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What I Like! The Joint Impact of Attitude, Perceived Quality, and Experience on Brand Loyalty: Semi-Parametric Additive Mixed Modeling

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Abstract: Several psychological brand performance indicators that predict a brand's intermediate market share have been identified. So far, rating studies have exclusively investigated brand effects in terms of linear relationships, and their specific and possibly nonlinear interactions have yet to be examined in comparison. Hence, we investigated the relative importance of three well-established psychological performance indicators, attitude toward the brand, perceived quality, and brand experience, in predicting brand loyalty. A sample of 1,077 participants completed an online survey and rated subsets of 105 international brands from various product and service industries. Relations between attitude, perceived quality, and experience in predicting loyalty toward a brand were analyzed using semi-parametric additive mixed regression models. We replicated that all three predictors significantly impacted brand loyalty and revealed a pronounced nonlinear relationship between attitude and loyalty. The inclusion of nonlinear interactions between predictors improved model fit. In particular, the nonlinear interaction between perceived quality and attitude substantially impacted brand loyalty. In addition, these effects differ by type of industry, specifically fast-moving consumer goods, automotive, fashion, electronics, and finance/insurance. These findings draw attention to nonlinear patterns between specific psychological features of brands. Future research should address nonlinear effects and the specific interactions of other essential predictors of brand equity.

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1 Introduction

Brands guide consumers' decision-making and purchase behaviors as they stand symbolically for prior experiences with products or services of a particular brand (Achar et al. 2016; Mostafa and Kasamani 2020; Plassmann, Ramsøy, and Milosavljevic 2012). Accordingly, brands may help consumers efficiently recognize the manufacturer of a product, minimize risks of wrongly spending money, signal social group membership, and forecast the quality of a product (Keller 2003b). When evaluating brands, individuals use cognitive resources to process information, compare options, and judge the brand's quality, reliability, and alignment with their values. This evaluation often involves recalling past experiences, analyzing marketing communication, and considering social influences, all of which require mental effort (Guo and Zhang 2020). The complexity of the decision, the number of choices available, and the level of personal involvement can increase the cognitive load (Wu, Shah, and Kardes 2020). As a result, individuals may rely on heuristics or mental shortcuts to conserve cognitive resources, such as choosing familiar brands or those with strong reputations, to simplify the decision-making process (Pohl et al. 2013). Hence, consumers' knowledge about a brand and associated emotions help consumers make efficient decisions while saving resources. Furthermore, consumers' expectations about a particular brand have a substantial psychological impact as they modulate consumption pleasure and trigger specific brand associations (McClure et al. 2004; Pina and Dias 2021; Shiv, Carmon, and Ariely 2005). Psychological assessments are essential indicators of a brand's psychological equity related to an enterprise's intermediate market share. While many aspects substantially impact psychological brand equity and brand value (Keller 2003a), research on the relative importance of different dimensions in increasing brand value is rare. Typically, linear relationships are assumed between predictors and explananda while utilizing only a small set of brand stimuli.

In the present study, we aim to compare the relative impact of three established brand performance indicators, i.e. attitude toward the brand, perceived quality of the brand, and brand experience, to predict a consumer's loyalty toward a brand. Most importantly, we aim to explore potentially nonlinear relations among these predictors, including main and interaction effects. To increase the generalizability of the results and the ecological validity of the study, we collected data on a large set of international brands from a broad array of product or service industries through an online questionnaire. Correspondingly, the impact of the three brand dimensions

(i.e. attitude towards the brand, perceived quality, brand experience) on brand loyalty is compared between five industries (i.e. fast-moving consumer goods, automotive, fashion and lifestyle, electronics, and finance/insurance), since previous studies have provided preliminary evidence that the specific relationship patterns between these brand performance indicators can vary by industry (Albaity and Rahman 2021; Erjavec, Dmitrović, and PovalejBržan 2016; Rafiq, Hussain, and Hussain 2020).

1.1 Relevant Brand Concepts

Consumer-based brand equity is conceptualized as multifaceted knowledge of a brand, which is the backbone of building strong brands and is a precursor of high customer loyalty and price premiums (He 2022; Keller 2003b; Oliveira et al. 2023). Traditional approaches to measuring brand equity focus on the consumer's subjective evaluation of the brand (Keller 1993) and operationalize the brand knowledge based on multidimensional brand associations (Çifci et al. 2016; Cobb-Walgren, Ruble, and Donthu 1995; Heitmann et al. 2020; Hyun, Park, and Hong 2024; Sankaran and Chakraborty 2023; Tong and Hawley 2009; Washburn and Plank 2002; Yoo and Donthu 2001). Tasci (2021) reported in a meta-analysis with over 200 empirical brand equity studies that over 40 components were investigated in the past. Brand quality, as well as brand associations and brand image, cover the main components of brand research. In addition to the perceived quality of a brand, we utilized a global (brand attitude) and a differentiated (brand experience) operationalization to account for different aspects of the consumer's brand associations. Furthermore, previous studies often used attitude toward a brand, perceived quality, and brand experience (i.e. affective, sensory, cognitive, and behavioral experiences) to forecast relevant outcome variables (Buil, Martínez, and de Chernatony 2013; Çifci et al. 2016; Hyun, Park, and Hong 2024; Pappu, Quester, and Cooksey 2005; Rodrigues and Martins 2016; Washburn and Plank 2002; Yoo and Donthu 2001). Hence, we used these established dimensions to predict loyalty toward familiar brands and explicitly modulated potentially nonlinear and industry-specific effects.

