery*. Stage two used keywords such as *China*, *Cyclist*, *Policy*, and *Behavior*, which shows how scholarly attention moved from technological research and development to issues and topics that arose following the initial adoption of e-bikes. The focus on societal issues intensified in the third and current stage, with

the strongest keywords being *Electric bike rider*, *Health*, *Safety*, *Intersection*, and *Signalized intersection*, driven by the overall more hazardous behavior of e-bike riders in traffic, as shown in multiple studies including Weber, Scaramuzza, and Schmitt (2014).

Research on the motives for e-bike adoption does exist, but its interest in academia overall does not seem to be particularly high based on these findings. A set of papers analyzes motives, perceptions, and usage as well as general factors related to the adoption and possession of e-bikes. However, to the group's best knowledge, no scientific articles exist that examine the topic of e-bike adoption from a business and marketing perspective. For example, no articles were found that explore success factors for e-bike manufacturers, which is surprising given the extraordinary growth the market has seen over the last few years. Online archives like Sage Journal, JSTOR, ResearchGate, Academia, and De Gruyter have been used to get the best possible outcome for essential scientific research. In addition to specific search commands, important keywords such as *e-bike marketing*, *e-bike market*, *pedelec*, *marketing German e-bike*, *electric bike marketing*, *e-bike Germany*, or *marketing electric bike* were used to narrow down the literature search thematically and geographically. Topics related to e-bike traffic, such as *urban mobility*, *urban cycling*, or *cycling*, were searched for using the relevant literature archives. While the research identified a more-or-less clear set of motives for purchasing an e-bike, it would certainly be valuable to analyze what specific factors lead a prospective buyer to choose one brand over another and how firms can establish competitive advantages.

Furthermore, researchers found that motives for e-bike adoption, as well as usage of e-bikes (intended and actual) and societal issues related to e-bikes, vary significantly by country (Zhou et al., 2023). In this respect, it is noteworthy that there is little research on the German market and consumers.

3.2 Academic Research on E-Bikes – Individual

3.2.1 Motives for Purchasing an E-Bike – Pauline

Academic research on the reasons for purchasing an e-bike discloses several studies about e-bike ownership. For instance, Jones et al. (2016) explored the motives for buying an e-bike by conducting semi-structured interviews with e-bike owners living in the Netherlands and the UK. In the course of the dialogues, interviewees explained how they first got in touch with e-bikes. The ownership or purchase of an electric bicycle by a friend or acquaintance in a closer environment to the participant and witnessing more e-cycling on the roads over time has led to a first personal stimulus. In order to fulfill their new desire and better understand e-cycling, they researched the topic on the Internet. Subsequently, they went to see retailers to get more details and test electric bicycles. Besides that, interviewees mentioned other reasons that eventually resulted in an e-bike purchase, such as health and travel behavior (Jones et al., 2016).

Health

For instance, the prevailing perception of e-bikes is that they positively contribute to health and well-being. In most cases, purchasing an e-bike was driven by health. The recognition of decreasing physical abilities at an advanced age has led to an investment in an electrified bike to sustain or even build up their everyday cycling habits. Furthermore, the opportunity to cycle greater distances, which results in more movement during the same period than riding a traditional bicycle despite less physical effort, was mentioned as a positive impact of e-cycling (Jones et al., 2016). Also related to health reasons are smart features, which help the rider track important parameters. Relevant smart features are health monitoring and performance logging about the current physical conditions of the rider, which are provided via smart displays (Stilo et al., 2021).

Travel Behavior

Accompanying this, the influence of e-bikes on travel behavior has been another incentive for investment. In the Jones et al. (2016) study, interviewees without or just minimal prior cycling

background highlighted situations, such as a car breakdown, forcing them to reconsider and change their travel behavior. Nevertheless, the available data about how e-bikes affect general travel behavior is mixed and differs between countries. According to Bourne et al. (2020), the effect of e-bikes on traveling comes from the previously used form of conveyance. Based on their global meta-study (leaving out Chinese evidence), electric bicycles will presumably replace automobiles in countries or areas with prevailing usage, for instance, almost everywhere in the UK. However, this conflicts with other findings. In the Netherlands, a high-cycling country, e-bikes are purchased as a better alternative to conventional bicycles than automobiles (Kroesen, 2017a). In Denmark, where riding bikes is common, too, people purchase electric bicycles to replace automobiles (Haustein & Møller, 2016).

The results of the studies of Fyhri and Fearnley (2015), Plazier et al. (2017) and Cairns et al. (2017) about loaned electric bicycles, amongst other things, show that they are well-used as a mode of transportation, thereby replacing other forms of transportation, such as cars. However, it is challenging to infer a general effect on travel behavior due to the techniques used for assessment. Specifically, commuting has been more significantly affected by e-cycling compared to other traveling reasons (Plazier et al. 2017; Cairns et al., 2017). Moreover, in a study particularly targeting commuters, de Kruijf et al. (2018) discovered a significant modal shift from traditional bicycling and using cars to e-cycling.

Buyer Demographics

Apart from the survey of Kroesen (2017), which is based on data from *Dutch National Mobility*, no other academic study has explored the impact of the e-bike user and owner characteristics, specifically not in the German market. Over the three-year observation period from 2013-2015, e-bike ownership of the Dutch sample increased. In terms of demographics, other authors validated Kroesens discoveries, that typical e-bike customers tend to be of higher age, female, most likely retired, and with a higher household income (Bourne et al., 2022). On the contrary, the

ownership of e-bikes declines in conjunction with household size, being an employee or student, as well as educational level and residential density. Compared to the growth in age in owning an e-bike, young people who own an e-bike are more likely to use it (Kroesen, 2017).

Barriers to E-Bike Adoption

The deterrents to riding an e-bike were explored in thirty-seven studies. Bourne et al. (2020) classified these insights into three segments: individual, social, and physical (including environmental and e-bike-specific) and sorted them by the quantity of reporting (Appendix 1). The most significant obstacles arose from the environment as well as barriers, explicitly resulting from the electrification itself. The highest concern came from the battery because users were worried about insufficient range, implying consumers were afraid that the battery would die before finishing the bike ride (Kohlrautz & Kuhnimhof, 2023). Moreover, technical difficulties, as well as high maintenance expenses, portrayed an argument against using an e-bike. Regarding safety, most respondents were anxious about riding in car traffic or with conventional bikes and pedestrians. The lack of infrastructure due to missing or poor maintenance of cycle lanes was also mentioned as a deterrent in many studies. According to Jones et al. (2016), deterrents to e-cycling can also vary depending on the cycling culture in the country. For instance, in the UK, a general issue is the scarcity of bike infrastructure, leading to dissatisfaction among e-bike users because riding alongside distracted car drivers increases their safety concerns. Compared to the Netherlands, however, only 1% of all trips are done using e-bikes in the UK, which is why e-bikes are more likely to adapt to the regular traffic speed. In contrast, e-bikes are used for 27% of all trips in the Netherlands. A prominent problem here is riding next to conventional bikes because of the speed differences. Since there are special cycling lanes in most parts of the country, sharing those means for e-bike drivers to moderate their speed to reduce the risk of an accident. Moreover, respondents said the weather, especially rain, would be a barrier. In terms of social factors, the most frequently described anxiety in studies was derived from the potential theft of the e-bike. For individual responses, particularly young e-bike owners stated that riding

electrically assisted bicycles was perceived as laziness due to less physical effort and activity than conventional bikes. Thus, working-age individuals were more concerned about being judged than older people (Bourne et al., 2020).

3.2.2 Public Policy for Accessibility of E-Bikes – Pauline

With the growing presence of e-bikes in road traffic, some European countries, such as the Swiss Federal Roads Office, started to introduce precise regulations for e-bikes and *trend vehicles* in 2022 regarding speed, braking system, minimum age, and obligation to wear a helmet due to growing concerns about road safety (Bundesamt für Strassen ASTRA, 2022). However, Germany is doing differently to reduce e-bike entry barriers, with federal states and cities investing millions into transforming their cities towards a better infrastructure for e-bikes and BEVs (Jens Hohnwald, 2020). Many smaller and larger cities in Germany provide services and infrastructure to support using e-bikes as daily commuter vehicles. Furthermore, there is a range of governmental initiatives to make e-bikes more accessible, including those described below.

Federal Subsidies of E-Cargo Bikes

The only government agency currently promoting e-bikes in Germany is the Federal Office of Economics and Export Control (BAFA). However, the subject of the program is solely e-cargo bikes instead of normal e-bikes. Moreover, only commercially used models are eligible for funding. Thus, private individuals do not profit from this subsidy. The BAFA finances up to 25% of the purchase, up to a maximum cost of 2,500€ per e-cargo bike (BAFA, 2023).

E-Bike Employer Lease

Over 60,000 employers in Germany offer *JobRad* to employees to save money due to the possibility of e-bike leasing. The monthly contribution is deducted from the gross salary, so taxes and social security contributions can be saved. The leasing contract itself usually runs for two to three years. At the end of this period, individuals can lease other models or buy their e-bikes. The purchase price is correspondingly low after the leasing period (JobRad, 2023).

E-Bike Financing via Health Insurance Fund

German healthcare providers often offer a health program where insured persons can collect bonus points. While for most health insurances, bonus points can only be used for courses and no sports equipment, health insurance fund *Techniker Krankenkasse* offers a maximum subsidy of 600 euros if the e-bike is recognized as medical aid (Die Techniker, 2023).

E-Bike Sharing

In Germany, e-bike-sharing projects in various cities are part of an innovative and sustainable mobility service to encourage public transport. Local providers, such as VAG Freiburg, Stadtmobil Hannover GmbH, and Münchener Verkehrsgesellschaft mbH, offer instant (e-)bi-cycle sharing at several bike stations across the city. Furthermore, two providers, nextbike by TIER and Callabike by Deutsche Bahn Connect GmbH, operate nationwide (VDV - Die Verkehrsunternehmen, 2023). In contrast, other companies like Swapfiets, Otto Now, and Grover have monthly subscription models for e-bike rentals throughout large cities in Germany (Weser Kurier, 2020).

3.3 General Research on Marketing and Consumer Psychology – Individual

3.3.1 Influence of Colors on Brand Perception – Pauline

The Swiss psychiatrist Carl Jung, a well-known researcher in the examination of colors, was quoted as saying, “Colors are the mother tongue of the subconscious”. According to the study of Singh (2006), individuals form their opinions within 90 seconds of their first encounters with products or people. Colors solely account for up to 90% of the evaluation. Therefore, using color carefully can impact opinions on specific products as well as moods and emotions, both favorably and unfavorably. Colors can also support product distinction from other brands. Particularly in marketing and advertisement, including precise color association in the design of ad claims can raise their believability and contribute to brand credibility (Lohse & Rosen, 2001). Several factors influence the perception of colors, such as demographic aspects (e.g., age, gen-

der, personality) and inherent psychological and physiological bias. Nevertheless, the perception of a product is influenced by multi-layered references and not solely colors. Thus, the combination of various signals can affect consumers' perceptions, preferences, and purchases (Singh & Srivastava, 2011).

From the marketing perspective and daily life, the following paragraph highlights the importance of various colors (Singh & Srivastava, 2011). *White* symbolizes peace, purity, youth, cleanliness, light, and truth. In addition, white is often used as a background to provide a neutral effect. In contrast, *black* can represent various dimensions, e.g., elegance, power, style, modernity, mystery, seriousness, and professionalism. The image of *gray* as a blaze color is used to illustrate, for instance, neutrality, elegance, balance, respect, and wisdom. When it comes to intense color, *red* can strongly influence feelings and personality. The association with strength, passion, excitement, energy, leadership, ambition, and power inspires brain waves, encouraging individuals to make fast choices. Furthermore, the color is used by advertisers and product designers to highlight essential objects or advocate brands. In comparison, a non-threatening and calm color presents *blue* as it de-stresses the mind. The perceived picture of trustworthiness, confidence, water, creativity, and reliability supports blood pressure reduction and decreases the pulse rate. *Orange* represents happiness and enthusiasm. Furthermore, the color is related to playfulness, energy, gaudiness, heat, and desire. *Brown* is an earthy color connected to environmental quality, as it stands for natural organisms, roughness, boldness, steadfastness, reliability, and calmness. In addition, it is commonly correlated with *green*, as this color illustrates a refreshing and stabilized mind. Furthermore, the color embodies nature, stability, fertility, renewal, generosity, growth, and creative intelligence.

3.4 Conceptual Background on Research Methods – Group & Individual

3.4.1 Perceptual Map – Group

The perceptual maps analysis was selected as a central method of the primary research of this work in order to explore how Germans perceive e-bike brands.

In a market with numerous companies offering products and services with comparable functionalities, brand differentiation has become essential (Nigam & Kaushik, 2011). The perception of a brand depends on the consumer's values, beliefs, needs, experiences, and environment (Gigauri, 2019a). Thus, communicating the brand's worth and quality can be crucial for standing out from the competition and winning over customers (Nigam & Kaushik, 2011). Furthermore, substantial brand equity benefits the market positioning (Aaker, 1996) and diminishes the company's exposure to activities from competition.

For assessing the brand positioning in the market, marketers use a perceptual map to indicate the relationship between different brand characteristics. Furthermore, it illustrates gaps in the market, i.e., where no brands are positioned yet. In addition, the perception of various brands and products can reveal where consumers might perceive substitutes (Iacobucci et al., 2019).

Based on the evaluation of the result, marketing actions can be adjusted and redefined to assemble a more suitable market positioning for the brand. As products mostly have more than just two attributes, Gigauri (2019b) suggests two approaches: the attribute rating and the overall similarity. While the first method is designed for easily identifiable qualities, the second is used for challenging characteristics. Hence, brands are being compared by being presented to interviewees in pairs. For participants to assess the items, the Likert scale is a valuable tool for visualizing the similarities and opposites by multidimensional scaling (Mishra & Mohanty, 2013). The measurement range can be individually modified on a scale from 0 to 10, depending on the evaluation profundity of the research question. The 5-point Likert scale ranges from (1)

strongly disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) strongly agree (Opuni & Alhassan, 2023).

To understand the psychological associations of consumers with different brands, the attribute rating method technique will be used for the survey because the chosen brand characteristics are rather effortless to recall. For the evaluation of the study, a 5-point Likert scale proved to be a suitable medium between the level of detail and clarity.

3.4.2 Conjoint Analysis – Group

Besides perceptual map analysis, this research also relies on conjoint analysis to uncover the importance of selected attributes for Germans when purchasing an e-bike. Conjoint analysis is a powerful and multivariate market research technique uniquely suited to understand the complex web of consumer preferences and decision-making processes. By evaluating the respondents' choices, conjoint analysis uncovers the implicit trade-offs individuals make when selecting from a priorly selected set of product bundles (Smith & Albaum, 2005). In contrast to traditional survey methods, it simulates real-world purchasing scenarios by presenting respondents with various product profiles composed of different attribute levels (Alp & Öz, 2020). In a choice-based conjoint experiment, participants are asked over multiple rounds to select the one profile they would purchase based on its unique characteristics and the participant's personal preferences. In conjoint analysis, products have *attributes* such as price, battery capacity, and smart features. Each attribute has different *levels*, such as specific prices or battery capacities offered in the market (Kuzmanovic et al., 2012).

The conjoint analysis conducted in this research is brand-specific, meaning that all data is available on brand granularity. This unlocks insights into the impact and overall importance of brands which is essential to draw richer conclusions by combining the results from both the perceptual map as well as the conjoint analysis. By further segmenting participants based on demographic and preference-related factors, one can gain a better understanding of potential

buyer clusters and develop a more solid marketing strategy. Typical output of conjoint analysis includes attribute partworths and preferences for levels (Sänn, 2017).

Attribute Partworths

Conjoint attribute partworths, also known as relative attribute importance, provide a quantitative measure of the impact each attribute has on consumers' overall preferences within a conjoint analysis. These values represent the degree to which variations in preferences for specific levels, such as price, contribute to the perceived value of a product or service. Partworths are essentially coefficients assigned to different attribute levels, reflecting the utility or desirability associated with each level. A higher partworth indicates a greater influence of that attribute level on overall preference. Attribute partworth values add up to 100% for each brand, illustrating how the lower importance of one attribute results in the higher importance of other attributes. Analyzing these partworths allows researchers to identify key drivers of consumer choice, helping businesses understand the relative importance of different product features and tailor their offerings to align with customer preferences through segmentation (Kuzmanovic et al., 2012).

Preferences for Levels

While attribute partworths are useful in gaining an overall picture of which attributes are most or least important to consumers, analyzing preferences for levels is essential to understand consumers' actual preferences and the choices resulting from them. Level analysis helps marketers understand the desirability of specific product features – in this case, specific battery capacities or e-bike categories. Also, the question of how brands promote their products can impact the preferences for features of their product. The perceived values and subjective preferences for specific attributes are mostly based on perceived benefits for the purchase in contrast to the cost of the purchase. This can lead to unviable product preferences (Khalifa, 2004).

4 Preliminary Research – Group

4.1.1 Demographics – Group

Of the final sample size of $n=38$, 25 participants identified as male and 13 as female. Nine respondents were between 18-25 years old, another nine respondents were between 26 and 30, seven respondents were between 31 and 40, and four respondents were between 41 and 60. The remaining nine respondents reported an age above 60 years. Eleven respondents live in rural areas, and 16 are in small to medium-sized cities. The remaining eleven respondents live in large cities. Regarding e-bike ownership, 13 respondents (34.21%) stated that they already own an e-bike, with the remaining 25 not owning one. Only one respondent stated that he did not consider buying a bicycle within the next five years. The rest was split between 13 participants who can imagine buying any type of bicycle, i.e., would consider buying either electric or non-electric, and the other 24 participants who would only consider buying an e-bike in the future. Further, 100% of e-bike owners would consider purchasing one, either again or purchase their first e-bike, assuming they did not yet own one in the first place. It is noted that 100% of e-bike owners specifically answered that they would only consider purchasing e-bikes in the future.