1.1.1 Brand Loyalty as Explanandum

Brand loyalty emphasizes the behavioral aspect as a commitment to consistently rebuy products or services of a specific brand in the future (Oliver 1999). According to this definition, brand loyalty has been measured by indicators such as repeat purchase frequency or relative volume of same-brand purchasing (Dawes, Graham, and Trinh 2021; Tasci 2021). Such behavioral loyalty can be approximated from an

attitudinal perspective because a favorable attitude is required to achieve behavioral loyalty (Dandis and Al Haj Eid 2021; Day 1969; Dick and Basu 1994). Otherwise, the repurchase of a product is considered spurious loyalty since the repurchase might be only based on a convenient factor (e.g., availability of the product) but not on proper preference compared to competitors' products (Tseng, Liao, and Jan 2004; Zhang and Zhang 2021). Accordingly, brand loyalty is conceptualized as repeat purchases under high involvement (Dawes, Graham, and Trinh 2021; Møller Jensen and Hansen 2006), and the relationship between the brand and the customer needs to be long-term (Omoregie et al. 2019). Hence, to classify true brand loyalty, attitudinal loyalty must exist, including a dispositional commitment toward the brand (Chaudhuri and Holbrook 2001), which served as an explanandum in the present study. There is also preliminary evidence that brand loyalty's impact can vary between service industries (Erjavec, Dmitrović, and PovalejBržan 2016).

1.1.2 Brand Attitude as Explanans

Brand attitudes are defined as the consumer's overall brand evaluation (Jiang, Ge, and Yao 2024; Keller 2003a; Mitchell and Olson 1981; Spears and Singh 2004). Brand attitudes have a strong history in branding and consumer behavior literature. Attitudes are a temporary evaluation at the moment of judgment (Feldman and Lynch 1988; He 2022) based on an emotional process (Ito and Cacioppo 2001). An affective and temporary attitude formation also seems more plausible for brands since consumers tend to avoid cognitive efforts (e.g., lack of ability and motivation), and contextual-driven factors (e.g., consumers' goals and presentation characteristics) seem to play a significant role in the buying process (Argyriou and Melewar 2011).

When consumers come to an overall evaluation of a brand and form a favorable attitude toward it, it is likely that this also leads to an increase in attitudinal loyalty (Dandis and Al Haj Eid 2021; Keller 1993; Oliver 1999). Highly loyal consumers are also consistently more favorable in their attitudes toward the brand, demonstrating the interdependence between brand loyalty and attitude toward the brand (Hussain et al. 2024; Rubinson and Baldinger 1996). The direct impact of brand attitude on loyalty has been confirmed for two grocery products (i.e. shampoo and sweeteners (Chaudhuri 1999)). In addition, there is evidence that brand attitude positively influences brand loyalty in the fast-moving consumer goods industry (Rafiq, Hussain, and Hussain 2020; Rajumesh 2014). Correspondingly, a significant and robust positive relationship exists between brand attitude and brand loyalty in the cell phone industry (Kruger et al. 2013). Also, for finance (Albaity and Rahman 2021) and luxury fashion brands (Liu et al. 2012), the attitude has a crucial positive impact on loyal customers' behavior. In summary, there is converging evidence of a positive

relationship between brand attitude and brand loyalty, particularly for industries such as fast-moving consumer goods, electronics, and fashion.

1.1.3 Perceived Quality as Explanans

Perceived quality results from comparing consumer expectations with the actual performance of a product or service (Snoj, Pisnik Korda, and Mumel 2004; Tian et al. 2023). It is defined as the customer's judgment of the superiority or excellence of a brand (Zeithaml 1988). Notably, perceived quality differs from actual quality. The actual quality is based on a measurable and verifiable supremacy of a specific feature or functionality of the product or service and can be compared to a predefined standard. Hence, it is evaluated using overall product benefit, function, durability, technology, and reliability (Garvin 1983; Munten and Vanhamme 2023). Perceived quality, in contrast, is the subjective reaction of consumers to products and is, therefore, a relativistic assessment that differs between individuals (Holbrook and Corfman 1985). It is primarily based on people's expectations and their pre-knowledge. It is dissociable from the actual quality (Chi, Yeh, and Yang 2009; Tian et al. 2023): Consumers may lack sufficient information, time, or motivation to evaluate a product objectively, and hence, perceived quality is influenced not only by product-related factors but also by situational factors such as the purchase situation and time pressure or by individual attributes such as the educational level and personal risk-taking preference (Chi, Yeh, and Yang 2009).

The perceived quality of a brand is a consumer's subjective judgment, and the consumer evaluates product or service quality from their previous experiences. Hence, perceived quality is considered a key predictor of brand loyalty (Darsono and Junaedi 2006). Customers form opinions about superiority or excellence by comparing actual performance with expected performance. Consumers form a preference and commitment toward the brand when this judgment results in a positive evaluation (Akoglu and Özbek 2022; Szymanski and Henard 2001). Some researchers see customer satisfaction as a mediator in the quality-loyalty relationship (Darsono and Junaedi 2006; Olsen 2002). At the same time, various authors also confirm a direct link between perceived quality and loyalty, for example, for photography services (Dabholkar, Shepherd, and Thorpe 2000) and the fashion industry (Erdoğan and Büdeyri-Turan 2012; Hyun, Park, and Hong 2024; Vazifehdoost and Negahdari 2018). Furthermore, a high perceived quality, especially service quality, enhances customer loyalty in the finance industry (Omorgie et al. 2019; Prasad 2018). Apparently, in the latter sector, the effect of perceived quality is even higher on loyalty compared to satisfaction (Prasad 2018). Lastly, customer loyalty is indirectly influenced by perceived quality in the electronics industry, as customer trust plays a significant mediating role (Marakanon and Panjakajornsak

2017). In summary, there is converging evidence of a positive relationship between perceived brand quality and brand loyalty, particularly in the finance, electronics, and fashion industries.

1.1.4 Brand Experience as Explanans

Brand experience conceptualizes consumption patterns that depend on multi-sensory and emotional aspects (Chieng et al. 2022; Hirschman and Holbrook 1982), accounting for the fact that decision-making relies on emotional aspects apart from strictly rational reasoning in general (Slovic et al. 2007) and specifically in consumer decisions (Bapat 2017; Chieng et al. 2022). Accordingly, experience marketing acknowledges that consumers are emotionally driven and aim to achieve sensual and pleasurable experiences through consumption (Cleff, Lin, and Walter 2014). Since products and services are becoming increasingly commoditized, the customer experiences created by brands matter strongly to the consumer (Pine and Gilmore 1998). Hence, brand experience is a multi-componential construct including internal consumer processes (i.e. sensations, feelings, and cognitions) and behavioral aspects elicited by brand-related stimuli like product design, packaging, and marketing communications such as advertisement (Hussain et al. 2024). Experiences also happen when consumers consume, search, and shop for products or services (Jung and Soo 2012; Massi, Piancatelli, and Vocino 2023). Brand experience is believed to have a more significant impact on shaping customer preferences than the attributes of a product or service (Lee, Hsiao, and Yang 2011; Zaltman 2003).

Brand experience that engages the customer's senses and emotions can create a connection to the brand, leading to improved brand commitment, trust, and satisfaction, and, as a consequence, this leads to increased brand loyalty (Brakus, Schmitt, and Zarantonello 2009; Chattopadhyay and Laborie 2005; Choi, Ok, and Hyun 2017; Ding and Tseng 2015; Huang 2017; Hussain et al. 2024; Iglesias, Singh, and Batista-Foguet 2011; Jung and Soo 2012; Mostafa and Kasamani 2020; Nysveen and Pedersen 2014; Pina and Dias 2021; Ramaseshan and Stein 2014). This connection is validated in several product and service industries: Brand experience has a positive impact on brand satisfaction, trust, and loyalty for automotive brands (Sahin, Zehir, and Kitapçı 2011; Saragih et al. 2019). Brand experiences directly affect brand prestige, influencing attitudinal loyalty for coffeehouse customers (Choi, Ok, and Hyun 2017). It also impacts brand loyalty mediated by brand trust (Huang 2017) and brand commitment (Jung and Soo 2012). A recent study on the electronics industry, especially smartphones, confirms that brand experience positively affects brand loyalty (Mostafa and Kasamani 2020). Likewise, a positive relationship between brand experience and brand loyalty is found in the fashion and finance industries (Wulandari 2016). In summary, there is converging evidence of a positive

relationship between brand experience and brand loyalty, particularly for automotive, electronics, fashion, and fast-moving consumer goods industries.

1.2 Overview and Aims

Psychological brand equity can be conceptualized as multifaceted knowledge of a brand and is thought to be the foundation for building and thriving strong brands. Specifically, there is converging evidence that perceived quality, attitude toward, and experience with the brand positively correlate with customers' brand loyalty. However, the current scientific understanding of these relationships is limited due to two aspects: Existing literature exclusively assumed linear and non-interactive relationships between these predictors. Hence, it is unclear if attitude toward the brand, perceived quality of a brand, and brand experience show nonlinear and possibly interactive relations with brand loyalty. Furthermore, since most of the previous brand studies examined only a small number of brands and industries, the findings' generalizability and ecological validity are limited due to the actual complexity of the real market and the relevance of dynamics between industries.

Accordingly, we aim to estimate the relative importance, linearity, and interaction of these predictors on brand loyalty. Hence, we compare main effect models, all two-way and the three-way interaction effects, to determine the best fitting predictive model for brand loyalty. We use semi-parametric additive mixed modeling as it allows both linear and possible nonlinear effects and determines nonlinearities within the main- and interaction effects between the three predictors and the loyalty toward a brand (Wood 2006; Wood, Scheipl, and Faraway 2013; Wood and Scheipl 2020). Furthermore, we investigate 105 brands from various product and service industries and report industry-specific effects for fast-moving consumer goods, automotive, fashion, electronics, and finance. To control for potentially interfering and confounding effects of relevant covariates, we additionally controlled our models for the impact of general brand involvement and gender*brand interactions. This is the first study that accounts for nonlinear and interaction effects in brand research in various industries.

2 Methods

2.1 Participants, Stimuli, and Study Design

A convenient sample of 1,077 German-speaking volunteers participated anonymously in the online survey (282 males). Age of the participants varied between 18

Table 1: Overview of the brands included in the study and the frequency of participants who rated a brand and were familiar with a brand.

Brand	Presented	Familiar	%	Brand	Presented	Familiar	%
Adidas	84	84	100 %	Hyundai	83	71	85.5 %
Coca Cola	80	80	100 %	Zara	87	74	85.1 %
H&M	79	79	100 %	Heineken	76	64	84.2 %
IKEA	77	77	100 %	Panasonic	80	67	83.8 %
McDonalds	88	88	100 %	MTV	73	61	83.6 %
Nike	84	84	100 %	Nescafe	64	53	82.9 %
Pepsi	77	77	100 %	Intel	71	58	81.7 %
Lego	100	99	99.0 %	Visa Card	82	67	81.7 %
BMW	84	83	98.8 %	Prada	78	63	80.8 %
VW	84	83	98.8 %	Philips	89	71	79.8 %
Disney	79	78	98.7 %	Mastercard	74	59	79.7 %
Ebay	75	74	98.7 %	Kia	85	66	77.6 %
Apple	74	73	98.6 %	UPS	93	72	77.4 %
Google	74	73	98.6 %	Harley Davidson	82	60	73.2 %
Langnese	74	73	98.6 %	Huawai	93	67	72.0 %
Mercedes Benz	82	80	97.6 %	Smirnoff Vodka	76	54	71.7 %
Samsung	84	82	97.6 %	AXA	67	47	70.1 %
Microsoft	73	71	97.3 %	IBM	84	58	69.0 %
Facebook	95	92	96.8 %	Ralph Lauren	66	45	68.2 %
Marlboro	91	88	96.7 %	Landrover	65	44	67.7 %
Porsche	79	76	96.2 %	Budwiser	84	52	61.9 %
DHL	74	71	95.9 %	FedEx	87	52	59.8 %
Pampers	90	86	95.6 %	SAP	72	43	59.7 %
Canon	88	84	95.5 %	KFC	86	49	57.0 %
Gillette	85	81	95.3 %	American Express	95	54	56.8 %
Sprite	83	79	95.2 %	Moet	81	46	56.8 %
Nestle	80	76	95.0 %	Burberry	67	38	56.7 %
Nissan	78	74	94.9 %	Tesla	70	38	54.3 %
Amazon	78	74	94.5 %	Lenovo	75	37	49.3 %
Paypal	88	83	94.3 %	Tiffany	80	37	46.3 %
Siemens	95	89	93.7 %	John Deere	79	36	45.6 %
Starbucks	79	74	93.7 %	Hermes	86	37	43.0 %
Ford	94	88	93.6 %	Cartier	77	33	42.9 %
L'Oreal	91	85	93.4 %	Santander Bank	91	39	42.9 %
Kellogs	85	79	92.9 %	Corona	84	35	41.7 %
Toyota	85	79	92.9 %	HP Enterprise	86	31	36.0 %
Sony	81	75	92.6 %	Goldman Sachs	80	27	33.8 %
Colgate	79	73	92.4 %	Caterpillar	88	29	33.0 %
Audi	90	83	92.2 %	Johnnie Walker	87	27	31.0 %
Shell	71	64	90.1 %	HSBC	99	28	28.3 %
Nintendo	84	75	89.3 %	Johnson & Johnson	72	20	27.8 %
Allianz	79	70	88.6 %	Oracle	74	18	24.3 %