5 Primary Research – Group & Individual

5.1 Survey Design – Group

5.1.1 Questionnaire Structure – Group

For the primary research, the marketing research platform *Conjointly* was used to construct one questionnaire that included both the conjoint and perceptual map sections. Initially, it was intended to collect data in two separate questionnaires, with *Conjointly* for the conjoint analysis and *Qualtrics* for the perceptual map. Both surveys were planned to be linked through automatic redirects, passing data in the links to map conjoint responses to perceptual map responses and vice versa. Comparing the benefits of keeping both research methods separate versus combining

them into one larger questionnaire showed that the latter option seemed more beneficial for four reasons.

Firstly, despite well-structured redirects, the number of successfully mapped responses was estimated to be low. Participants were free to choose which questionnaire to start with, and they could not be forced to proceed with the other survey after completing the first. Consequently, responses from such participants who did not enter the second questionnaire through the redirect would be impossible to map. Secondly, to prevent participants from entering an infinite loop of surveys, the questionnaires would need a decision tree to distinguish between known and new respondents, adding further complexity. Third, combining both methods into one questionnaire means that participants only had to enter demographic information once and ensured identical sample structures for both methods. Finally, it was assumed that a single, longer questionnaire allowed for a more efficient data collection strategy, as participants did not have to be motivated twice to participate.

Accordingly, the final questionnaire included two main sections, plus the demographics section and other pages such as task instructions (see Appendix 6 for a translated version of the questionnaire). The first questions were about e-bike ownership. Participants were asked whether they already owned an e-bike and, if so, of which brand. If they stated that they did not own one, a follow-up question appeared, asking about current, past, or future intentions of purchasing an e-bike. In case they never had the intention of purchasing or were once interested in the purchase but decided against it, a follow-up question asked participants to elaborate on why they were not interested in purchasing an e-bike.

Instructions

Before the conjoint section, participants were shown a more detailed set of instructions explaining what they would see on the screen and what they were asked to do, as well as a remark explaining that the conjoint section is, after all, a simulation that cannot possibly include all factors that are relevant in a real-world purchasing decision. The pretest with 38 participants

revealed several difficulties that participants, especially those of higher age, encountered with the first version of the questionnaire. Hence, this, as well as all other instructions, were rewritten to provide more information and use simple language (Appendix 6). These difficulties mostly arose from a lack of understanding of the format and concept of conjoint analysis. Either they did not understand the task or what they saw on the screen. Some struggled to view the options shown on the screen as holistic “packages” and based their decision on single attributes rather than the combination of multiple different attributes. Some had initial difficulties understanding that the only options relevant for each decision round were those shown on the screen, and some did not realize that those options updated each time they chose one option. In this case, participants were confused because they clicked on an option and did not register that the next round began.

While the first instruction page covered the concept of conjoint analysis, the second instruction page detailed which attributes participants were about to see and included an overview of the brands incorporated in the block of conjoint questions. Participants were shown four screenshots of the brands’ website landing pages and logos. This was done to increase brand recognition and allow the participants to become more familiar with the brands. The alternative solution of displaying brand descriptions posed the risk of introducing biases. Showing the websites appeared to be the most neutral way to educate participants in this case, as the information displayed is primary information, i.e., it is generated by the brand itself and not a third party like an online retailer. It is a richer medium than plain text, as it includes text, imagery, and other visual elements that convey information. Hence, it should best reflect what the brand is trying to communicate and how it aims to position itself. Participants were again asked to carefully read the information before proceeding to the conjoint section.

Conjoint Section

Participants were shown the options sorted by price in ascending order from left to right. Below the options, further information on the levels displayed was shown. Initially, those level descriptions were also visible by hovering over the respective attribute, but the pretest showed this to be distracting as it covered other information on the screen. On top of the page, participants were reminded that only the options shown on the page were relevant to the decision and that they would find descriptions for the levels at the bottom of the page. Conjointly automatically set the number of decision rounds to twelve.

Perceptual Map Section

After the conjoint section, participants saw an instruction for the upcoming perceptual map section. This included an explanation of the tasks as well as a brief overview of the traits and statements for which participants were asked to rate their opinions. On the second instruction page, they were shown the website screenshots again and asked to take a moment to familiarize themselves with the brands. Elaborating on the questions in advance allowed the participants to better judge the brands they saw. As described in Section 5.1.2, the perceptual map question block consisted of nine items about four brands, resulting in 36 judgments to be made by the participants. At the top of the page, participants saw all items and their explanations. Below this, the website screenshots were displayed, followed by the Likert-based rating element. Participants were asked to rate the extent to which they agreed with the statement on a Likert scale of one to five (*1 = strongly disagree, 5 = strongly agree*) for each brand. To minimize the drop-off rate, participants saw their progress within this block of questions.

Demographics

Following the perceptual map section, participants were asked about their age, gender identification, education, employment status, and annual gross income. These questions were given in single-choice format and contained options for *Other* or *Prefer not to say*.

5.1.2 Data Collection Strategy – Group

The questionnaire was open for participation from 18 October 2023 to 12 November 2023. It was primarily spread to direct contacts of the group members who knew that their contacts already owned an e-bike or were considering purchasing one. Other participant sources include platforms such as SurveyCircle and SurveySwap, Facebook groups, Instagram, and LinkedIn. Contributing to about 65% of participants, direct contact is the largest source of participants among the sample. Among these respondents is a rather large group of students who were personally asked to participate. All of them are close to completing their master's degree and, thus, about to enter their first full-time employment, earning their first proper income and were expected to be more likely to consider higher value purchases (Mankiw, 2020). With the high number of employers already offering JobRad leasing, it is likely that a significant share of those students will have such corporate benefits. Hence, they were considered an appropriate part of the target demographic. Most direct contacts received a link to the survey, as well as a brief description to give context about the survey. Some older participants were visited in person to aid in case of technical difficulties.

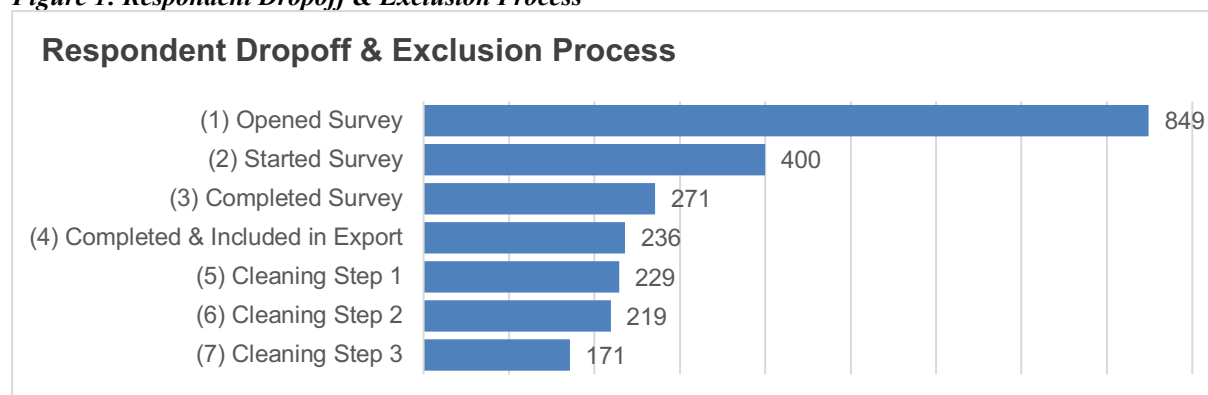
Platforms like SurveyCircle and SurveySwap allow students to reach a broader audience in a cost-effective way. The questionnaire was posted on both platforms, which operate in a circular, points-based incentive scheme. Users list their survey on the platform and, by participating in other surveys, earn points that improve the user's own survey ranking, improving visibility and the likelihood of collecting more responses.

5.2 Data Cleaning and Processing – Pauline

In total, the platform documented that the questionnaire link had been opened 849 times. However, for the analysis, the final sample contained responses from 171 participants, as not all data proved valuable for providing insights. The collected responses emerged from pre-elimination

through Conjointly and a manual three-step cleaning process performed to exclude participants not matching the target group, as illustrated below in Figure 1.

Figure 1: Respondent Dropoff & Exclusion Process



Firstly, out of 849 times the survey link was opened, it was completed 271 times. The drop of 548 consists of 449 respondents who merely opened the link and left immediately (52.8%), as well as 129 participants who quit the participation during the process (32.5% of 400 survey starters). Furthermore, out of the 271 complete responses, 35 (12.9%) were deemed invalid after finishing the survey due to being marked as low quality by the platform. Those respondents either did not look through all alternatives or moved their mouse too little. Most of those respondents tried participating via smartphone devices despite being explicitly asked not to.

Manual Participant Exclusion

After the platform screening, the pre-selected data based on 236 participants was exported as an Excel sheet and further cleaned based on response validity and participants' speed in responding, as well as their interest in e-bikes to achieve high data quality. As is often the case, participants in the sample still provided invalid answers, for example, by always selecting the same value throughout a series of questions. The perceptual map section seemed ideal to test for such invalid responses due to its repetitive nature. To identify those, the standard deviation of each response in the perceptual map section was computed for all participants on a brand level. Participants whose answers had a standard deviation of zero for each of the four brands

gave identical answers for all traits for all brands. All seven identified participants were excluded from further analysis in the first manual cleaning step. In addition, the minimum duration for completing the survey was set to five minutes to remove individuals who clicked through it without consideration. Thus, ten further responses were excluded due to their fast participation time in the second step. In the third and last step, the respondents' interest in e-bikes was examined to guarantee the sole consideration of participants with valuable insights in the final sample size. For this reason, the survey included two questions (Q2 and Q4) to screen out individuals who neither owned nor used an e-bike and likewise claimed not to be interested in purchasing one in the past, present, or future. Thus, 48 responses were removed from the adjusted sample since they did not use e-bikes and lacked interest. Those respondents who do not own an e-bike but still use one – for example, a family member's e-bike, remained in the sample because these respondents were deemed to be of similar quality as owners. In the end, a total of 171 responses remained in the final sample.

Data Transformation and Visualization

The data exported from Conjointly underwent extensive data transformation to be used in further analysis. Conjointly's Excel file served as an input for an *extract, transform, and load* process in Power Query which removed irrelevant columns and, importantly, restructured perceptual map responses from 180 binary columns – five columns for the Likert ratings for four brands for nine statements about the brands – into a format more appropriate for analysis in Excel, Tableau, and SPSS. Excel was used to calculate individual partworths, relative attribute importance, and level preferences on a participant-level for conjoint analysis. This was done to be able to estimate and compare the various values for different demographics and go beyond the standard insights that Conjointly provides. Using Tableau's powerful dashboard functionality provided multiple perspectives on the same data simultaneously and allowed the group to spot disparities for different descriptive data. It also showed how partworths and level preferences varied when splitting the data by demographic factors or brands. Hence, Tableau was

primarily used to analyze demographics and conjoint results, while SPSS was used to create the perceptual map through factor analysis, as explained in the following.

Factor Analysis in SPSS

Before creating the perceptual maps, the average values of all traits of each brand were computed in Excel. Afterward, the information for statistical data analysis was processed in SPSS to evaluate the brand perception by copying the average weighting of each trait/brand combination from the spreadsheet to SPSS. In the next step, factor analysis was used as a dimension reduction technique to identify and compress communalities in items – latent variables mirrored in manifest variables and to estimate the existence of correlation. The program's default settings were altered to increase the informative value of the output. Thus, the univariate descriptives and the coefficients in the correlation matrix were chosen for the descriptive statistics. To assess the general sampling adequacy and check whether the correlations between the variables are sufficiently different from what would be expected by chance, the Kaiser-Meyer-Olkin and Bartlett's sphericity test (Cleff, 2014) were selected. For the initial extraction, the principal components method was picked. The number of removed variables was based on the Eigenvalue, with Eigenvalues greater than one. Following the recommendations of (Backhaus et al., 2023) to simplify the interpretation and to ensure the restraint of factor correlation, an orthogonal rotation option was used afterward. The goal of the varimax rotation is to increase each factor's variance to a maximum, resulting in a redistribution of the total amount of the explained variance across the two removed factors. The selection of additional options, such as the rotated factor solution and the scree plot, were activated to assist in the reasoning of the analysis.

5.3 Sample Demographics & Characteristics – *Pauline*

The gender distribution of the final sample size displays an almost perfect 50-50 split with 87 male and 84 female participants. Other options, for instance, *diverse* and *prefer not to answer*, were not selected. The age classification resulted in a distinction of seven groups, including an option to *prefer not to answer*. The 91 participants between 25 and 34 constitute the largest age

group, representing 54.9% of the sample. 52 participants (30.4%) were aged between 18 and 24. The third largest age group contained 25 participants (14.6%), with respondents between 55 and 64. The remaining age groups, 35-44, 45-54, and 65-74, had similar shares with 11.1%, 12.3%, and 8.8%, respectively. With ten participants (5.8%), those over 75 are least strongly represented. Regarding education level, with exactly 60 participants each, the bachelor's and master's degrees (or equivalent) are the most commonly stated highest levels of completed education at the time of participation. Both groups of participants make up a combined 70.2% of the final sample, 35.1% each. Following that, 29 (17.0%) respondents had a high school diploma or equivalent qualification. The remaining participants are almost evenly split into eleven participants (6.4%) who completed an apprenticeship, ten (5.8%) who hold a doctoral degree, and one who responded with *other*. This person stated in the follow-up question to hold a state examination in law. With 83 participants (48.5%), the single largest group of respondents were employed fulltime at the time of participation, followed by the group of 53 students (30.9%). Subsequently, 19 participants (11.1%) responded that they were already in retirement, and 13 (7.6%) stated that they were part-time employed. Three participants responded with *other*. The most common income group consists of 31 participants (18.1%) currently earning less than 9,999€ a year, followed by 70-79,999€ with 18 (10.5%) and 10-19,999€ with 17 participants (9.9%), respectively. Fifteen participants (8.77%) selected *prefer not to answer*.

E-Bike Usage among Participants

A total of 80 respondents (46.7%) reported that they owned an e-bike, while 37 (21.6%) stated that another person in the household owned an e-bike. In contrast, the remaining 54 (31.6%) said they did not have or use an e-bike. Ownership rates varied between 55-70% for most income groups except for the two groups with the lowest income. As shown in Appendix 8, the ownership rate drastically increases from the income groups earning less than 20,000€ annually to those earning more. Given this, ownership rates are generally higher for more increased incomes and older age groups, but there is no clear linear relationship. Rather, it is just a higher

rate from a certain income group upwards. Those who do not own an e-bike but use one owned by another household member are particularly strongly represented within the lower-income groups. Predominantly, they are students using what are likely their parents' e-bikes. 65.8% of prospective buyers – those who neither own nor already use another person's e-bike but stated that they are interested in purchasing one – are in the age group of 25-34, notably graduates and young professionals.

The fleet of e-bikes owned or used by 117 participants consists of at least 32 brands. Two participants simply entered "E-Bike" in the input field, and one participant explicitly stated that he did not know the brand. 46 other participants left the input field blank. The most commonly reported brand is Cube, with eight e-bikes, followed by Gazelle, with five as well as VanMoof, Riese & Müller, and Sushi Bikes, with four bikes, respectively.

Out of all 91 participants who did not own an e-bike (i.e., users and prospective buyers), 75 participants stated that they would consider buying an e-bike in the future. The remaining 16 stated in a follow-up question that they once considered buying an e-bike but then actively decided against it. By far, the most common reason provided by those participants involves high costs (43.7%, see Appendix 7 for a complete overview of stated reasons). Some also felt that the normal bike they already owned was still sufficient. Other reasons include fear of theft and that other modes of transportation are more suited for the participant's needs. As mentioned in the previous section, those participants who did not own nor ever showed interest in purchasing an e-bike were previously excluded from the sample. Among those participants, however, fitness and age-related reasons were most commonly stated: participants still felt young and fit enough not to require an e-bike. This was followed by the high purchasing costs.

5.4 Perceptual Map Results – Group

5.4.1 General Evaluation of Brand Perception – Group

In the following, the results of the perceptual maps will be presented, and their significance discussed in order to answer the research question. Clusters of items will illustrate the positioning of the individual e-bike brands according to the consumers' perceptions.

SPSS Output

Looking at the generated output in SPSS, the explanation of the total variance (Appendix 9) provides insights into the rotation sums of squared loadings as it illustrates the variance distribution after the executed varimax rotation. The results demonstrate that the cumulative percentage of the first factor explains 68.188% of the variance. By including the second factor, both account for 98.929% of the total variance. Hence, the statistical requirement of a 95% variance explanation is fulfilled (McShane et al., 2023). The scree plot (Appendix 10) shows the eigenvalue against the factor number. The nearly flat line next to the second factor indicates a two-factor solution.

Regarding the rotated component matrix, Table 1 reveals the factor loadings resulting from the Pearson correlations between two data sets. Accordingly, the traits of user-friendliness, sustainability, quality, comfort, purchase probability, innovation, and uniqueness are closely related to component 1. In contrast, component 2 appears to correlate with the variables of diversified portfolio and price-performance. A closer glance at the items innovative and unique supports the theory because comparing both rotated factor loadings, they are positive (I: 0.927; U: 0.862) for component 1 and negative (I: -0.375; U: -0.497) for component 2.