Table 1: (continued)

Brand	Presented	Familiar	%	Brand	Presented	Familiar	%
Jack Daniels	77	68	88.3 %	Discovery Chanel	68	15	22.1 %
Victoria's Secret	76	67	88.2 %	Cisco	88	19	21.6 %
Danone	73	64	87.7 %	General Electric	89	18	20.2 %
Luis Vuitton	88	77	87.5 %	3 M	62	12	19.4 %
Honda	78	68	87.2 %	Morgan Stanley	72	13	18.1 %
HP	86	75	87.2 %	J.P. Morgan	101	17	16.8 %
Rolex	92	80	87.0 %	Citi Bank	84	11	13.1 %
Adobe	73	63	86.3 %	Xerox	81	10	12.3 %
Mini	102	88	86.3 %	Thomas Reuters	86	9	10.5 %
Gucci	86	74	86.0 %	Accenture	94	5	5.3 %
Dior	84	72	85.7 %	Overall Means	81.7	59.9	73.3 %

and 75 years ($M = 27.3$, $SD = 9.3$). 5 % of the participants were excluded a priori from analysis due to bad quality indices provided by the survey platform (e.g., high-speed and invariant answering behavior). At the beginning of the study, participants filled in a sociodemographic questionnaire including age and gender and rated their general brand involvement (Walsh, Mitchell, and Hennig-Thurau 2001). Afterward, each participant was shown a random subsample of eight brands assessed on various psychometrical scales (see Assessments and Measures). The brand logos of 105 internationally high-performing brands served as brand stimuli (Table 1). This set of brands covers a wide variety of service and product branches like fast-moving consumer goods (25 %), automotive (14 %), fashion and lifestyle (14 %), electronics (11 %), as well as finance and insurance (11 %). Each brand was presented to 81.7 participants on average. Participants needed approximately 15 min to complete the survey. Data for the study are permanently stored at https://osf.io/7ea85/?view_only=25c7083a1c804d87a7f0318cb56e90cf.

2.2 Assessments and Measures

The measurement instruments compile existing psychological self-report scales, including constructs and items previously tested for reliability and validity. First, participants were asked whether they knew a particular brand on a dichotomous scale (“Yes” or “No”). All subsequently presented items were rated on a unified seven-point Likert scale (Lissitz and Green 1975) with the poles “I don’t agree at all” (1) and “I agree completely” (7) to improve the reliability and comparability of the

scales. Items were randomized in order between and within each scale. All rankings were translated into German utilizing back translation (see Appendix A for an overview of the items).

Perceived quality and brand loyalty constructs consisted of three items derived from various previous studies (Buil, de Chernatony, and Martínez 2008; Christodoulides, Cadogan, and Veloutsou 2015; Pappu, Quester, and Cooksey 2005; Yoo and Donthu 2001). The brand experience scale is based on Brakus, Schmitt, and Zarantonello (2009), with the four intercorrelated components sensory, affective, behavioral, and intellectual experiences. Various empirical studies have validated the scale (Cleff, Lin, and Walter 2014; Iglesias, Singh, and Batista-Foguet 2011; Nysveen and Pedersen 2014; Walter, Cleff, and Chu 2013; Zarantonello and Schmitt 2010). The brand attitude was based on existing scales (Berger and Mitchell 1989; Park et al. 2010). General brand involvement was measured by five items adapted from Walsh, Mitchell, and Hennig-Thurau (2001). We also collected one-item ratings of emotional valence and arousal for each brand on an exploratory basis, which were not reported in the present study.

2.3 Data Reduction and Semi-parametric Mixed Models

Questionnaire data of specific brands were included in the further analysis when subjects indicated that they knew the brand and when brand-related items were answered thoroughly. Across all subjects, data on 6,284 brands were included in the subsequent analyses ($M = 59.9$ participants per brand). Notably, brands varied in recognition rates and, as a consequence, in their influence within statistical modeling (see Table 1).

Items were averaged per scale, and *Cronbach's Alpha* scores were reported to evaluate scale reliability by internal consistency. Inverted items of the brand experience scale were excluded because of poor measurement reliability. Spearman correlations between all relevant scales were calculated to determine descriptive relationship patterns.

We carried out semi-parametric additive mixed modeling as the main analysis to predict the loyalty toward brands with the function *gamm* included in the R-package “*gamm4*” (Wood and Scheipl 2020). To control potentially inferring effects of relevant covariates, we first developed a null model controlling general brand involvement (see Assessments and Measures) as well as gender and brand interactions as fixed factors and the participants as random factors (Model 0, see Appendix B for results). The latter approach allows for both linear and nonlinear

effects. Such models can detect nonlinear effects in a data-driven way without using prior strict assumptions, such as linearity. Next, we calculated the main effects separately for attitude (Model 1A), quality (Model 1B), and experience (Model 1C), as well as a model including all three main effects (Model 1).

Furthermore, we estimated the two-way interactions (Model 2) and the three-way interaction (Model 3). In contrast to parametric linear models, we can estimate the interaction effects directly without including the (univariate) main effects additionally in the model. Using tensor products to merge the independent variables to bi- or trivariate effects, the dependent variable's effects can be visually inspected. Visual inspections of the interaction effects for the fitted models were carried out with perspective and contour plots included in the R-Package "itsadug" (Van Rij et al. 2017). Significance testing against zero effects was integrated into the contour plots. Significance levels were always $\alpha = 0.05$. *AIC* and *BIC* were utilized as model fit indices (Burnham and Anderson 2004). A large change in model fit was interpreted by an absolute difference of 10 for *AIC* and *BIC*. In addition, we report the adjusted pseudo R^2 to estimate the amount of explained variance and the adjusted maximum likelihood (*REML*).

3 Results

3.1 Reliability and Intercorrelations of the Brand Scales

Information regarding reliability and intercorrelations between scales can be obtained in Table 2. Cronbach's alpha was excellent for attitude, quality, and experience ($\alpha \geq 0.90$), good for loyalty ($\alpha = 0.89$), and acceptable for the brand involvement scale ($\alpha = 0.75$). Spearman correlations revealed highly significant positive and mostly strong relationships between the four brand-specific scales.

Table 2: Cronbach's alpha (in brackets) and intercorrelations (spearman's ρ) as well as mean (M) and standard deviations (SD) for all scales.

Scales	Loyalty	Attitude	Quality	Experience	M	SD
Loyalty	(0.89)	0.72	0.56	0.52	2.97	1.77
Attitude		(0.96)	0.70	0.49	4.13	1.69
Quality			(0.90)	0.43	4.61	1.46
Experience				(0.90)	3.21	1.46

All correlations are highly significant ($p < 0.001$).

3.2 Prediction of Brand Loyalty

We fitted seven relevant models to predict brand loyalty (see Table 3): The null model underlying all models controlling for gender*brand interactions and general brand involvement (Model 0), single main effects for brand experience (Model 1A), perceived quality (Model 1B), attitude (Model 1C) as well as an integrated model for the three main effects (Model 1), two-way interactions (Model 2) and the three-way interaction (Model 3).

The null model modulated the loyalty ratings ($R^2_{\text{adj}} = 27.3\%$) with a significant gender and brand involvement influence, indicating a generally higher reported loyalty of female and highly brand-involved participants. Furthermore, significant gender*brand interaction effects for 26 brands out of 105 brands can be reported, which justifies the inclusion of this interaction pattern as a covariate in the

Table 3: Semi-parametric additive mixed models for all brands.

Model	Model 0	Model 1A	Model 1B	Model 1C	Model 1	Model 2	Model 3
Attitude				1,023.7 (5.8)	293.0 (5.4)		
				<0.001	<0.001		
Quality			620.1 (5.2)		91.4 (2.8)		
			<0.001		<0.001		
Experience		454.2 (4.7)			123.4 (3.5)		
		<0.001			<0.001		
Attitude*						105.7 (14.8)	
Quality						<0.001	
Attitude*						29.9 (7.2)	
Experience						<0.001	
Quality*						0.4 (4.7)	
Experience						0.854	
Attitude*							43.5 (41.1)
Quality*							<0.001
Experience							
df	214	216	216	216	220	229	228
R^2_{adj}	0.273	0.465	0.515	0.622	0.664	0.672	0.674
REML	22,477	20,647	19,896	18,349	17,633	17,530	17,531
AIC	22,904	21,079	20,327	18,781	18,073	17,988	17,987
BIC	24,348	22,536	21,785	20,238	19,558	19,532	19,525

Model 0 (only controlling for general brand involvement and brand*gender interaction effects; see Appendix B for detailed results), Model 1 (main effects), Model 2 (two-way interactions), and Model 3 (three-way interactions). Values indicate specific effects on brand loyalty (F-values, adjusted degrees of freedom, p -values). Bold values indicate models with the best model fit.

subsequent models (see Appendix B). Analysis of the single main effect models revealed a strictly monotonically increase between all three predictors (i.e. attitude, experience, and quality) and loyalty toward a brand (see Table 3). attitude predicts loyalty strongest (Model 1C), followed by quality (Model 1B), followed by experience (Model 1A). Interestingly, this pattern slightly changes if all three predictors are integrated into one model and effects are estimated simultaneously (Model 1). While attitude still showed the most substantial impact, in contrast to the single main effect models, experience showed a larger effect than quality. It is notable that in comparison to experience and quality, attitude showed a strong nonlinear impact on loyalty (see Figure 1). While a negative to neutral attitude only weakens loyalty, the effect is strongly increased from neutral to positive attitudes.

Next, we fitted a model including the two-way interaction effects (Model 2, see Table 3). The most substantial impact on loyalty stems from the attitude*quality interaction, which showed an increase in loyalty for both highly positive attitudes and high perceived quality and a decrease for negative attitudes and low quality (see Figure 2). Correspondingly, this effect was highly nonlinear. In addition, the interaction effect for attitude*experience modulated loyalty significantly. This effect is relatively planar and mainly driven by experience, increasing loyalty for high experience and decreasing low experience. This effect was even more pronounced for positive compared to negative attitudes. The quality*experience interaction did not modulate loyalty significantly.

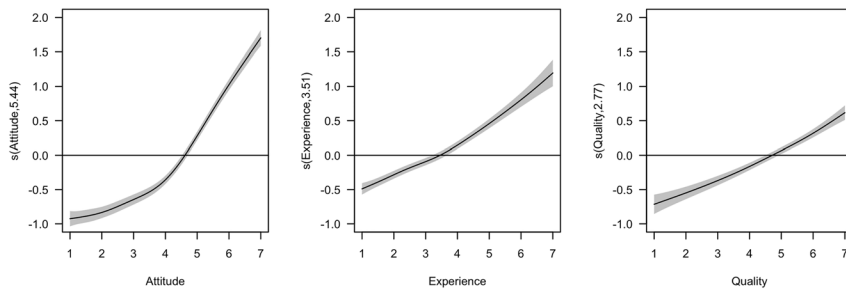


Figure 1: Fitted smooth effects of the main effect model. Note. The graphs show the estimated marginal effects of attitude, experience, and quality on brand loyalty. The effects are centered around zero. The shaded areas show 95 % pointwise confidence intervals. For example, $s(\text{attitude}, 5.44)$ describes the impact of attitude on brand loyalty, and the value of 5.44 indicates the extent of non-linearity.