Table 1: Rotated Component Matrix

Items	Component 1	Component 2
Usability	0.989	0.134
Sustainability	0.987	0.131
Quality	0.977	0.152
Comfort	0.929	0.350
Innovation	0.927	-0.375
Uniqueness	0.862	-0.497

Purchase Probability	0.828	0.557
Price-Performance	0.263	0.951
Portfolio Diversity	-0.091	0.992

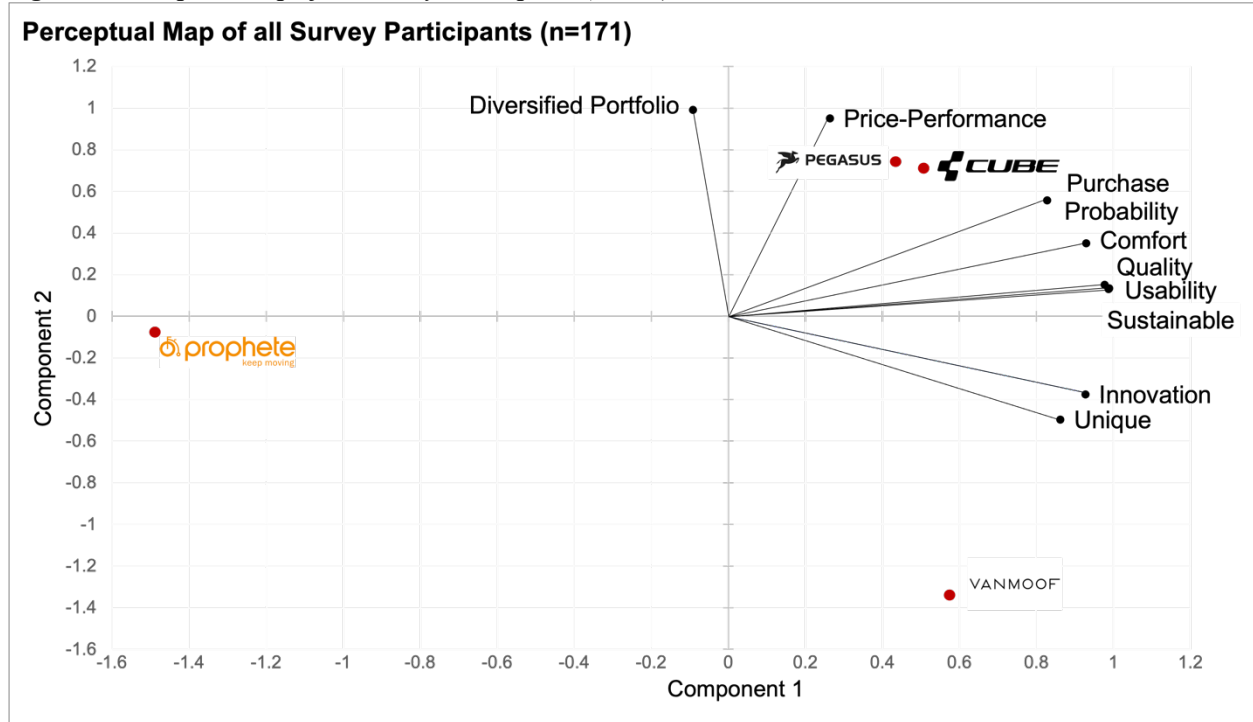
As the second component expresses the ratio for a diversified portfolio and price performance, the values are reasonable because a high degree of innovation and uniqueness tends to contradict an adequate cost-benefit ratio as well as a large product range.

The communalities are based on the principal component analysis and express the amount of variance for each variable accounted for by the components. Moreover, they characterize the sum of squared factor loadings for the variables (Appendix 11). The variance proportions of all variables can be explained mostly by the found components. This highlights the objectivity of these variables and that none of the components need to be excluded.

Perceptual Map Output

The component plot in rotated space (Appendix 12) displays the individual items on a graph with component 1 and 2 denoting the horizontal and vertical axes, respectively. In order to plot the coordinates of the analyzed brands on the graph, the factor scores were estimated using a multiple regression calculation. Specifically, the regression method was chosen because it enables finding a correlation between traits in component 1 and a correlation of items in component 2. The final perceptual map in Figure 7 below illustrates the disparity between the two components mentioned before and the positioning of the four brands.

Figure 2: Perceptual Map of all Survey Participants (n=171)



Component 1, represented by the horizontal axis, can explain most items. Component 2, however, is represented by the vertical axis. All items except for Diversified Portfolio are on the right-hand side of the vertical axis, concluding that no items in component 1 were perceived to conflict with each other. Taking into consideration the perceptual map (Figure 2) as well as the rotated component matrix (Table 1), the complementation of items in component 1, as well as a high correlation of items in component 2 can be revealed. Thus, a total of three clusters can be identified, which were classified into three categories according to their relevance. The first cluster is called *Primary Focus*, and it incorporates closely correlated items with high values in the first component and low to medium values in the second component: user-friendly, sustainability, quality, comfort, and purchase probability. The indication is that those items represent the core elements that a brand's product should include. The *Secondary Emphasis* cluster can be pinpointed on the vertical axis and consists of two items: diversified portfolio and price-performance. As the items hold no direct counter-item, it is assumed that they serve as supporting components for a brand to the primary focus of the product. The last cluster is named *Tertiary Consideration*, and it encompasses innovative and unique, the two elements that have

negative value in component 2 and are the farthest from the others (Appendix 12). Therefore, those are the most contrasting items perceived by survey participants, and the hypothesis is made that they provide additional context for brand individuality but generally have a lower priority than the items in the other clusters.

For the factor analysis, SPSS created two new variables, FAC 1 and FAC 2 (Appendix 13), which denote the brands' values for components 1 and 2, respectively. These values are computed based on the item ratings given by the participants. The combination of both factors characterizes the positioning of the four brands on the graph. Hence, a clear picture of the perceptual map, comprising all elements, emerges. At first glance, the examination manifests that Cube and Pegasus are located very close to each other between the first and second clusters. VanMoof, on the other hand, can be found in the bottom right corner below the third cluster. Meanwhile, Prophete is positioned opposite the map, not near any of the three clusters.

Taking the values of both factors (FAC 1 / FAC 2) into account, Cube and Pegasus had the highest participant ratings. The values were also comparable, so the assumption was that the brands were perceived similarly. VanMoof is ranked based on the average ratings of respondents, who predominantly associated the brand with innovation and uniqueness near the proper cluster. The separate positioning of Prophete suggests a distinct brand perception compared to the other three brands.

As SPSS summarized all items in a rational way, it is likely that a brand has a more positive factor loading but performs worse in individual traits than a brand with a lower factor loading. Consequently, for a detailed analysis, the perceptual map will be continuously likened to the average values of the spreadsheet (Table 2).

Before diving into the analysis of each brand, the following section will first discuss the total averages of the brands' and items' perceptions of all participants. Afterward, a comparison to

the analysis of the perceptual map strives to discover similarities and differences between the perceptions of the brand elements and interpret the outcomes precisely.

Excel Output

For better visualization of the results, conditional formatting at the row level is applied to highlight the best (green) and worst values (red) for each item.

Table 2: Brand Perception – Item Ratings of all Participants

Item	Cube	Pegasus	VanMoof	Prophete	Average (Total)
Price-Performance	3.842	3.965	3.287	3.497	3.648
Quality	4.345	4.047	4.058	2.865	3.829
Usability	3.965	3.977	3.930	3.462	3.833
Diversified Portfolio	4.275	4.152	2.766	3.784	3.744
Comfort	4.029	4.099	3.848	3.339	3.829
Innovation	3.848	3.772	4.392	2.842	3.713
Unique	3.339	3.427	4.058	2.632	3.364
Sustainable	3.310	3.240	3.240	2.836	3.156
Purchase Probability	3.854	3.725	3.187	2.637	3.351
Average (Total)	3.867	3.823	3.641	3.099	3.608

The quality of Cube, Pegasus, and VanMoof was favorably approved and overall above average. In comparison, Cube performed best in the category, averaging 4.345. In terms of a diverse portfolio, Cube and Pegasus were identified as producers with a broad range of e-bikes. In addition, the products of both brands were characterized as comfortable. Apart from that, it is again noticeable that VanMoof is the only brand being recognized as innovative and unique, as both values are almost 0.7 above average. Meanwhile, the diversification of its product portfolio is perceived as insufficient as the value is 2.766, which is almost one point below average. In comparison to the other brands, Prophete has the poorest perceptions regarding quality, innovation, uniqueness, sustainability, and purchase probability. Furthermore, the brand performed below average in eight out of nine categories. Consequently, the brand emerged to have the lowest ranking, with 3.099 – compared to the average of 3.608.

Regarding the categories, price-performance, and usability were reviewed similarly for all brands, with a low standard deviation. Likewise, the standard deviation for sustainability was the lowest, with a minor total average of 3.156. At the same time, the most dispersed data in relation to the mean was registered for a diversified portfolio and quality.

Cube

Comparing the total averages of all items, Cube performed best as a brand valued at 3.867. By looking at the new variables created by SPSS while simultaneously reviewing brand item perception scores, Cube and Pegasus had the highest participant ratings. The factor loadings were also similar, assuming the brands were perceived similarly. The high score of both brands in component 2 can be justified by the participants' perception of a diversified portfolio and a good price-performance. However, looking at the perceptual map, Cube is further right on the horizontal axis than Pegasus, resulting from its higher rating score in product features, such as the predominantly perception of quality (Table 4). According to the CHECK24 report, based on the number of e-bike insurances taken out on the platform in 2021 (Figure 2), Cube is the most popular e-bike brand in the German market. As people generally rate familiar brands better than unknown ones (Chew et al., 2012), Cube's brand recognition and market positioning could have led to the highest average value of all brands.

Comparing the items identified on the perceptual map to the brand image targeted by Cube according to its website and other public contributions, the overall perception corresponds in most parts. For instance, Cube advertises its broad portfolio of high-quality e-bikes with a wide range of functions and comfort, which can also be recalled in the perceptual map. Yet, the low score for sustainability (3.310) does not match the image, as Cube is one of the pioneers of alternative means of transport, has a wide range of cargo bikes, and actively promotes sustainable production.

Pegasus

In terms of total averages, Pegasus is the only brand that surpassed above-average ratings in all categories. Followed closely by Cube, who solely performed below average in the perception of uniqueness. Pegasus stands out for having the highest factor loading for the second component due to being ranked best for price-performance. Hence, Pegasus is positioned in the upper right-hand corner with a slightly lower score than Cube for component 1. Looking closely at

the item varieties, Pegasus is perceived as the best brand for comfortable e-bikes. However, regarding quality, Pegasus is ranked behind Cube and VanMoof, indicating that its e-bikes are considered positively comfortable despite not having the highest quality. Regarding the overall brand perception, Pegasus is ranked second with a value of 3.823, slightly behind Cube's. Yet, the disparities are minor, and the brand perception is positive, as components 1 and 2 display. The top ten ranking of bicycle and e-bike manufacturers (Figure 2) indicates that Pegasus is the fifth most popular e-bike brand in the German market.

Again, comparing the items identified on the perceptual map to the brand image that is intended to be conveyed by the manufacturer's website and social media presentation, Pegasus specifically values its high-quality standards. This is emphasized, for example, through quality seals and affordable prices. Contrasting the self-positioning of Pegasus with the outcomes of the perceptual map, for instance, in terms of price performance, the results display similarities. On top of that, the perceptual map indicates a slightly smaller product portfolio than Cube, which also applies when exploring brand information. In the context of self-depiction, Cube attempts to present itself uniquely. However, the survey rating reveals that Pegasus had a more individual perception, although the brand does not use large marketing campaigns for promotion.

VanMoof

Examining the position of VanMoof on the perceptual map and comparing it with the spreadsheet, the brand ranking is predominantly based on the high item associations in the third cluster, including Innovative and Unique as well as high quality. In contrast, due to the negative value in the second component, VanMoof is set almost on the opposite of the second cluster, including diversified portfolio and price-performance, which most likely result from the below-average scores for these items. Another observation emerged from taking a closer look at the competitor Prophete. Despite a worse perception of price performance, VanMoof still has a higher purchase probability. As a consequence of VanMoof's high quality and innovative

strength, the hypothesis can be made that consumers are willing to accept a poorer price-performance ratio if they receive a better e-bike in absolute terms.

Comparing the brand's target positioning – modern, stylish, and revolutionary with continuous improvement – according to its website with the perception of the participants, the outcome of the survey is in accordance. Nevertheless, an interesting and important insight is that respondents did not visibly penalize VanMoof in their ratings despite potential negative press about its bankruptcy. Hence, it was assumed that it does not affect the perceived quality of a brand.

Prophete

The isolated positioning of Prophete on the far left of the map suggests a distinct brand perception compared to the other three brands. Additionally, taking the overall performance of Prophete into account, a clear picture emerges. The negative value for the first component indicates that factor 1 is below average. The highest average score and the only criterion Prophete did not occupy last was diversified portfolio. Consequently, Prophete lags behind its competitors, even though it is the ninth most popular e-bike brand in the German market, according to Figure 2. While Prophete is trying to differentiate itself with a broad portfolio and a reasonable price-performance, respondents perceived these criteria only as average in relation to the other brands. In order to encounter the motivation for the perception, it was deduced that customers probably associate the low prices proclaimed by Prophete with inferior quality despite Prophete, just like Pegasus, having several quality seals on their website.

5.4.2 Evaluation of Brand Perception: Ownership – Group

After analyzing the perceptual map of all respondents (n=171), the participants were split into two groups: (1) *e-bike owners and shared users* (n=117) and (2) *non-owners* (n=54) to get insights on disparities and similarities in the brand perception between both groups. Furthermore, the objective was to figure out distinct aspects of needs and seek potential misjudgment by the consumers before the e-bike purchase, which they, however, only became conscious of after, such as estimating battery capacity too high. The reason is that in the preliminary survey,

as well as during the first evaluations of the primary survey, dissimilarities in brand perception based on ownership status were prominent, for instance, due to the divergent topic relevance. Therefore, as in the previous analysis, the average values of the two groups were calculated in separate tables (Appendix 15-16). In addition, all steps in SPSS were replicated to create two perceptual maps and evaluate the brand perception. On top of that, the delta (Δ) was computed to visualize the differences better (Appendix 14).

Looking at the total averages, all variables, except for innovation (Δ : -0.080), scored higher overall by owners and shared users, with 3.658 in total (Appendix 15), than non-owners, with 3.498 in total (Appendix 16). Then again, comparing the individual brand performance between the two groups, particularly Pegasus, stands out due to its higher perception (Δ : +0.459) by the owners and shared users' group. Going more in-depth into the examination, the superior rating can primarily be linked to the greater price-performance (Δ : +0.815), purchase probability (Δ : +0.789), diversified portfolio (Δ : +0.655), and comfort (Δ : +0.605). The underlying cause could be that group 1 obtained a better knowledge-based view due to their research prior to the e-bike purchase. In contrast, group 2 could only judge from the website screenshot provided in the survey (Appendix 17) if the brands were unknown before and no further information was sought.

A comparison of both perceptual maps holds evidence to support the hypotheses (Appendix 18-19). At first glance, depending on the ownership level, a mixed positioning of Cube and Pegasus can be identified. While non-owners perceived both brands quite differently, Cube (FAC 1: 0.598 / FAC 2: 1.278) being considerably better than Pegasus (FAC 1: 0.009 / FAC 2: 0.005) (Appendix 19), owners and shared users encountered similarities in the brands' perception. Thus, both brands were placed closely (Appendix 18).

Non-Owners

Based on the evaluation, solely taking the screenshot into account (Appendix 17) as the leading cause for the disparities in the perception of group 2 displays that the websites' appearance

genuinely differs (Appendix 16). Cube uses dark shades, such as deep forest green, which appear professional and dignified in the context of branding, advertising, and marketing of products, according to (Walker, 1999). Furthermore, earth shades like brown are associated with environmental quality, representing natural organisms, roughness, steadfastness, and reliability according to the theory described in Section 3.3.2. The illustrated page is divided into two sections. In addition, each section consists of two to four photos, making the parts more fragmented. Nevertheless, the imagery, colors, and arrangement make the website look clean. Meanwhile, the assembling of Pegasus' page is more neutral due to the particular use of white as a background, delivering a neutral effect of purity and innocence, and light grey, a blaze color, releasing a sense of elegance, simplicity, neutrality, and balance. Furthermore, red highlights essential objects on the website and advocates the brand, illustrating strength and passion (Section 3.3.2). The page is split into two sections, each showing one e-bike. Cube has a greater choice of e-bikes presented in the screenshot than Pegasus, so the perception of having a broader product range is relatable. Considering those insights, the implication is that the brand impression of Cube, being high quality and having a diversified portfolio, is heavily based on the look and feel of the website. Consequently, the reasoning for non-owners to purchase a Cube e-bike rather than a Pegasus is logically comprehensible, as well as the clear distinction in the view of both brands according to the positions on the perceptual map.

Following that assumption for the analysis of the other brands, the perception of VanMoof, especially being innovative and high quality, comes from the simple, modern website appearance. The color selection of white, grey, and black and solely portraying a cutout of an e-bike, emphasizes, on the one hand, the image of power, style, modernity, and professionalism (color black) and, on the other hand, cleanliness, and purity (white) as well as elegance and balance (gray) forming an image of quality, high class (Section 3.3.2). In contrast, Prophete uses a broad color range of orange, white, green, blue, and red on its website, evoking several emotions

simultaneously. Red, in particular, can strongly influence feelings and personality, symbolizing excitement, energy, and ambition. However, the color could also have a negative impact due to the power that inspires brain waves, encouraging individuals to make fast choices. Orange appears to be seen as playful, possibly with energy and gaudiness (Section 3.3.2), resulting in mixed feelings. Furthermore, the page is divided into six sections containing more fragmented details. Accordingly, the page could be interpreted as unorganized and chaotic, potentially leading to a perception of a lack of seriousness, modernity, and professionalism. Consequently, the negative perception of *Pegasus* through non-owners compared to owners and shared users (Δ : -0.065) could have emerged from the website deducting a worse quality and comfort, less innovation and uniqueness, causing a lower purchase probability.

Owners and Shared Users

In the preliminary consumer interviews, all owners stated that before purchasing an e-bike, they spent extensive time (up to half a year) seeking information about the products via local bike shops or the Internet (Section 4.2). Accordingly, the presumption that e-bike owners and even shared users have advanced knowledge about brands and their products compared to non-owners can be supported. Following that sense, the assumption was made that group 1 is probably less affected by the impression of the brands' website screenshots compared to group 2, driving the different brand perceptions on the maps as well as in total averages.

Beginning by examining the performance of *Pegasus*, as mentioned before, owners and shared users perceived the brand substantially better than non-owners (Appendix 14). Looking at the categories that stand out the most, such as price-performance, diversified portfolio, and comfort, the higher rating could result from the superior brand expertise of the owners gained through prior market screening and a comparison of different brand and e-bike offers. As both perceptions are positive and price performance is a decisive variable in buying judgments, the high value for purchase probability can likewise be justified. Interestingly, *Cube* has been

ranked first according to Figure 2. Nevertheless, owners and shared users would rather buy a Pegasus (Δ : -0.076), which only got fifth place.

Considering the perception of VanMoof, the relatively negative rating for the product range compared to group 2 (Δ : -0.477) can be attributed to knowing that the brand only provides six models. At the same time, the better rating for comfort and uniqueness can also be explained since VanMoof provides specific information on its website, such as for test rides and suitable e-bike models according to size. On the other hand, the overall unfavorable ranking for Prophete (-0.065) most probably comes from the perception of a low-cost provider, as Prophete actively promotes its *reliable mobility for excellent value for money*. Furthermore, Prophete is broadly diversified to serve various target groups, such as prospective buyers of (e-)bikes, e-scooters, and other means of transport (Prophete In Moving GmbH, 2023). This could imply a lack of focus on e-bikes, contributing to a worse perception of quality, innovation, uniqueness, and purchase probability.

5.4.3 Summary of Perceptual Maps Results – Group

The two previous sections explored the perception of the e-bike brands Cube, Pegasus, VanMoof, and Prophete based on specific items using a perceptual map. The responses of 171 survey participants provided insights into broad consumer perspectives as well as the impact of owning or using an e-bike on the image of those brands in contrast to non-owners.

The calculation of all items in SPSS explains 98.929% of the total variance. The program automatically divided all items into two components depending on their weight and correlation values to other characteristics. The first component included user-friendly, sustainable, quality, comfort, purchase probability, innovative, and unique, while the second incorporates diversified portfolio and price-performance. Additionally, using the multiple regression method revealed a correlation between items in component 1 and the correlation of items in component 2, identifying a total of three clusters on the perceptual map. Those were classified into three

categories: Primary Focus, Secondary Emphasis and Tertiary Consideration. The first combines comfort, sustainability, quality, user-friendly, and purchase probability. The second incorporates diversified portfolio and price-performance, complementing the key essentials but with a slightly lower priority. The last one includes innovative and unique items that contribute additional value to e-bike brands, albeit with a lesser emphasis compared to the other clusters.

Cube and Pegasus were positioned between the first and second clusters. As a result, they are perceived as similar brands of high quality with a diversified portfolio and comfortable e-bikes. VanMoof, likewise observed as a quality brand, was ranked in third place, and particularly stood out for its identification as innovative and unique – the items of the third cluster. Accordingly, the brands' positioning on the map was right beside it. Prophete appeared to be seen as a brand without high quality, innovativeness, or uniqueness, contributing to being not considered when purchasing an e-bike. However, the example of VanMoof illustrated that even though the brand turned out to have a poorer price-performance ratio than its competitor, Prophete, customers are willing to pay a higher price for an innovative and unique product.

An in-depth examination of the answers split between (non-) ownership and e-bike user groups revealed that owners and shared users consistently ranked all items higher than non-owners except the contemplation of innovation. Furthermore, a distinction in the perception of Pegasus and Cube was noticeable because the first group, consisting of owners and shared users, perceived more similarities than the second group, which characterized non-owners. While Pegasus reached the best average value of owners and shared users, group 2 had a considerably better picture of Cube. The image of VanMoof and Prophete almost had no deviation between both groups.

In conclusion, the perception of all four brands mainly depended on the ownership status. Yet, the survey highlighted that some brands could enhance their online presence to attract more

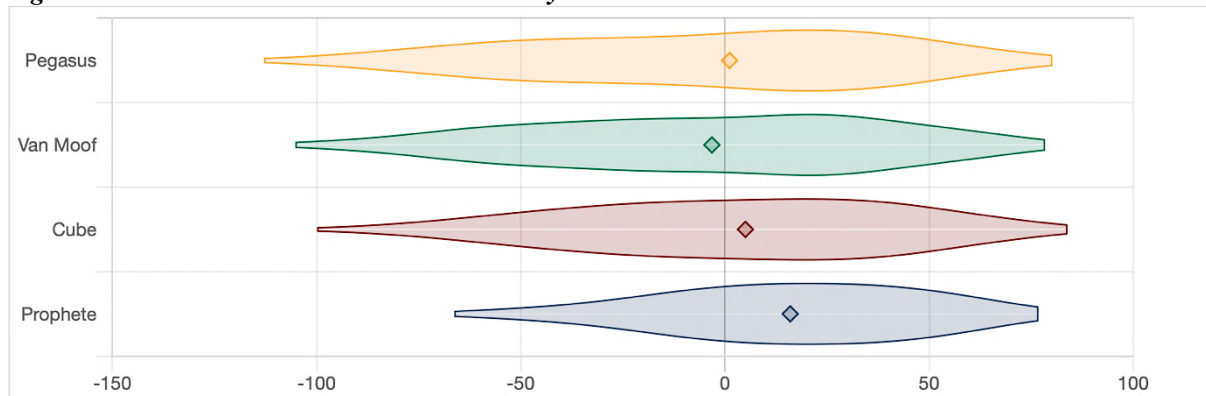
potential buyers and increase the brand's appearance in terms of quality, product range, and price-performance.

5.5 Conjoint Data Results – Group

5.5.1 Preferences for Brands and Product Attributes – Group

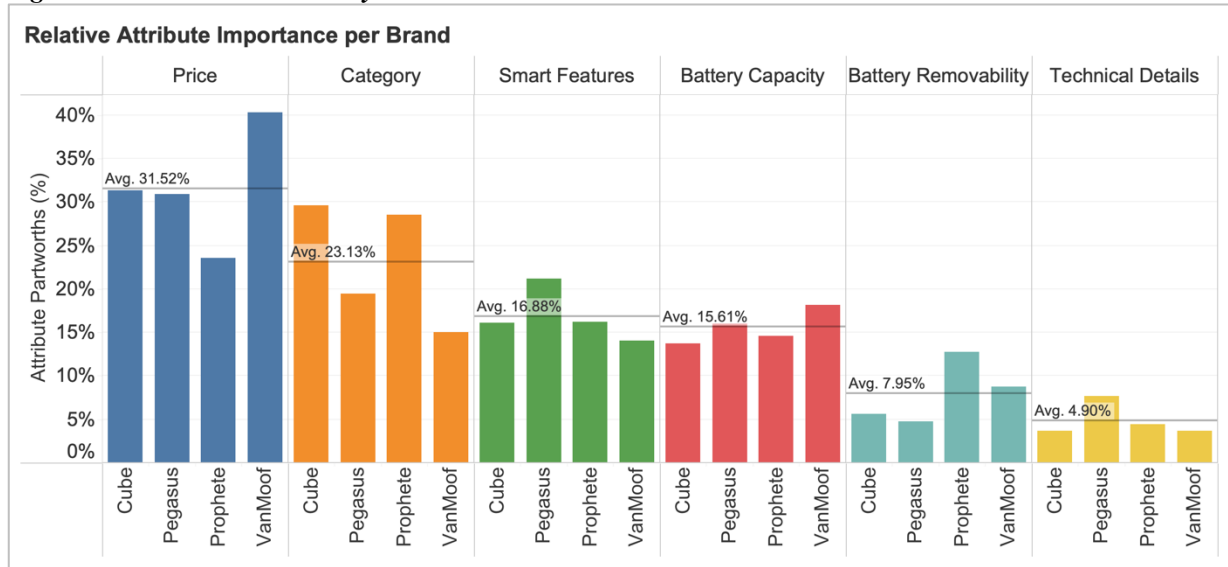
Despite the mixed perceptions observed in the previous chapter, the conjoint results clearly show how the brand seems to be of overall low importance to participants in the simulated purchasing decisions. Figure 3, exported from Conjointly shows for each brand the preferences for all possible combinations offered by the brand in the experiment. The further right, the more value a combination presents to participants, whereas the further a combination lies to the left end of the axis, the less valuable it is perceived by participants. The diamonds in the middle indicate the median value. Overall, the shape and positioning of the brands are very similar. Pegasus has the widest range between the most preferred and the most disliked model, whereas Prophete has the smallest range, which can directly be attributed to the fact that Prophete did not offer the most disliked price level of 4,499€.

Figure 3: Violin Plot – Brand Values Perceived by Consumers



Regarding the other, more directly product-related attributes, it can be seen that price is clearly most relevant in participants' decisions, followed by category as well as smart features (Figure 4). Battery capacity has almost identical average values as smart features. The least important attributes were the removable battery and technical details. Only slight differences between the brand were indicated by the participants' choices.

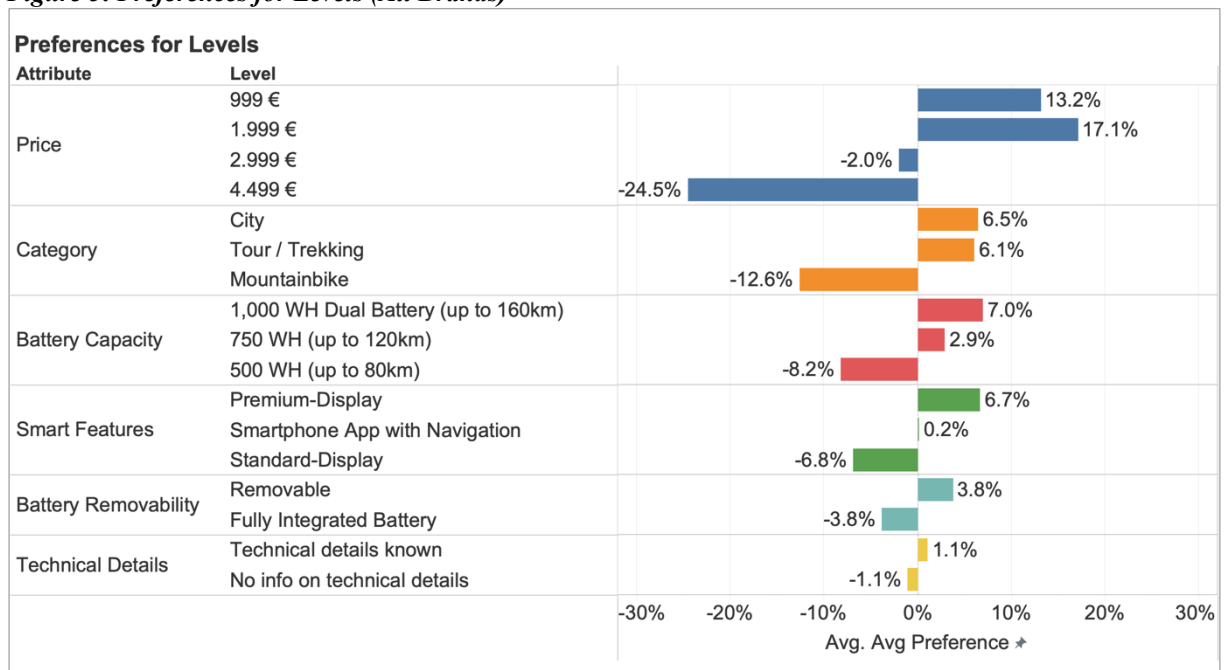
Figure 4: Attribute Partworths by Brand



5.5.2 Preferences for Levels – Group

Figure 5 illustrates the average preferences for levels recorded by the tool for all 171 participants in the final sample. It must be noted that as a result of the conjoint design, Figure 10 represents the average of the brand-specific values, and as a result, the bars for price and battery capacity do not average zero.

Figure 5: Preferences for Levels (All Brands)



The levels offered by Prophete differed slightly compared to the other brands to reflect Prophete's distinct brand positioning more accurately as a low-cost provider. Hence, the absence of some levels as well as the offering of the lowest price level slightly distorts the numbers.

Analyzing the data on a level of granularity shows similar results to the attribute preferences. Price dominates as the most important factor, with lower prices appearing more favorable to participants than higher prices. In short, considering the entire sample, consumers prefer lower prices as well as larger and removable batteries. They are also mostly indifferent between city and trekking bikes and only have a very slight preference for knowing technical details about their bike. As described in the rest of this section, analyzing the data on a brand granularity shows similar patterns for all brands, with those levels expected to offer the most utility being the most appealing overall. For a detailed breakdown by brands, see Appendix 20.

Price

As expected, lower prices are more attractive than higher prices. As shown in Appendix 20, price sensitivity seems to be very similar for Cube, Pegasus, and VanMoof. In contrast, the low-cost brand Prophete might indicate a lower price sensitivity in lower price regions followed by a stronger drop for its highest price point. A possible explanation for the overall lower preference value for Prophete's lowest price point could be that the price range offered by Cube, Pegasus, and VanMoof is higher than Prophete's, and participants more strongly prefer the lowest price point to keep expenses low. With Prophete, participants might be less strongly inclined to choose the lowest price because price sensitivity might be lower in lower-price regions.

Category

With the full sample, it can be clearly seen that MTB is the least attractive segment across all brands. Between city and trekking categories, there seems to be no clear preference for any of the categories, which aligns with the data reported by the German bicycle lobby group ZIV,

illustrated in Section 2.2.2 by Figure 1. Sales figures for electric trekking and city bikes are almost on par (ZIV, 2023). The rather strong dislike of e-MTB bikes indicates that, overall, the sample of participants does not include enough participants interested in the e-MTB segment. Hence, it is to be noted that insights from the Conjoint and Perceptual Map analysis shall not be applied to the field of e-MTB.

Battery Capacity

The data shown in Appendix 20 indicates a clear preference for higher battery capacities. While VanMoof shows a strong tendency towards dual batteries with 1,000 WH, the preference for the most powerful battery is not as pronounced for Cube and Pegasus. For Prophete, as a low-cost brand, the strongest battery was omitted in the conjoint, which means that the tendency of the respondents for the next strongest storage, the 750 WH battery, was more pronounced than for the other three brands. The equipment with a 500 WH battery was less preferred by the participants for all brands.

Battery Removability

Overall, the removable battery for an e-bike was preferred to the fully integrated battery for all brands. Participants showed almost identical preferences in favor of removable batteries across the three premium brands: Cube, Pegasus, and VanMoof. For Prophete, on the other hand, there was more than twice as strong a preference for removable batteries.

Smart Features

Within the conjoint analysis, three displays were offered for e-bikes of the four brands in the Smart Features area. In addition to a standard display with only basic values for the rider, there was also a premium display with a more detailed presentation and analysis of important parameters for the rider. The third offer was a smartphone application with integrated navigation, which allows the rider to use their cell phone for detailed navigation.

While the standard and premium displays were offered for all brands, a smartphone application for *Prophete* was not offered to the participants. Despite the brand's offering of a smartphone

app, a preference for or against the application was not determined, with an average of -0.2% to +0.4%.

At the same time, respondents across all brands indicated a strong preference for the premium displays in relation to the standard displays on offer. There was no significant difference between the cheaper brand Prophete, the more sports-oriented brand Cube and the high-quality brand Pegasus. This can be linked to the desire for a better display and analysis of the important parameters in all quality levels of the brands. In contrast, the participants indicated a 3% lower preference for premium displays and against standard displays for VanMoof.

Technical Details

For all product combinations available to the participants, knowledge, or lack of knowledge of all technical details of the e-bikes was indicated below the specified details. Preferences for knowledge of the specific technical details were relatively low for the three brands Cube, Pegasus and VanMoof, at 1.4% to 1.6%. Prophete represented a divergence, as Prophete was the only e-bike-brand with a slight preference of 0.3% against the knowledge of technical details. This can be interpreted to imply that there is a sublet preference for the three brands mentioned above. In contrast, the respondents showed an almost perfect indifference to Prophete.

5.5.3 Most Preferred Levels – Group

When analyzing the level preferences, participants' choices indicate several tendencies and differences in choice when comparing differences in the most preferred levels of attributes. The priorly defined attributes of the e-bike category, type of battery and the knowledge of technical details were for all four brands the same, while the price, the battery capacity and availability of smart features for Prophete were customized compared to the other e-bike brands. This resulted in interesting differences in the most preferred levels per brand. Appendix 21 shows the most preferred levels for each brand and attribute.

Price

The survey showed an overwhelming leaning toward German e-bike manufacturer Cube when focusing on the price level that participants were able to select. An impressive nine-tenths of respondents strongly preferred Cube's 1,999€ price point. A comparable, albeit slightly weaker, inclination towards the 1,999€ price point for the Pegasus brand was shown by 86% of participants. For Prophete, with its strategic focus on low-cost products, an adjusted price spectrum was indicated, ranging from 999€ to 2,999€. Significantly, more than 70% of Prophete respondents also showed a preference for the lowest price range, demonstrating a pronounced tendency towards a price-oriented pattern of behavior. However, the share of participants preferring the next higher price level is larger than for other brands. It is worth noting that although VanMoof's preferences for the 1,999€ category were somewhat less pronounced than those of Cube and Pegasus, they still showed a remarkably high concentration in this price category.

Category

A more detailed analysis of the e-bike categories revealed different preferences depending on the brand. With a preference of over 49% of respondents and a clear superiority over the mountain and trekking bike categories, participants preferred city bikes among those offered by Cube. On the other hand, the preference is more evenly distributed for Pegasus: 37% of respondents tended towards city bikes, while 41.9% expressed a preference for trekking or touring bikes. Mountain bikes were preferred by Pegasus with just over 20%, which is the highest figure for mountain bikes with VanMoof. Respondents showed a notable preference for Prophete touring/trekking e-bikes, which would be chosen over the other categories by 43% of participants. This was closely followed by electrified city bikes. It is interesting to note that VanMoof, despite its urban-oriented product portfolio, 50% of participants clearly preferred touring or trekking e-bikes.

Battery Capacity

Preferences for battery capacity showed a congruent trend for Cube, Pegasus, and VanMoof, with around 70% of respondents preferring the 1,000 WH dual battery over the two weaker models. Pegasus had the largest relevant tendency, with a preference of almost 75% for the largest selectable battery. While 23.7% preferred the 750 WH battery, only a fraction preferred the smallest possible battery for their e-bike from Pegasus. In contrast, for Prophete, because of the focus on pragmatic pricing, the brand did not offer the 1,000 WH battery in the experiment, resulting in an even higher preference from respondents for the largest battery offered by the brand. Here, over 81% of respondents preferred the 750 WH battery.