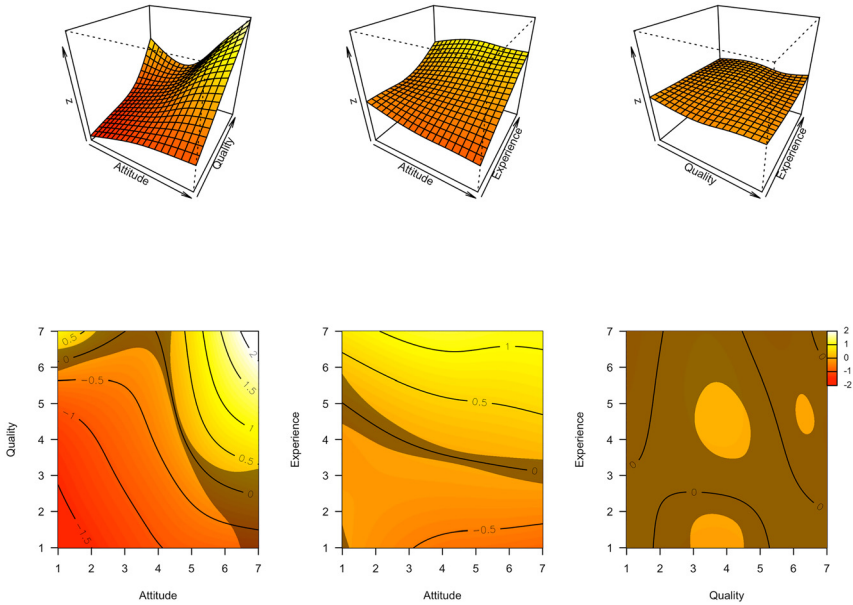


Figure 2: Fitted smooth effects of the two-way interaction effect model. Note. Three-dimensional (upper row) and two-dimensional (lower row) visualization of simultaneous partial interaction effects on brand loyalty for attitude*quality, attitude*experience, and quality*experience. The shaded areas in the two-dimensional visualization show significant differences from zero.

Finally, we fitted the model, including the three-way interaction effect (Model 3, see Table 3), which revealed a highly significant and nonlinear impact on loyalty. To resolve the three-way interaction, we inspected the two-way interaction effects between attitude and quality by holding experience constant for low experience, moderate experience, and high experience. As depicted in Figure 3, the interaction effect between attitude and quality on loyalty increases for increasing experience, i.e. the area with a significant increase in loyalty gets larger for higher experience, and inversely, the area with a significant decrease in loyalty gets smaller for the experience.

Comparing the fit of the three primary models (Model 1, Model 2, Model 3) regarding the fit indices listed in Table 3 (i.e. *AIC*, *BIC*, *REML*), we observed a vastly better fit for interaction-effect models (Model 2 and Model 3) compared with the main-effect model (Model 1). However, the three-way interaction model slightly increased model fit exclusively on *BIC*, penalizing complexity more than *AIC* and *REML*. R^2_{adj} was comparable between the three models, between 66.4 % and 67.4 % explained variance, showing a maximum difference of 1 %.

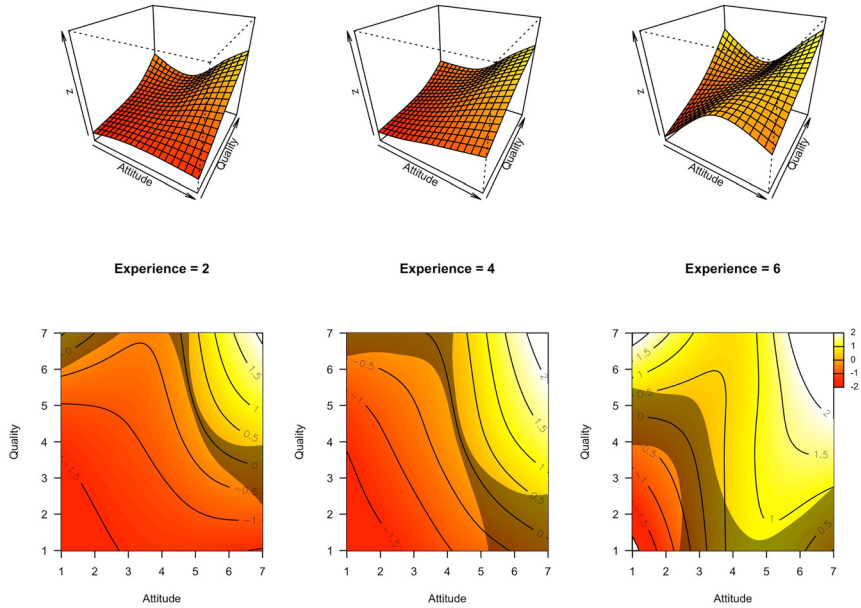


Figure 3: Fitted smooth effects of the three-way interaction effect model. Note. Three-dimensional and two-dimensional visualization of simultaneous partial interaction effects on brand loyalty for attitude*quality by holding experience constant regarding low experience (2), moderate experience (4), and high experience (6). The shaded areas in the two-dimensional visualization show significant differences from zero.

3.3 Prediction of Brand Loyalty by Industry

We separately applied the model-fitting rationale from our primary analysis to account for industry-specific effects on an experimental basis. Therefore, we grouped brands into five industries: Fast-moving consumer goods, automotive, fashion, electronics, and finance/insurance, covering approximately 81% of all brand ratings. In Table 4, we report the fitted Model 0 (null model), Model 1 (main effects), Model 2 (two-way interaction effects), and Model 3 (three-way interaction effects).