Battery Removability

Participants showed the least inclination towards removable batteries when choosing among Pegasus e-bikes, with around 71% expressing a preference for this feature compared to Cube and VanMoof. For these brands, around 80% of participants expressed a preference for removable batteries. For Prophete, the most affordable brand that does not offer the largest battery, over 90% of the respondents indicated a preference for removable batteries, expressing a clearer tendency against the integrated batteries compared to the other brands.

Smart Features

In the area of smart features, the participants showed a striking affinity for the premium display, with almost 70% for Cube. Participants showed similar preferences with Pegasus, with 70% preferring the premium display. In contrast, one in five participants preferred a smartphone app with navigation for a Pegasus, and only just under 10% of participants preferred e-bikes with a standard display. VanMoof stood out from the other brands in terms of preferred smart features, with almost 30% of respondents preferring a smartphone app with integrated navigation – a marked departure from the established consumer preferences of the other brands. It is also worth noting that VanMoof had the lowest preference for the premium display at 57.6%, indicating a slightly different preference for smart features across brands. For Prophete, only the standard

and premium displays were available for selection. Almost 87% of participants preferred the premium to the standard display, illustrating the strongest desire to upgrade from the standard display between all four brands.

Technical Details

When asked about the importance of technical details, the participants stood out in their preferences for Prophete: they placed the lowest value (44%) on comprehensive information about the technical details. For Cube and Pegasus, respondents expressed a similar trend between both brands, with at least 70% of respondents highlighting the importance of technical information prior to purchase. For VanMoof, respondents' attitudes were similar to those of Cube and Pegasus. For all three brands, respondents placed a high value on the transparency of technical details before buying an e-bike. The results show that for brands that claim to produce and sell higher quality e-bikes, consumers tend to have a higher demand for technical transparency. In contrast, respondents are more willing to accept a lack of knowledge about technical details when it comes to e-bikes in the lower price segment – such as those offered by Prophete.

5.5.4 Influence of Demographic Factors on Preferences – Group

Analyzing attribute importance and level preferences by segments defined by demographic factors does not show any big differences between different participant groups. While the preliminary survey indicated differences in attribute importance between owners and non-owners, the conjoint results do not entirely support these differences. As Appendix 22 shows, attribute importance varies only slightly across ownership groups. Price is slightly more important among those who neither own nor use an e-bike. These participants earn lower incomes overall and might be a bit more price sensitive. For smart features, there is a more visible difference in importance shown by users (those who do not own but use an e-bike). Splitting by gender reveals slightly higher partworths in smart features among female participants than male participants, with average attribute partworths of 16.2% and 13.6%, respectively. For all other attributes, female participants showed lower partworths as compensation. Splitting by age showed

strong decreases in partworths for price with increasing age, as well as partworths for the e-bike category increasing with age. The other partworths show smaller variations in partworths.

5.5.5 Most and Least Valued Profiles – Group

Analyzing the profiles, the participants perceived most and least valuable yields unsurprising results. The profiles with the highest value to consumers are city or trekking bikes with the largest – and, at the same time, removable – batteries and a premium display. These bikes shall cost no more than 1,999€, and technical details shall be communicated clearly. In line with this, the least value is perceived from MTBs offering the smallest, fully integrated batteries, and a standard display at 4,499€ with a lack of transparent communication regarding components. When analyzing the profiles developed from the survey preferences, it must be noted that the brands and bike stores cannot implement them. As shown in Figure 3, market data suggest this would not be viable at the price point of 1,999€ given that this is for many brands even below the base price of their e-bikes. The desired installation of a small removable battery would risk the viability of an e-bike, according to the most valued profile. However, the largest possible battery is the most highly valued and desired by the respondents. Installing the largest removable battery at 1,999€ would make the product's viability impossible for the brands due to material costs.

5.5.6 Summary of Conjoint Results – Group

This chapter analyzed conjoint results on attribute and level granularity for each brand. It provides a clear conclusion that participants are pragmatic in their decision-making and emphasize attributes directly linked to the costs and benefits provided by an e-bike. Price is clearly the most important factor, followed by the e-bike category. As expected, lower prices are generally perceived more favorably than higher prices and price sensitivity seems to increase from prices above 1,999€. For Prophete, the highest share of consumers would prefer the price one level above the base price, which might be linked to concerns about product quality, as seen in the

perceptual map analysis. Averaging the brand-specific values, smart features, and battery capacity scored almost identical attribute partworths, indicating similar importance in the purchase decision. This is also supported by the stronger preference for removable batteries when participants choose Prophete bikes, which do not offer the largest battery. Knowledge of technical details scored the lowest importance among all attributes. However, participants generally showed a slight preference for knowing about the components installed in the bike.

6 Discussion – Group

6.1 Drivers for E-Bike Purchases – Group

This work focuses, among two other aspects, on the question: *What drives German customers to buy e-bikes?* The literature suggests that personal health and sustainability are the most relevant reasons for purchasing an e-bike. The findings from Kroesen (2017) and McQueen et al. (2020) about the positive environmental aspects of e-bike usage over that of cars could be a strong reason for choosing an e-bike for shorter distances. The preliminary consumer interviews partly validated their findings, where five out of ten participants stated that they associated e-bike usage with sustainability because of the reduced use of their cars. Kroesen (2017), as well as Haustein and Møller (2016), provided similar findings in Denmark and the Netherlands. In both countries, participants stated that they purchased an e-bike to replace the car daily. People can also use subscription models with several methods. While companies like Deutsche Bahn Connect GmbH or TIER provide short-term rentals, startups like Swapfiets challenged the traditional market with monthly subscription models for conventional bicycles and e-bikes. This is also driven by the financial barriers prospective buyers face when considering the purchase of an e-bike.

As the literature and participants' responses clearly show, price is still a significant deterrent for buyers considering a purchase. Particularly non-owners rated the price of e-bikes as well as alternative financing models higher than e-bike owners. Other commonly stated reasons for

deciding against a purchase collected in the questionnaire were related to other modes of transportation being more suitable for participants' use cases, with which most were referring to their commutes. Also, fear of theft seems prevalent, as mentioned by the interviewee from Karlsruhe, who ended up not using her e-bike as much as she had expected. Among those who would not consider purchasing an e-bike in the first place, health and age-related reasons also dominate together with price. Participants felt physically fit enough to ride without pedal support and perceived that e-bikes are still targeted exclusively toward older demographics.

This insight may give new brands a higher chance of overcoming market entry barriers in the e-bike market. Studies from Mosca, Casalegno and Gallo (2021) come to a similar conclusion that the market entry for new brands in the e-bike market is easier compared to markets like luxury products or automobiles because the customers make their purchasing decisions based on the brand's positioning. Young brands can focus on developing features that are valued by the customer. The almost complete absence of brand names as purchasing factors can lead to increased pressure to innovate, as existing companies in the market cannot rest on their laurel.

6.2 Perceptions and Relevance of E-Bike Brands in Germany – Group

The second research question was *How do Germans perceive e-bike brands?* The results revealed that brand awareness is primarily influenced by ownership status and can thus lead to different brand perceptions.

The perceptual map analysis illustrated the three clusters of brand traits, or items, that participants associated with each other and the corresponding cluster's implications. Cube had the highest item scores overall, which could be traced back to its high brand recognition. Furthermore, Cube and Pegasus were perceived similarly overall between the first and second clusters, indicating that both brands successfully convey essential information such as high-quality but also benefits for consumers, for instance, a reasonable price-performance and diversified portfolios. VanMoof was recognized as a brand with innovative and unique e-bikes, in line with its

intended positioning. This leads to the perception of being highly individualistic with less emphasis on basic product specifications. Yet, the example of VanMoof demonstrated that consumers are willing to pay a higher price for an innovative and unique product, which not only encompasses vital components but also contributes additional value to the product. The location of Prophete on the left side of the map presumably comes from its perception as a low-quality brand that participants will most likely not consider for e-bike purchases.

Furthermore, the in-depth investigation of brand comparison based on the perception of owners and shared users versus non-owners exposed a discrepancy in the image of Pegasus and an overall more conservative perception by non-owners. Owners and shared users generally rated the perceived items better than non-owners except for contemplating innovation. Accordingly, among owners and e-bike users, Pegasus received a better rating for price-performance, the diversification of its product portfolio, product comfort, and the likeliness to purchase an e-bike of the brand. In an attempt to comprehend the origins of the discrepancy in the brand image, it was assumed to be caused by a lack of knowledge. In contrast, owners could have spent extensive time looking closely at various brands and e-bike models for research prior to their e-bike purchase decision-making process, as seen from the consumer interviewees in the preliminary interviews (Section 4.2). Hence, they likely had an advantage by having a higher brand awareness overall. At the same time, non-owners might not have known some e-bike brands in advance. Thus, their brand evaluation was presumably solely based on their interpretation of the look and feel of the website screenshot shown in the questionnaire.

Similar to those findings are the results from the preliminary survey, where owners had a stronger brand awareness across nearly all brands displayed. Three brands emerged with the highest overall awareness, attracting the attention of both groups equally, indicating a collective understanding of e-bike companies or previous brand knowledge based on their conventional bike portfolio.

To discover the reasoning for the perceived fluctuation range, the intended positioning of each brand according to their websites and other public contributions was compared to the total average perception values of non-owners. Based on that hypothesis, Cube successfully established its intended image as a high-quality brand with a broad product range at a reasonable price point for (non-) owners and shared users. The distinct impression of Pegasus was attributed to its website, which had a different structure than Cube. In the non-owners' perception, the brand's quality and broad product portfolio were not recognized sufficiently, leading to a different brand image. On the other hand, VanMoof's modern and innovative self-appearance was claimed on its website. Hence, the impression of both groups came close to the intended positioning. According to the sample, Prophete, at the lower end of the perceived quality and price-performance ratio, does not live up to its proclaimed marketing of good quality at a reasonable price. This could come from the choice of varied colors because they account for up to 90% of the evaluation, according to Singh (2006), and the website structure. Compared to the other three brands, Prophete uses multiple colors that implicate playfulness and gaudiness, which could have resulted in a perception of a lack of quality and credibility.

The lack of clear preferences for any brands is notable, given the different ratings the brands received. Although Prophete was clearly perceived as having the worst quality and had the lowest purchase probability in the perceptual map, conjoint data showed no obvious dislike for the brand. In contrast, Prophete's median value is the highest among all brands, which can be traced back to its lower price range.

However, the results are not surprising overall, considering the large number of brands serving the market as well as the insights generated through the interviews and the preliminary survey. Brand was rated 16th among the 20 attributes tested in the survey, highlighting the relatively low importance of brands in purchase decisions for potential e-bike buyers.

For consumers, aspects such as the price of the e-bike and its attributes like battery and smart features are more important during the purchase decision. The emphasis on price is clearly visible when bringing the best and worst-rated product profiles back in mind. When it comes to potential buyers, e-bikes should be affordable. The selection of higher prices would only be reasonable when the quality and integrated features correspond to a higher price. The brand Prophete validated these assumptions during the analysis. This shows that the respondents do not look that much at the brand during the purchasing process compared to the price, the quality of the product and the functions of the features like the e-bike connectivity.

Further, most of the interviewees neither sought much information outside of their local retailer nor were they able to name other brands besides their own because they put little emphasis on the e-bike brand. Buyers often simply visited their local retailer and asked for expert advice as well as a test ride. According to ZIV (2023), 73% of all e-bikes sold in Germany were bought in specialized retail stores. However, the range of e-bike brands and models offered by the local retailer varies and depends on the size of the store. Therefore, buyers might not be able to recall several different e-bike brands as they solely know the brands suggested by the retailer. These findings are consistent with those of the preliminary interviews. At a stationary retailer, only a few brands are available to the customers, and potential buyers are naturally restricted in choosing various brands. A survey finding supports this statement because, among 117 survey participants, e-bikes from 32 brands were purchased, revealing high fragmentation. This suggests that many brands are perceived as desirable or at least good enough.

In conclusion, the experiment shows that all brands' perceptions primarily differ due to a lack of interest and knowledge. Unlike other goods, the brand is generally not decisive in e-bike purchase decisions. Quite the opposite, more important product attributes and features will be examined in the following. Accordingly, owners and shared users had a better knowledge basis,

and thus, the brand perception of Cube, Pegasus, VanMoof, and Prophete varied among ownership statuses.

6.3 Importance of Selected Attributes on Purchasing Decisions – Group

One aim of this study was to investigate whether and to what degree selected attributes influence German consumers when purchasing an e-bike based on their perceived importance. When looking at the third research question: *How important are selected attributes for German consumers in an e-bike purchasing decision?* – some differences within the preferences throughout the queried attributes were found among the 171 participants of the primary survey. The low number of decisions for brands is also shown for the distribution of brands during the primary survey. Of the 117 participants who use e-bikes, 32 brands were mentioned, showing a broad spread between the brands of e-bikes and their products.

Based on the conjoint analysis, the price of the e-bike and the specific category of the e-bike were the two most relevant attributes based on the participant's decisions throughout all four brands. As expected, participants tended to choose the lowest prices of the brands, which were 999€ and 1,999€, respectively. As with the other brands, participants strongly preferred Prophete bikes' base price of 999€. However, compared to the other brands, the share of participants who most strongly were interested in the next higher price level (1,999€) is higher for Prophete than was the case with the other three brands. The still good preferences for the second of the third prices for Prophete show one significant difference to the other three brands: when choosing among e-bikes from Prophete, participants were more inclined to upgrade their e-bike to the next higher price. This decision for the price, which is the entry-level price for the other brands, potentially reduces the risk of drawbacks when buying an e-bike, as indicated by the rating on quality in the perceptual map section. Further, this will likely be facilitated by a lower price sensitivity in lower price ranges – resulting in a less pronounced preference for the lowest price – and the desire to upgrade if a higher price is associated with somewhat higher quality.

The strong preferences for lower prices might also result from the group of respondents. Due to the high number of personal contacts that filled out the primary survey, students have been a large proportion of the 171 participants. Bourne et al. (2022) also mentioned the high importance of price, whose research found that price-intensive investments in e-bikes are a main concern for potential e-bike owners during decision-making and the purchasing process.

The category of e-bikes showed one of the strongest differences between the specific levels. While the city- and trekking-e-bikes were preferred by participants across all four brands, e-MTBs were by far the most disliked e-bike category of the three to be selected, starkly contrasting to official market numbers. The ZIV (2023) showed in its analysis of bike sales for 2022 that e-MTBs account for around 90% of all MTBs in Germany. While conventional bikes were the most sold category of bicycles, electrified city bikes were only sold in 528,000 units, around 62% of the e-MTBs sold in Germany in 2022. Also, the Trekking-e-bikes were far behind the more than 835,000 sold e-MTBs in the German market. These findings are congruent with the expert interviews, where the three experts of Bosch mentioned that there is a growing interest in substituting the car with an e-bike. Still, electrified bicycles are mainly used for extreme sports, which they see as the driver for sales of e-MTBs. These differences in the findings of the most preferred e-bike category might come from the fact that the main groups of respondents were students and people of higher ages. Based on that, the group concludes that the potential target group of those interested in e-MTBs might simply not be represented enough in the final survey.

With regards to e-bike battery capacities, the respondents of the primary survey rated the battery as the third most important attribute. The respondents clearly associated stronger batteries with a better user experience or utility offered by the bike. In turn, participants clearly disfavored the 500 WH battery with an approximate range of 80 km. This supports the findings by Bourne et al. (2022), who mentioned that the greatest concerns of their participants were about the battery

of the e-bike, which they traced back to users' uncertainty about the remaining range with electric support. After all, literature and consumer interviews suggest that customers are buying an e-bike to receive support to make their rides less strenuous and, in turn, ride longer distances. Hence, it is not surprising to see the strong interest in the largest battery capacities in the experiment. However, the literature, as well as the interviews, also showed that there can be discrepancies between intended and actual usage. The preliminary survey further indicated that prospective buyers value rate battery capacity as more important than owners did.

This is also supported by the higher partworth observed for battery removability for prospective buyers. Overall, the partworth of battery removability is considerably lower than that of battery capacity, which suggests that consumers are primarily concerned with having a sufficient range on a single charge in the first place. The respondents preferred the removable battery for e-bikes over the fully integrated battery for all brands. Prophete had a particular position within this attribute. Participants showed a more than twice as strong preference for removable batteries compared to the other three brands. The higher preference for removable batteries observed for Prophete can likely be explained by the smaller, albeit still large, maximum battery capacity offered by Prophete. Most likely, the removable batteries are perceived to compensate for the smaller capacities with the option of changing the battery to a charged one. In view of the participants' price preferences and the high costs of e-bike batteries, however, it is questionable whether this would be a realistic and common use case during ownership. As another, likely more useful benefit, the battery can be recharged indoors, which could be especially valuable for e-bike owners who do not have a garage or alternative place with convenient access to electricity. Removing the battery is also an effective means of preventing bike theft, as many e-bikes cannot be ridden without the battery. Also, once a battery degrades towards the end of its life, it can be replaced with a new battery, which extends the bike's overall lifespan and saves the owner costs in the long run.

As shown in the technical analysis of e-bikes (Section 2.3), electrification brought bicycles into the digital age. Smart features like displays and smartphone applications help cyclists see data like speed, distance, battery levels, and the level of pedal support, which is particularly useful to riders who want to adjust their riding experience to different terrains, weather, and the intended purpose of the ride. While the smartphone application was intended to be the “smartest” and feature-rich option of the three, the premium display was clearly more strongly preferred among participants across all brands. This leads to a key takeaway of this study, which is that while it shows that there is indeed an interest in smart features, participants overall seem to follow a philosophy of “form follows function.” The premium display was likely perceived as offering the best combination of smart features, usability, and practicality. With the smartphone app, participants might have had concerns regarding smartphone battery life, usability of their e-bike as an independent product, as well as damages to the phone in case of a crash or bad weather. Interestingly, those using another person’s e-bikes were found to have a higher part-worth for smart features than owners as well as prospective buyers. One interpretation could be that they appreciate this feature slightly more than the owners because they did not have to bear the purchasing costs themselves yet are already taking advantage of such features.