The null model modulated the loyalty ratings with significant influences of gender and brand involvement, which was stronger for FMCG brands, fashion, and finance/insurance compared to automotive and electronics. Concerning the main effects model (Model 1), the findings of our primary analysis maintained that attitude primarily showed the most substantial results, followed by experience and quality.

Table 4: Semi-parametric additive mixed models separately for industries.

	FMCG	Automotive	Fashion	Electronics	Finance & Insurance
Observations	1,670	1,080	945	851	513
Null Model					
df	54	34	34	28	28
R^2 (adj)	0.263	0.144	0.248	0.101	0.281
REML	6,065	3,838	3,347	3,189	1824
AIC	6,173	3,906	3,415	3,245	1880
BIC	6,466	4,076	3,580	3,378	1999
Model 1 – Main Effects					
Attitude	120.1 (4.0)	54.9 (3.9)	84.0 (4.4)	63.4 (4.8)	23.5 (3.8)
	<0.001	<0.001	<0.001	<0.001	<0.001
Quality	36.0 (2.4)	6.1 (2.4)	2.4 (3.7)	4.2 (4.0)	19.2 (3.2)
	<0.001	0.001	0.034	0.002	<0.001
Experience	62.2 (1.6)	40.2 (3.8)	18.0 (3.6)	76.3 (1.0)	27.9 (1.0)
	<0.001	<0.001	<0.001	<0.001	<0.001
df	60	40	40	34	34
R^2 (adj)	0.689	0.586	0.647	0.635	0.681
REML	4,681	3,062	2,669	2,473	1,448
AIC	4,801	3,142	2,749	2,541	1,516
BIC	5,126	3,342	2,943	2,702	1,660
Model 2 – Two-way Interaction Effects					
Attitude*	77.2 (7.9)	20.6 (9.1)	10.1 (9.4)	14.7 (13.0)	26.9 (10.3)
Quality	<0.001	<0.001	<0.001	<0.001	<0.001
Attitude*	35.1 (2.0)	23.2 (5.5)	3.7 (9.2)	8.1 (5.0)	12.8 (2.0)
Experience	<0.001	<0.001	<0.001	<0.001	<0.001
Quality*	0.9 (4.5)	4.5 (1.0)	0.3 (1.1)	0.5 (3.4)	1.9 (3.4)
Experience	0.509	0.033	0.657	0.746	0.127
df	69	49	49	43	43
R^2 (adj)	0.701	0.590	0.650	0.650	0.697
REML	4,632	3,058	2,672	2,467	1,439
AIC	4,770	3,156	2,770	2,553	1,524
BIC	5,144	3,401	3,008	2,757	1707
Model 3 – Three-way Interaction Effects					
Attitude*	52.6 (18.0)	15.6 (24.3)	11.0 (22.9)	16.1 (21.6)	12.4 (20.0)
Quality*	<0.001	<0.001	<0.001	<0.001	<0.001
Experience					

Table 4: (continued)

	FMCG	Automotive	Fashion	Electronics	Finance & Insurance
df	68	48	48	42	42
R^2 (adj)	0.701	0.594	0.651	0.651	0.696
REML	4,640	3,059	2,679	2,464	1,448
AIC	4,776	3,155	2,775	2,548	1,532
BIC	5,145	3,395	3,008	2,747	1710

Model 0 (only controlling for general brand involvement and brand*gender interactions), Model 1 (main effects), Model 2 (two-way interactions), and Model 3 (three-way interactions). Values indicate specific effects on brand loyalty (F-values, adjusted degrees of freedom, *p*-values).

In particular, experience appeared to have a large impact on automotive brands. In comparison, quality had a large effect on FMCG and finance and insurance brands (see Figure 4). Regarding the two-way interaction models (Model 2), the results mainly replicate the findings from our primary analysis that a combination of high attitude and high quality is particularly favorable for brand loyalty for FMCG, automotive, and electronics brands (see Figure 5).

Nevertheless, we observed important results regarding the interaction of the attitude*quality effect for the two remaining industries: First, there seems to be an overriding effect for attitude over quality for fashion brands. If participants stated a highly positive attitude toward a fashion brand, loyalty was consistently increased regardless of perceived quality. Second, there is an overriding effect of quality over attitude for finance and insurance brands. If participants stated a high quality toward a finance and insurance brand, loyalty was consistently increased regardless of attitude. However, the most substantial increase in loyalty can still be observed if positive attitudes and high quality are reported. In contrast to our general models, industry-specific models showed the best model fit for the main effect models. The industry-specific models, like our general models, show that the three-way interactions (see Figure 6) are similar to those of the two-way interaction models.

4 Discussion

In this study, we predicted consumers' reported brand loyalty by attitude toward the brand, perceived quality of a brand, and brand experience using an advanced semi-parametric estimation approach. All three predictors were positively associated with brand loyalty, corresponding with previous findings regarding the impact of attitudes (Arghashi, Bozbay, and Karami 2021; Chaudhuri 1999; Hwang et al. 2022;