With this insight in mind, e-bike brands might increase their profit when selling to younger customers by including well-developed smart features like premium displays or apps in their e-bikes. Smart features like those mentioned before also have high importance in measuring health-related data of navigation during long tours. Because of these essential tracking and navigation, smart features are gaining more and more significance for e-bikes, which is also acknowledged by Stilo et al. (2021).

In light of the price premium brands charge for e-bikes, the question arises to what degree this is driven by buyers’ active interest in advanced features or in how far it is a case of buyers willing to accept the prices in exchange for some features they might not need. The analysis

showed that interest in more technical and functional aspects of the bikes, battery details, as well as smart features do matter overall. The team lead in batteries and displays at Bosch stated during the interview that customers who are looking for a higher possible range, especially in southern Germany, are specifically seeking e-bikes with a battery from Bosch or other high-quality manufacturers to reduce concerns about the power and quality of the battery which is integrated in the e-bike. A better battery is subjectively associated with longer service life and fewer repairs during the operating lifetime. Indeed, there is a visible overall preference for knowing technical details on the bikes. However, the importance of this attribute is clearly the lowest among those tested in the conjoint analysis. An interpretation of this attribute's partworth being so much lower than those related to the battery and smart features is that buyers are interested in the components of their e-bike but are more focused on getting essential factors about their e-bike right. Knowledge of the components in this sense might just be a small value-add with purchasing decisions driven by affordable prices and essential fundamental technical features. Notably, the expert's statement implies that e-bike buyers are more concerned with the technical components than the bike brand. When comparing all four brands with each other, it seems like participants were more open-minded to accept not knowing about the details of their bikes, which could be driven by the lower prices offered by Prophete. It is assumed that for more affordable options, expectations on quality are not as high, and thus, the interest in what components are installed in a bike does not matter as much as if the bike was more expensive. The low emphasis on brand found in the conjoint experiment might indicate a notion that prospective buyers generally perceive any e-bike as "good enough" and as overall similar products, even if they perceive brands differently. E-bike technology might just have become mature and standardized enough so that consumers place more importance on more subjective aspects like riding experience and design, as well as good expert advice. After all, many brands use the same components, such as Bosch's drivetrains, displays, and batteries. As seen by the strong

dominance of specialist retailers as distribution channel, it could be the case that participants simply do not have many touchpoints with a brand beyond the product itself. This is reinforced by the fact that in 2022, 73% of all e-bikes sold in Germany were bought in specialized retail stores (ZIV, 2023). The low number of e-bike brands in the retail stores compared to the high number of brands in the market, shows the importance of adjusted measurements by e-bike brands in the German market to achieve advantage. From what was tested in the conjoint and perceptual map analyses, brands must focus on installing attributes to their product portfolio that their potential customers most value. With providing a portfolio of e-bikes with a highly valued combination of attributes, customers will potentially prefer the e-bike from one brand's portfolio over other those of other brands during a purchase at a local retail store.

7 Conclusion – Group

7.1 Managerial Implications – Group

Both the conjoint analysis as well as consumer surveys and interviews have indicated that consumers attach little value to brands and make decisions based on rational facts. Even though a strong brand image is important, companies should put enough emphasis in their marketing efforts on the technical features of their e-bikes. Further, it is essential for a brand to be state-of-the-art in its marketing communication.

The perceptual map revealed the importance of marketing material, such as website design, for non-owners in forming their opinion. Professionalism in design seems to significantly impact consumer perception, particularly for brands without a strong distribution network that instead rely more heavily on online information. Lessons from Prophete suggest that low prices must be complemented by an appealing brand design to avoid associations with low product quality. While it was not tested in the perceptual map, Sushi Bikes might be a promising example of a marketing strategy for a low-cost brand with a radically different and more modern brand language compared to Prophete's. Overall, value-focused brands, such as Prophete and Sushi

Bikes, must maintain perceived quality through active marketing efforts as well as quality standards and controls. From the example of VanMoof compared with Prophete, the recommendation can be concluded that for new or previously undifferentiated brands, customers are willing to pay disproportionately more for high perceived quality, functionality, and uniqueness. Further, consumers seem to welcome upgrade options within the lower price segments, opening up the opportunity for upselling campaigns that communicate clear benefits from upgrading.

Addressing the matter of price, the conjoint analysis revealed a preference for lower price segments due to pronounced price sensitivity. Manufacturers should carefully consider their pricing strategy, recognizing that not all features contribute to consumer value equally. An example of this is the display. For potential cost-saving measures, saving on a premium display cannot be recommended. Even if a smartphone holder is more economical to manufacture, the conjoint analysis indicated that buyers have a strong preference for a premium display, likely for practical reasons. Considering the rationality of consumers, the battery size and range of the e-bike are examples of what is particularly important for customers. Manufacturers should leverage this knowledge to differentiate themselves from the competition with targeted marketing campaigns that address the functional benefits of the bikes.

Portfolio diversity correlated with the price-performance ratio perceived by participants and the e-bike category ranked as the second most important attribute in the conjoint experiment. Recognizing this, offering e-bikes in different categories becomes crucial to capturing diverse segments of the total market. Not only should a product portfolio be diverse, but it should also be accessible in stores. Regarding distribution strategy, it was found that consumers particularly like to experience the brand and its bikes on-site at a dealer through a test ride and consultation. In this sense, Prophete's strategic focus on expanding its presence among trade customers seems promising.

Further, this work identified multiple barriers that hinder e-bike adoption, which brands should address. For those not interested in e-bikes, the reasons for this still lie in the price and a stigma around e-bikes being a product for elderly people, which is why younger demographics especially do not feel like they are the target group for e-bikes. Consumers also seem to have range anxiety, which could lead them to believe that entry-level bikes do not offer a sufficient range, despite studies showing that range is seldom fully used. With the premium price charged for larger batteries, some prospective buyers might be priced out of the market. Hence, targeted marketing could address range anxiety specifically. Lastly, manufacturers should allay buyers' potential concerns about environmentally damaging battery production by demonstrating the overall added value and, at the same time, promoting more sustainable production. Even though the e-bike has great potential to contribute to environmental protection and the reduction of CO₂ emissions, e-bikes and their brands are perceived as less sustainable than they might be.

7.2 Limitations and Future Research – Group

As with any other study, this work also presented limitations that should be addressed in future research. Firstly, it must be noted that with 171 respondents in the final sample, the sample size is rather small, and hence, it is impossible to claim representativeness. Further, related to the sample, it is likely that younger age groups are overrepresented when considering the entirety of potential e-bike buyers. After all, market data and literature show that e-bike buyers tend to be of higher age. Further, it could be the case that more knowledgeable participants show stronger preferences for or against certain brands or levels. While all respondents in the final sample either have direct experience with e-bikes (through ownership or regular usage) or stated that they are considering buying an e-bike in the near future, the questionnaire did not collect information on the respondent's perceived knowledge or immediate purchase intent. Hence, the preferences shown might be more pronounced in a study with a narrower sample consisting only of respondents directly engaged in a purchasing process at the time of participation.

Related to this, the experiment did not directly analyze the importance of more abstract or subjective attributes such as riding experience or bike design because more objective attributes, such as quantitative or binary ones, are better suited for conjoint analysis. Hence, the focus is on technical aspects of the bikes instead of descriptions of design or riding experiences.

As indicated in the preliminary survey and the interviews, riding experience might make a crucial difference in a purchasing decision, as potential buyers tend to do test rides before a purchase. Compiling these limitations, the group recommends an ethnographic study to examine buyer behavior in a real purchase setting just before their purchasing decision. Observation and in-depth interviews of a more narrowly defined sample could provide a holistic picture of the dynamics of the factors tested in this study together with those that were not.

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Appendix

Appendix 1: Barriers to E-Cycling

Individual	Social	Environmental	Physical	E-bike specific	
Less physical effort and activity than conventional cycling (5)	Theft concerns (15)	Safety concerns • riding in car traffic (17) • riding with conventional bicycles and pedestrians (6)		Battery concerns • Range anxiety (19) • Charging issues: Remembering to charge, not practical, time (5) • Heavy/awkward to carry (3) • Battery life not as long as proposed by manufacturer (2)	Most commonly reported ↑
Getting too sweaty (2)	Social stigma, e-bikes as cheating (8)	Cycling infrastructure • Lack of/poor maintenance of cycle lanes (11) • lack of charging stations (2) • lack of parking facilities (3)		Cost • E-bike itself (14) • Replacing battery (3)	
Fear of falling (1)	Regulation over where e-bike can be used (3) – North America specific	Weather (especially rain) (13)		Weight • Of e-bike (17) • Riding when battery dead (5)	↓ Least commonly reported
Unable to ride due to health (1)		Hard to integrate with public transport (2)		Hard and expensive to repair and maintain, technical difficulties (14)	
		Hard to integrate multiple destinations, easier and faster by car (2)		Design of e-bikes • Limited load capacity (4) • Too few gears (2) • Gear box issues (1) • Not designed to carry children (1)	
		Time constraints, faster by car (2)		Too slow (5)	
				Uncomfortable (4)	

Source: Bourne et al., 2020

Appendix 2: Consumer Interview Guides

1. Introduction

2. General Information

- Name (optional)
- Age
- Gender
- Marital status
- Profession
- Place of residence: federal state, town
- Place of residence: urban or rural?
- Do you have an e-bike?

3. Product

- Which brand and model?
- Did you buy or lease it?
- If purchased, how much did it cost?
- What type of e-bike (city bike, trekking-, mountain bike etc.) is it?

4. Motivation for the purchase

- What factors have prompted you to buy or consider buying an e-bike?
- What are the advantages of using an e-bike compared to conventional bicycles?
- Did you have certain e-bike brands on your shortlist? If so, which ones and why?
- Which features or characteristics are most important to you in an e-bike? For example:
 - Electric Range
 - Pedal assistance strength
 - Design
 - Connectivity or smart functions
 - Price

5. Purchasing Process

- How long did you think about the decision before you made the purchase?
- Where did you buy the e-bike?
- How did you search for information, i.e., what product and purchase process related information did you research?
- What sources did you use to inform yourself?

6. Utilization

- Which of your bike's features or characteristics do you value the most?
- When you think about the selling points of your bike (e.g. long range, design, etc.), have they been confirmed, or have you realized that other features were perhaps more important?
- Has the purchase of your e-bike had an impact on your mobility or lifestyle and if so, in what way?
 - Have you used a bicycle before?
 - Would you use it as a substitute for other means of transportation or do you see it more as a sport or leisure vehicle?
- How long do you use your e-bike already?
- How many kilometers and how often do you ride the e-bike per week?
- What kind of trips do you use it for?
- Information on sports and leisure activities

7a. Associations (1) Open question

- I associate electric bikes with:

7b. Associations (2) How strongly do you associate e-bikes with the term...

- ... Sustainability
- ... Sportiness / Fitness
- ... Prestige / Status

8. End of Interview

Appendix 3: Brand Recognition by Ownership

Brand	Owners	Non-Owners	Average (Total)
Pegasus	85%	80%	82%
Cube	77%	68%	71%
Canyon	62%	68%	66%
Gazelle	77%	60%	66%
KTM Bikes	69%	64%	66%
Kalkhoff	62%	56%	58%
Rose Bikes	46%	60%	55%
VanMoof	54%	56%	55%
Prophete	46%	32%	37%
Sushi Bikes	8%	52%	37%
I:SY	31%	32%	32%
Riese & Müller	31%	32%	32%
Focus	23%	32%	29%
Raleigh	31%	24%	26%
Babboe	31%	20%	24%
Schindelhauer	23%	20%	21%
Haibike	8%	20%	16%
Coboc	8%	8%	8%

Appendix 4: Final Items for Perceptual Map

Association	Description	Scale
(1) Price-Performance	The quality of the products justifies the purchase price.	1 - "Completely Disagree" to 5 - "Completely Agree"
(2) Quality	The products have high-quality components and are durable.	1 - "Completely Disagree" to 5 - "Completely Agree"
(3) Usability	The usability of the display and the removal of the battery are clearly understandable.	1 - "Completely Disagree" to 5 - "Completely Agree"
(4) Diversified Portfolio	The product portfolio offers a wide range of different models and/or e-bike categories.	1 - "Completely Disagree" to 5 - "Completely Agree"
(5) Comfort	The products provide a pleasant riding experience on any terrain.	1 - "Completely Disagree" to 5 - "Completely Agree"
(6) Innovation	The products have integrated smart features such as a compatible app.	1 - "Completely Disagree" to 5 - "Completely Agree"
(7) Unique	The brand and its products are highly unique compared to others.	1 - "Completely Disagree" to 5 - "Completely Agree"
(8) Sustainable	The use of raw materials as well as the production of the products is sustainable.	1 - "Completely Disagree" to 5 - "Completely Agree"
(9) Purchase Probability	I would choose this brand if I bought an e-bike.	1 - "Completely Disagree" to 5 - "Completely Agree"

Appendix 5: Final Attributes and Levels for Conjoint Analysis

Attribute	Levels	Note
(1) Brand	Cube Pegasus Prophete VanMoof	
(2) Price	999€ 1,999€ 2,999€ 4,499€	Exclusive to Prophete Not offered by Prophete
(3) Category	Mountain Bike City Bike Trekking Bike	
(4) Battery Capacity	500 WH (up to 80km) 750 WH (up to 120km) 1,000 WH Dual Battery (up to 160km)	Not offered by Prophete
(5) Battery Removability	Removable battery Fully integrated battery	
(6) Smart Features	Standard Display Premium Display Smartphone Mount with app	
(7) Technical Details	Technical details clearly communicated No information about technical details	

Appendix 6: Primary Research Questionnaire Design
Q1: Survey Introduction

For user-friendliness, we strongly recommend that you participate in this study via your laptop, desktop, or tablet !

Hello and welcome to our study! 🚲

We are a group of students at the Nova School of Business & Economics and are currently working on our master's thesis on marketing research on the e-bike market. Specifically, we want to understand the most important factors that influence a potential customer's purchasing decision and develop a product and marketing strategy for a fictitious manufacturer based on the findings we have gathered.

After briefly answering whether you already own an e-bike, in the first part of our survey (approx. 8-10 min) you will see a selection of 4 different fictitious bikes in several rounds of decision-making. We ask you to choose one of these bikes in each round. In the second part (2-5 minutes) we want to understand your perception of these brands and how strongly you would agree with certain statements.

Before both main parts, we will show you detailed instructions and ask you to read them carefully.

We assure you that all responses to this survey will be treated confidentially and your personal data will remain anonymous. The collection of your data is for research purposes only.

We look forward to your participation and hope you enjoy it! 😊

SurveyCircle & SurveySwap users will receive the survey code after completing the survey.

We are also giving away 4x €5 Amazon vouchers. To take part, please enter your email address on the last page.

Q2: Do you already own or use an e-bike?

- ☐ Yes, own e-bike
- ☐ Yes, e-bike of another person in the household
- ☐ No

Q3: Of which brand is the e-bike? *(conditional, if answer to Q2 was not "No")*

Input Answer

Q4: Are, or were you interested in buying an e-bike? (In the past, currently, or in the future)
(conditional, if Q2 was answered with "Yes, e-bike of another person in the household" or "No")

- ☐ Yes, I can imagine buying one currently or in the future
- ☐ Yes, but I decided against a purchase
- ☐ No

Q5: You have decided against buying an e-bike or are not considering it. Why is this the case?
(conditional, if Q4 was answered with "Yes, but I decided against a purchase" or "No")

Input Answer

Q6: Conjoint instructions

- Important for your understanding -

You will not be able to press "Continue" for another 20 seconds. Please take the time to read the instructions below

We want to find out which aspects are of particular importance to you in a simulated purchase decision. Please imagine that you are faced with the decision to buy an e-bike and have the choice between four **fictitious** bikes displayed on the screen.

What you will do on the following pages:

- In each decision round, please choose the bike that you would be most likely to buy from the options shown.
- If none of them meet your expectations, you can also click on "None of the displayed products".
- There are a total of 10-15 decision rounds.
- Please forget the bikes you saw in a previous round.

About the displayed options:

- Please view the profiles as "complete packages" with the characteristics shown. It may be that the bikes differ only in the brand. The bikes could just as well differ in every feature.
- After each decision you will see new bikes. **The models from the previous round are then no longer relevant.**
- **You keep comparing new bikes with each other.** These are selected at random and generated on the basis of certain characteristics. **This is the purpose of the research method.**

This is a simulation:

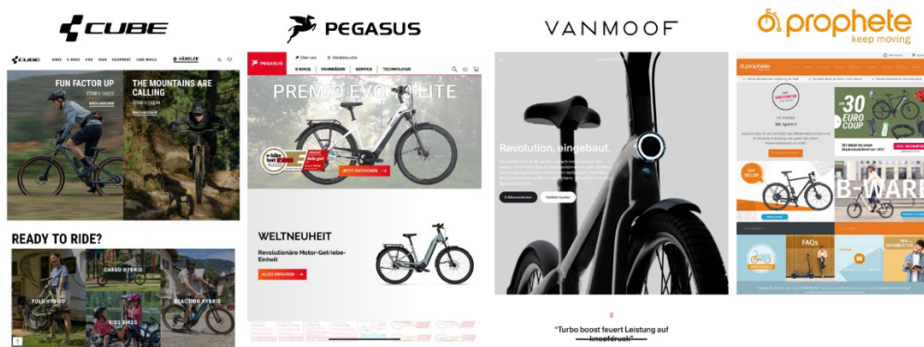
In reality, a large number of factors flow into the decision, which is why we ask you to make your decision based on the displayed characteristics as far as possible. We have selected these characteristics based on the results of a previous survey.

- **Assume that all bikes are available in your desired size and do not differ from each other except for the features shown.**
- **You are welcome to make your own assumptions for features that are not shown here.**

At the end of the survey, you have the opportunity to provide more detailed information about your personal, genuine decision-making process. We look forward to your insights!

Q7: Brands

Please take a moment to look at the websites of these manufacturers.



On the following pages you will see fictitious bicycles, which differ in the following points:

- Brand
- Price
- Battery capacity / range
- Removability of the battery
- Type of display / smart features
- The degree to which you know which components are built-in

Q8: Block of Conjoint Questions

Which of the e-bikes below would you choose?

Imagine these are the only options and these bikes only differ in those aspects you see on the screen.

Hint: on the bottom of the page you will find further information about the options shown below.

E-Bike 1



999 €

City Bike

500 WH (up to 80km)

Batterie is removable

Smart Display with App Connectivity



No further information on components

Choose

E-Bike 2



1.999 €

Tour / Trekking

500 WH (up to 80km)

Batterie is removable

Standard-Display



No further information on components

Choose

E-Bike 3



2.999 €

City Bike

750 WH (up to 120km)

Batterie fully integrated into the frame

Standard-Display



Details on components available

Choose

E-Bike 4

VANMOOF

2.999 €

Tour / Trekking

500 WH (up to 80km)

Batterie fully integrated into the frame

Smartphone Mount with App



Details on components available

Choose

Go back

None of the above

Q9: Perceptual Map Instructions

- Important for your understanding -

You can press "Continue" in 10 seconds. Please take the time to read the instructions below

In the second part, we want to understand your perception of these brands. On the following pages you will see the same brands as in the first part and we ask you to indicate to what extent you agree with the statements shown.

So please rate your agreement on a **scale of 1-5 (1 = strongly disagree | 5 = strongly agree)**.

- **We do not expect you to be perfectly familiar with the brands;** you probably have no personal experience with the brands. One brand in particular is considered rather unknown.
- This is only about your assessment based on your first impressions. Accordingly, there are no right and wrong answers.
- If in doubt, feel free to make your own assumptions.
- If you are unable to make a statement, please click on option 3 (neither).

The statements refer to:

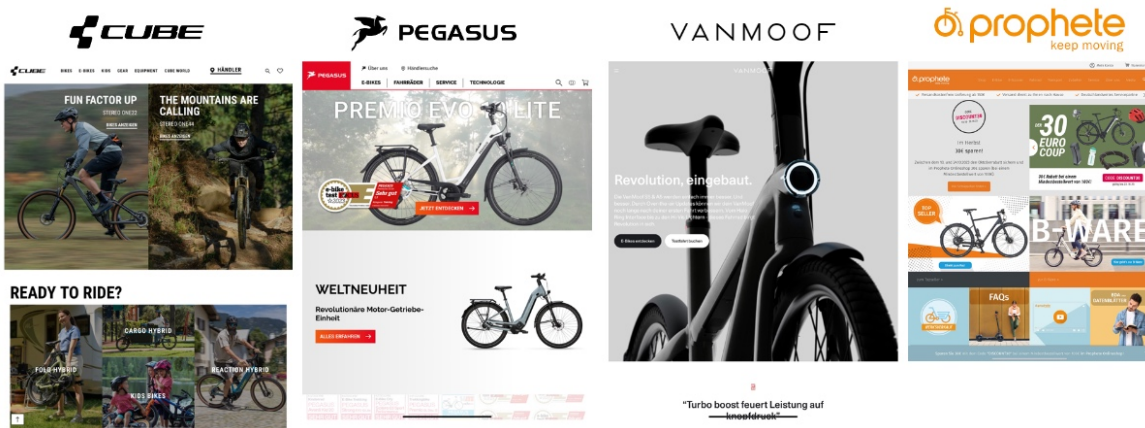
- Price-performance ratio
- Quality of the product
- User-friendliness
- Diversity of the product portfolio
- Comfort
- Innovation
- Uniqueness
- Sustainability
- Likelihood of purchase

This section should not take longer than 4 minutes.

To give you a better picture of the brands, please see the manufacturers' websites on the next page.

Q10: Manufacturer website evaluation

Please take another moment to look at the manufacturer's website.

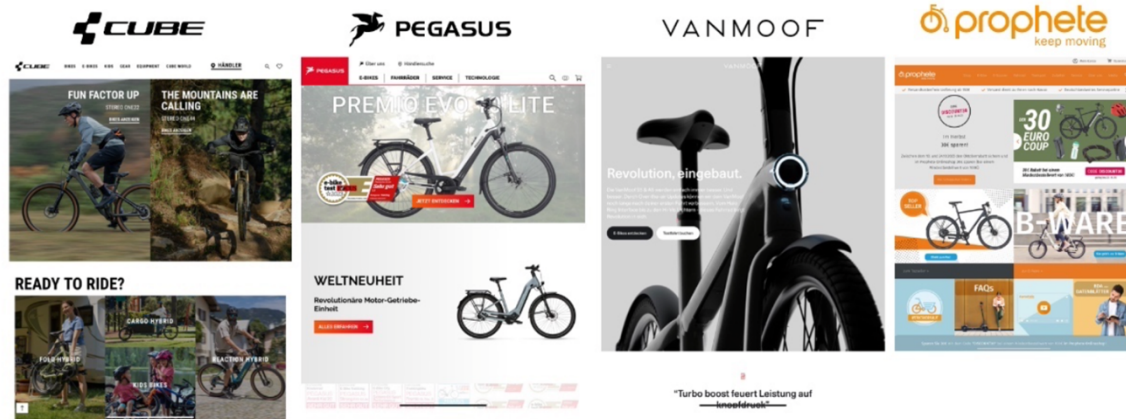


Q11: Perceptual Map Survey

To what extent do you agree with the following statement? (1 / 9)

Good Price-Quality-Ratio

The quality of the product justifies the purchase price.



	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

[Go back](#)

[Continue](#)

Q12: Final information: Which age group do you belong to?

- ☐ under 18 years
- ☐ 18-24
- ☐ 25-34
- ☐ 35-44
- ☐ 45-54
- ☐ 55-64
- ☐ 65-74
- ☐ 75+
- ☐ Prefer not to answer

Q13: Which gender do you identify with?

- ☐ Female
- ☐ Male
- ☐ Diverse
- ☐ Prefer not to answer

Q14: What is your highest level of education?

- ☐ Lower school leaving certificate
- ☐ High school diploma or equivalent
- ☐ Apprenticeship
- ☐ Bachelor
- ☐ Master
- ☐ Doctor / PhD
- ☐ Other
- ☐ Prefer not to answer

Q15: Which status best describes your current employment?

- ☐ Full-time
- ☐ Part-time
- ☐ Student
- ☐ Trainee
- ☐ Retired
- ☐ Other
- ☐ Prefer not to answer

Q16: What is your annual gross income in euros?

- ☐ 0-9,999
- ☐ 10,000-19,999
- ☐ 20,000-29,999
- ☐ 30,000-39,999
- ☐ 40,000-49,999
- ☐ 50,000-59,000
- ☐ 60,000-69,999
- ☐ 70,000-79,999
- ☐ 80,000-89,000
- ☐ 90,000-99,999
- ☐ 100,000 or more
- ☐ Prefer not to answer

Q17: Do you have any other thoughts about e-bikes or would you like to share our survey? (Optional)

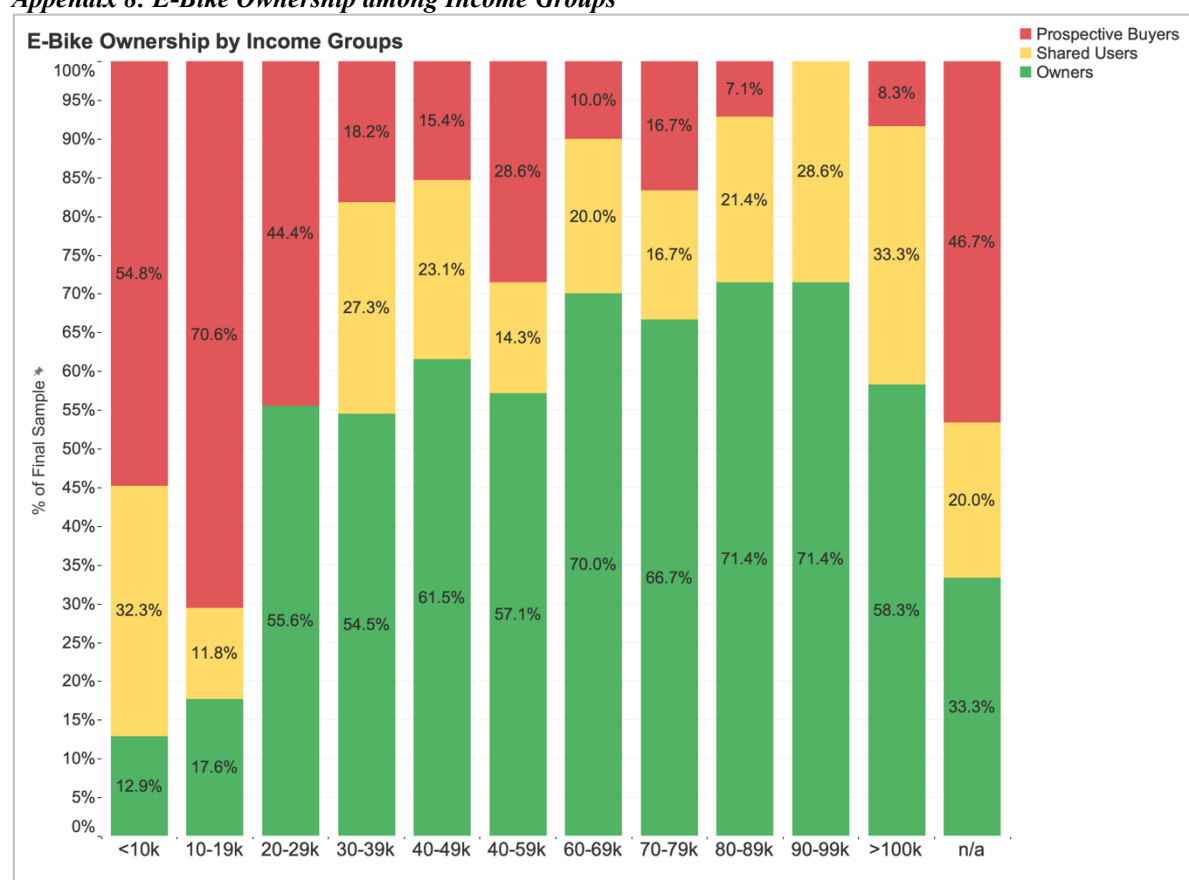
Input Answer

End of the survey

Appendix 7: Stated Reasons for not considering E-Bikes

Reason	Excluded Participants	Included Participants	Total
Too expensive	9	9	18
Fitness / Health	12	2	14
Normal bike is sufficient	6	2	8
No need	6	1	7
I don't use bikes	7	0	7
Other modes of transportation more suitable	2	3	5
Other	4	1	5
Age (Too young)	5	0	5
Theft / No space	0	3	3
Total	50	22	72

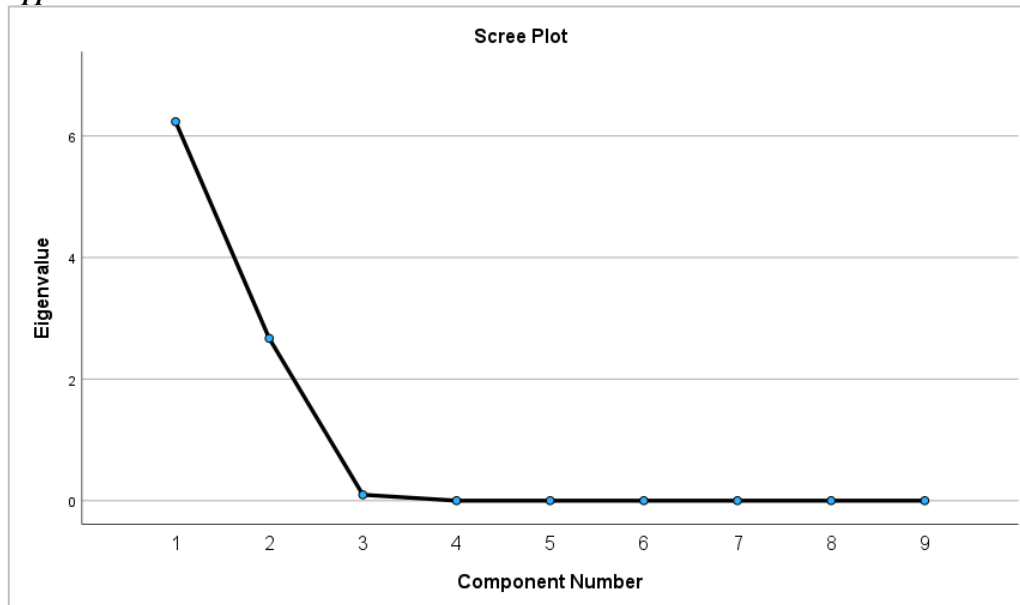
Appendix 8: E-Bike Ownership among Income Groups



Appendix 9: Total Variance Explained

Total Variance Explained						
Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6,234	69,266	69,266	6,137	68,188	68,188
2	2,670	29,663	98,929	2,767	30,741	98,929
Extraction Method: Principal Component Analysis.						

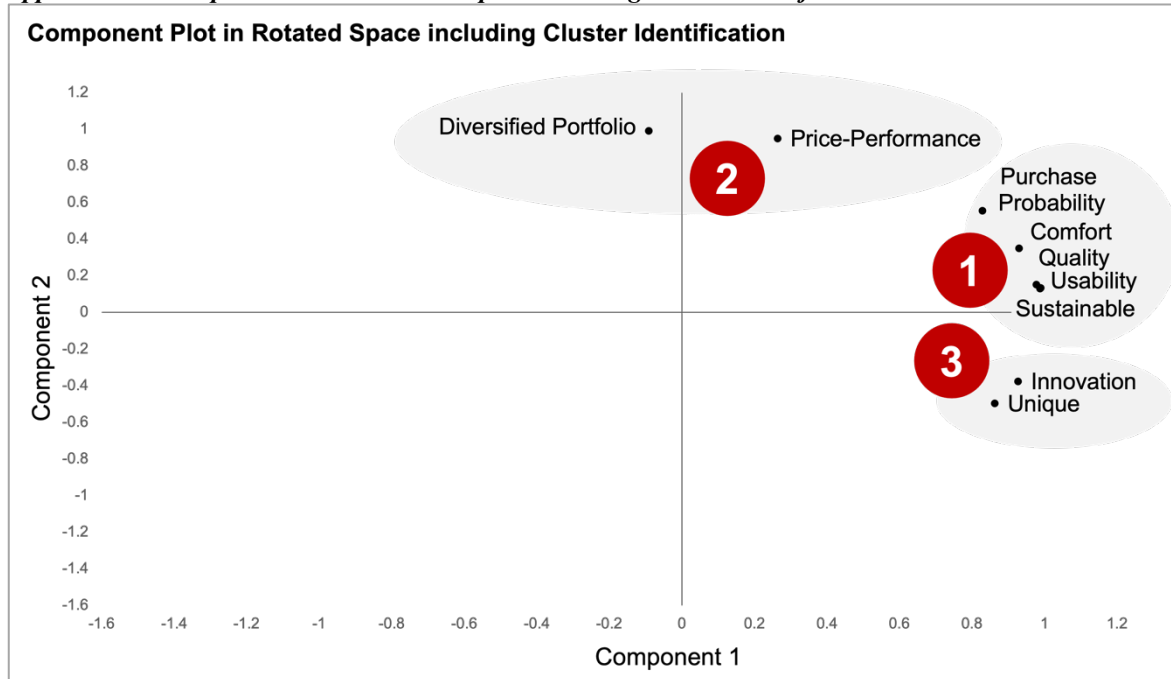
Appendix 10: Scree Plot



Appendix 11: Communalities

Communalities	
	Extraction
Price_Performance	,973
Quality	,978
Usability	,997
Diversified_Portfolio	,993
Comfort	,986
Innovation	1,000
Unique	,990
Sustainable	,991
Purchase_Probability	,995
Extraction Method: Principal Component Analysis.	

Appendix 12: Component Plot in Rotated Space including Cluster Identification



Appendix 13: Data Set with Factors

Brand	Price_Performance	Quality	Usability	Diversified_Portfolio	Comfort	Innovation	Unique	Sustainable	Purchase_Probability	FAC1_1	FAC2_1
Cube	3,84	4,35	3,97	4,28	4,03	3,85	3,34	3,31	3,85	,50736	,72323
Pegasus	3,97	4,05	3,98	4,15	4,10	3,77	3,43	3,24	3,73	,41139	,74489
VanMoof	3,29	4,06	3,93	2,77	3,85	4,39	4,06	3,24	3,19	,57776	-1,38383
Prophete	3,50	2,87	3,46	3,78	3,34	2,84	2,63	2,84	2,64	-1,49651	-,08429

Appendix 14: Delta of Group (1) and (2)

Item	Cube	Pegasus	VanMoof	Prophete	Average (Total)
Price-Performance	+0.256	+0.815	+0.013	+0.077	0.290
Quality	+0.369	+0.420	+0.113	-0.061	0.210
Usability	+0.030	+0.182	+0.222	+0.053	0.122
Diversified Portfolio	+0.077	+0.655	-0.477	+0.117	0.093
Comfort	+0.097	+0.605	+0.617	-0.046	0.318
Innovation	-0.168	+0.073	+0.085	-0.312	-0.080
Unique	-0.370	+0.137	+0.519	-0.105	0.045
Sustainable	+0.291	+0.459	+0.269	-0.023	0.249
Purchase Probability	0.111	+0.789	+0.138	-0.286	0.188
Average (Total)	0.077	0.459	0.167	-0.065	0.159

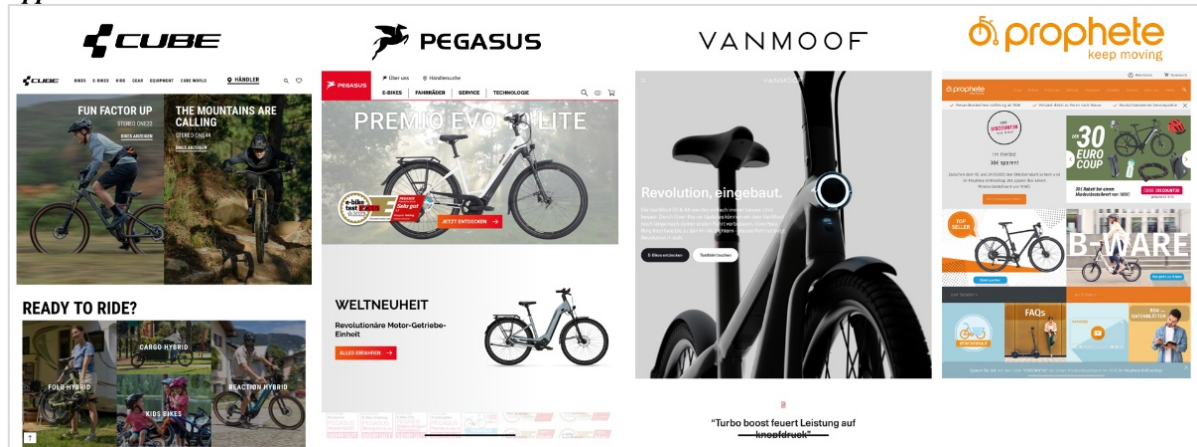
Appendix 15: Group (1) Owners and Shared Users (n=117)

Item	Cube	Pegasus	VanMoof	Prophete	Average (Total)
Price-Performance	3.923	4.222	3.291	3.521	3.739
Quality	4.462	4.179	4.094	2.846	3.895
Usability	3.974	4.034	4.000	3.479	3.872
Diversified Portfolio	4.299	4.359	2.615	3.821	3.774
Comfort	4.060	4.291	4.043	3.325	3.929
Innovation	3.795	3.795	4.419	2.744	3.688
Unique	3.222	3.470	4.222	2.598	3.378
Sustainable	3.402	3.385	3.325	2.829	3.235
Purchase Probability	3.889	3.974	3.231	2.547	3.410
Average (Total)	3.892	3.968	3.693	3.079	3.658

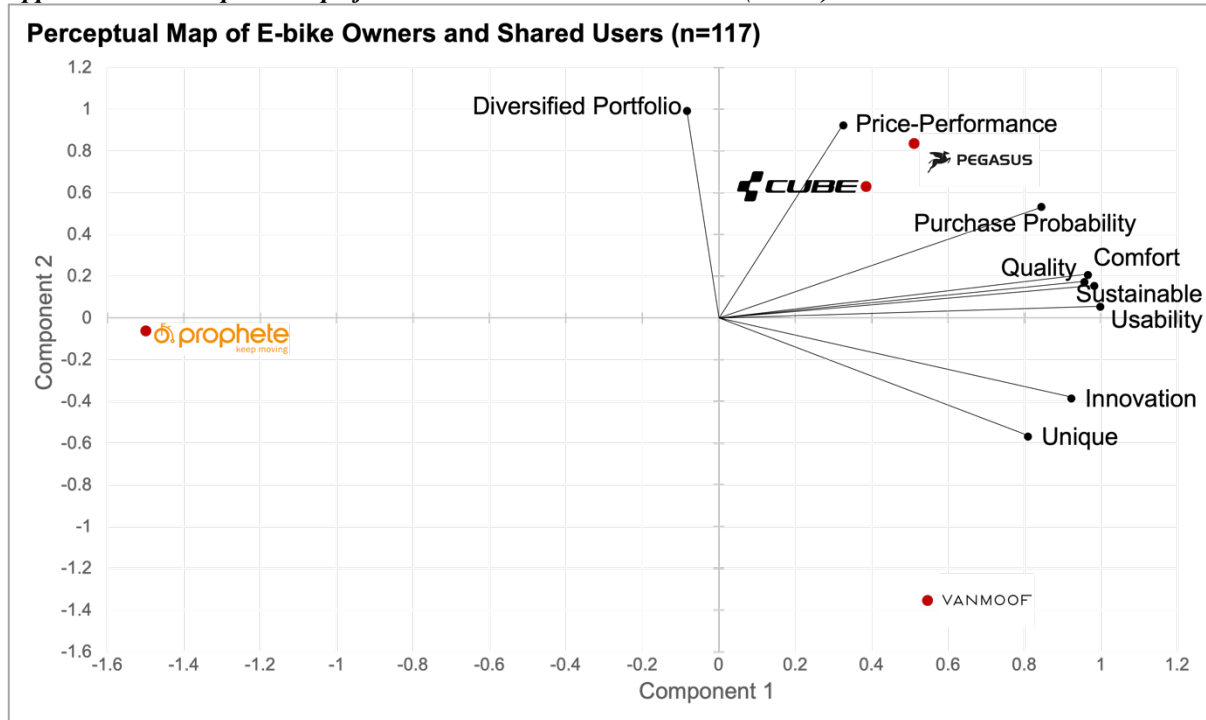
Appendix 16: Group (2) Non-Owners (n=54)

Item	Cube	Pegasus	VanMoof	Prophete	Average (Total)
Price-Performance	3.667	3.407	3.278	3.444	3.449
Quality	4.093	3.759	3.981	2.907	3.685
Usability	3.944	3.852	3.778	3.426	3.750
Diversified Portfolio	4.222	3.704	3.093	3.704	3.681
Comfort	3.963	3.685	3.426	3.370	3.611
Innovation	3.963	3.722	4.333	3.056	3.769
Unique	3.593	3.333	3.704	2.704	3.333
Sustainable	3.111	2.926	3.056	2.852	2.986
Purchase Probability	3.778	3.185	3.093	2.833	3.222
Average (Total)	3.815	3.508	3.527	3.144	3.498

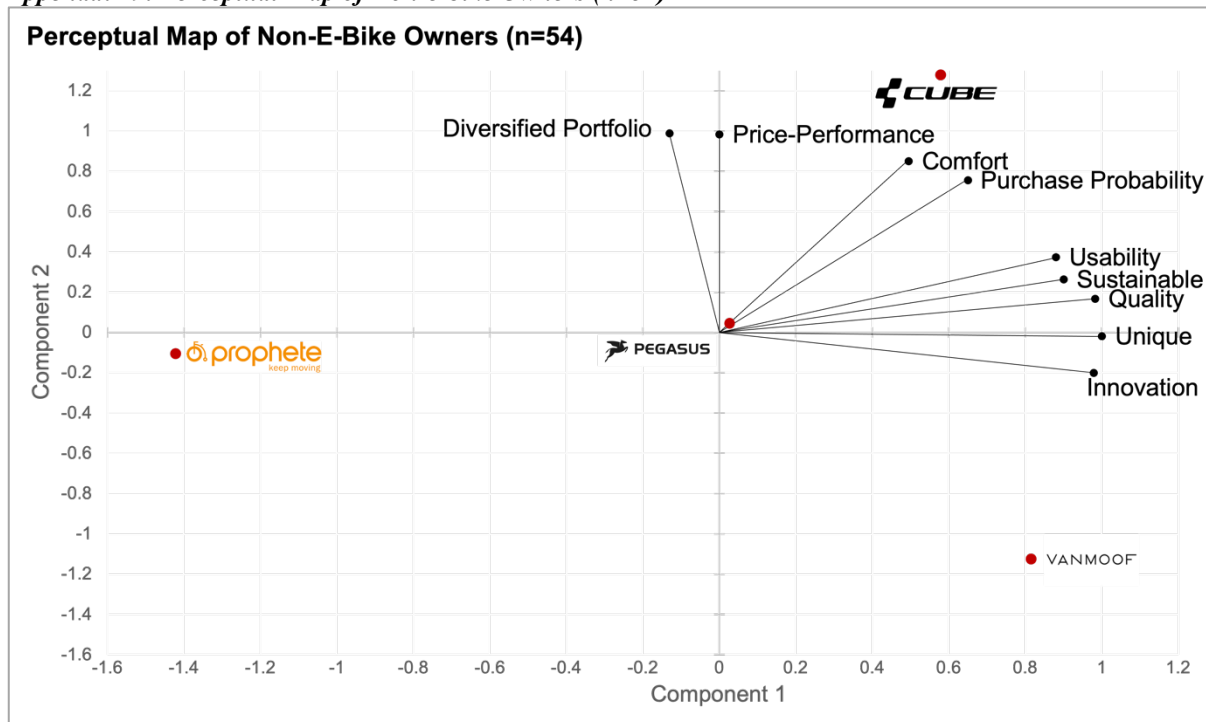
Appendix 17: Website Screenshots



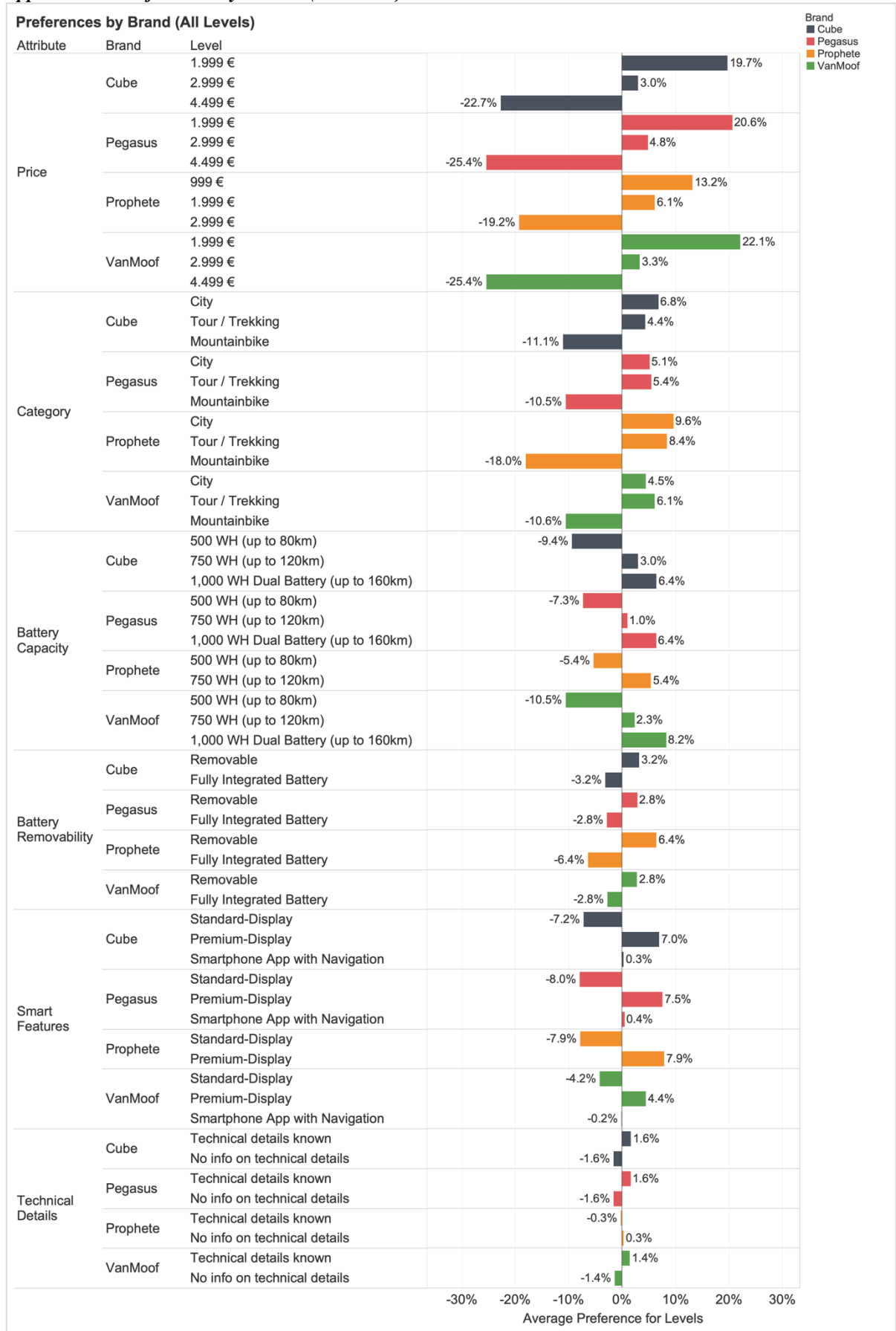
Appendix 18: Perceptual Map of E-bike Owners and Shared Users (n=117)



Appendix 19: Perceptual Map of Non-e-bike Owners (n=54)

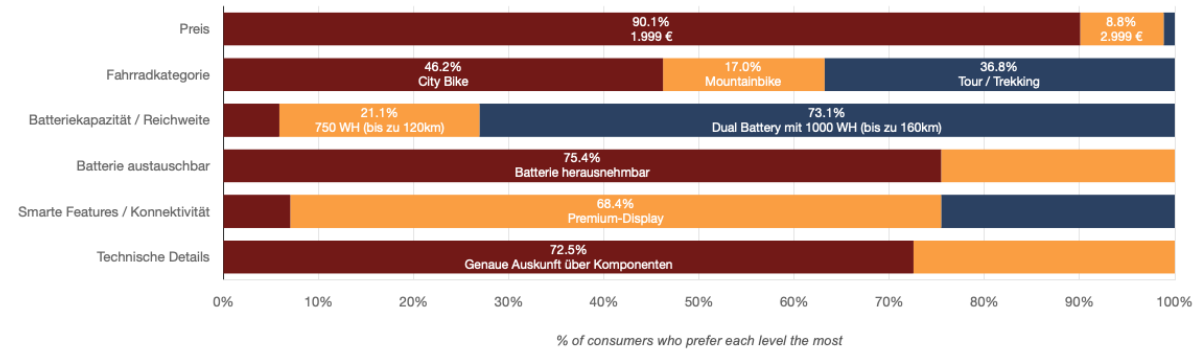


Appendix 20: Preferences by Brands (All Levels)

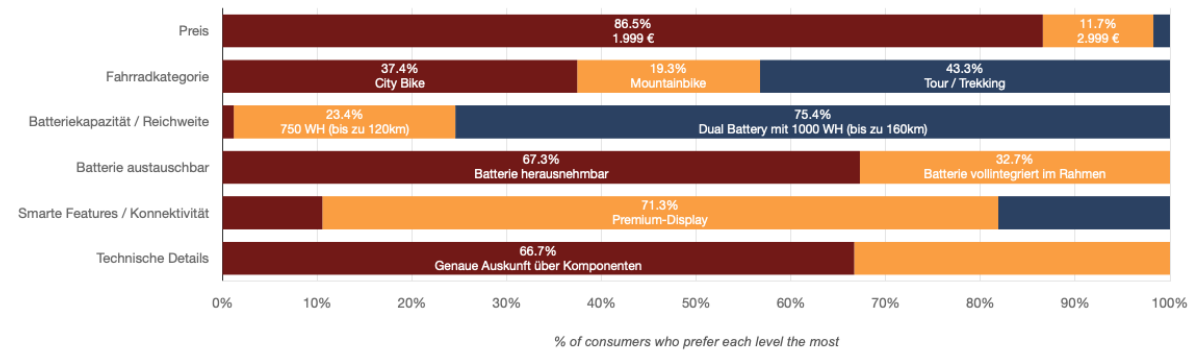


Appendix 21: Most Preferred Levels by Brand

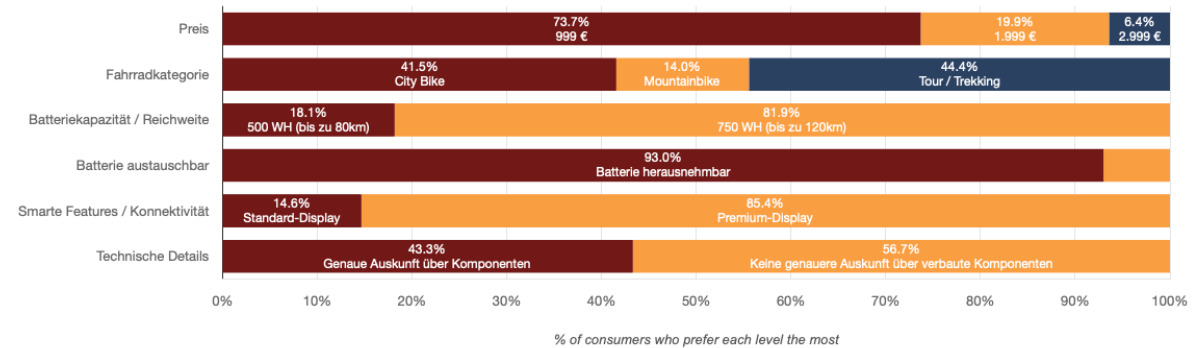
Cube



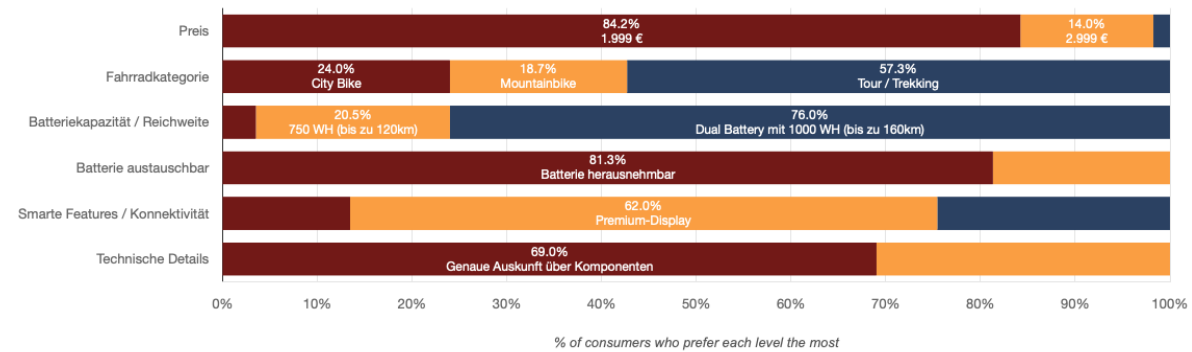
Pegasus



Prophete



VanMoof



Appendix 22: Relative Attribute Importance by Demographic Groups