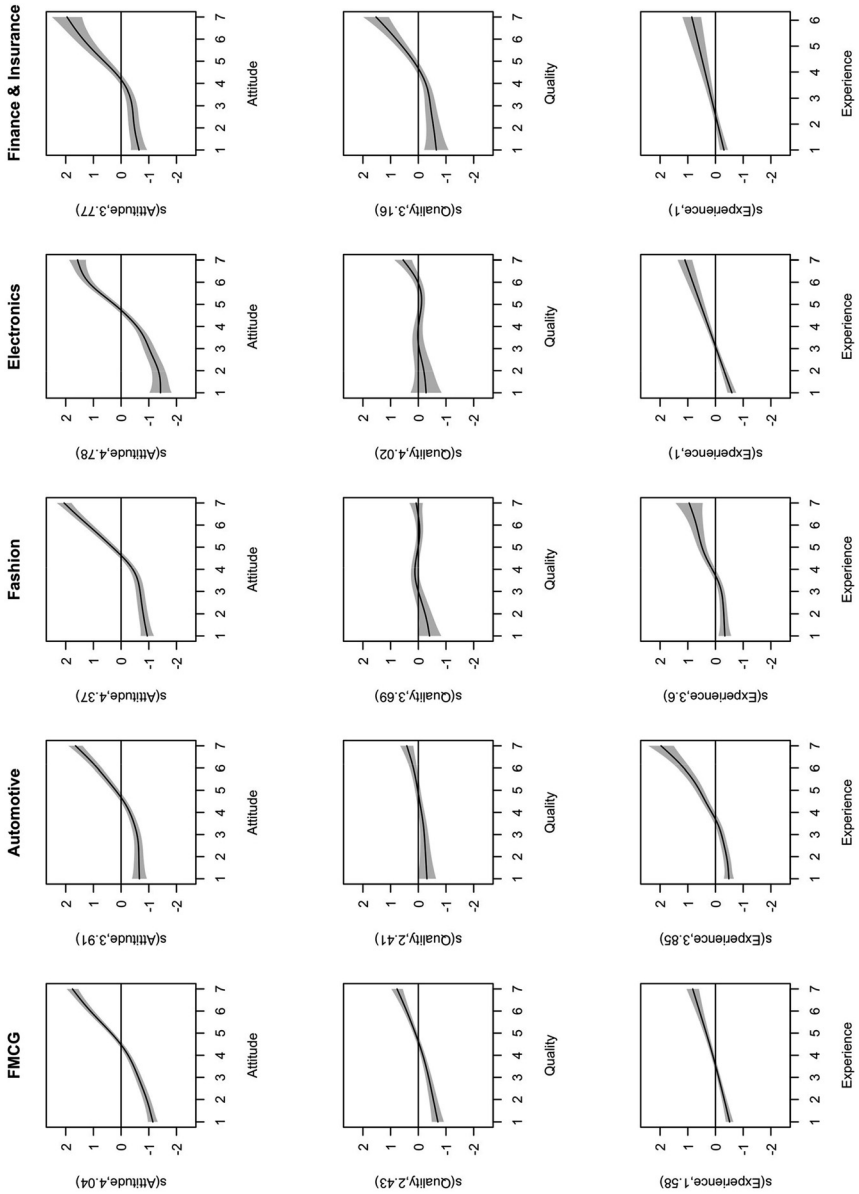


Figure 4: Fitted smooth effects of the main effect model separately for industries. Note. The graphs show the estimated marginal effects of attitude, quality, and experience on brand loyalty separately for different industries. The effects are centered around zero. The shaded areas show 95 % pointwise confidence intervals.

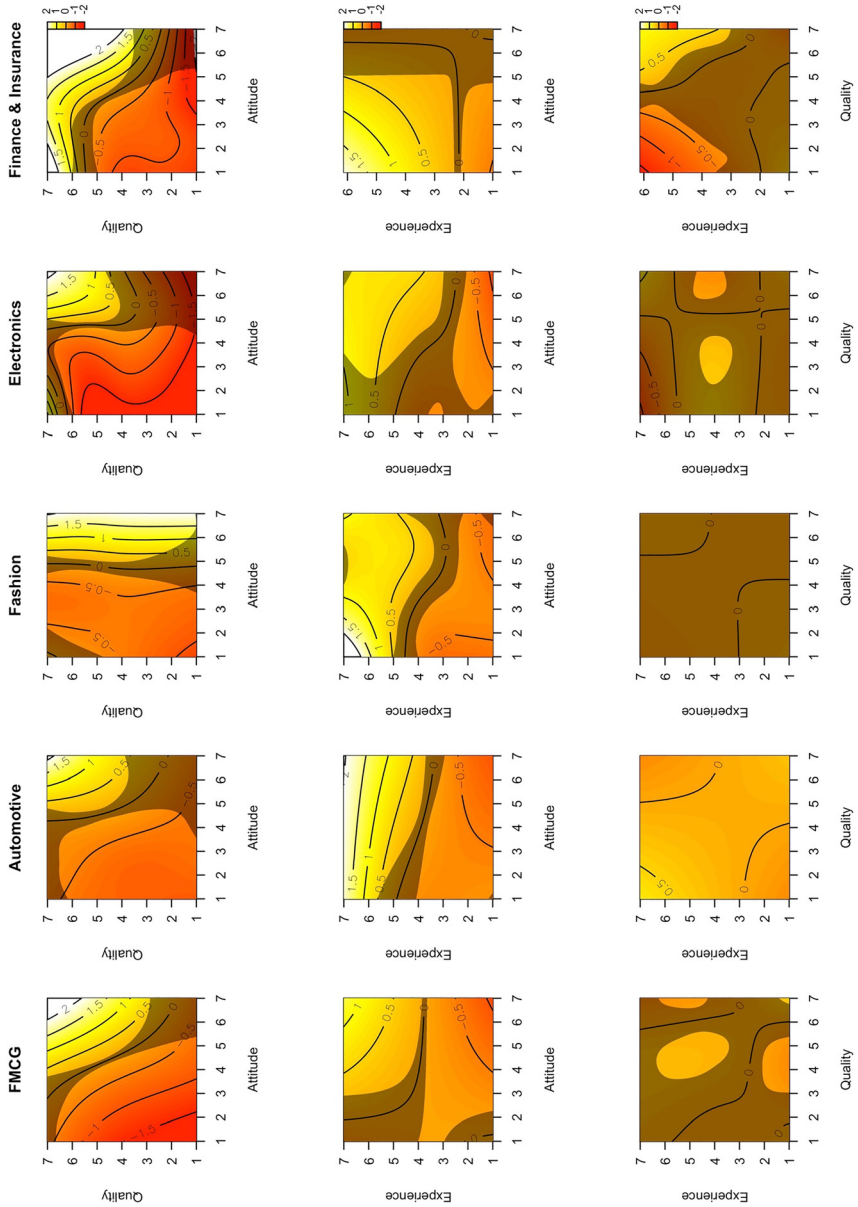


Figure 5: Fitted smooth effects of the two-way interaction effect models separately for industries. Note. Two-dimensional visualization of simultaneous partial interaction effects on brand loyalty for attitude*quality, attitude*experience, and quality*experience separately for different industries. The shaded areas show significant differences from zero.

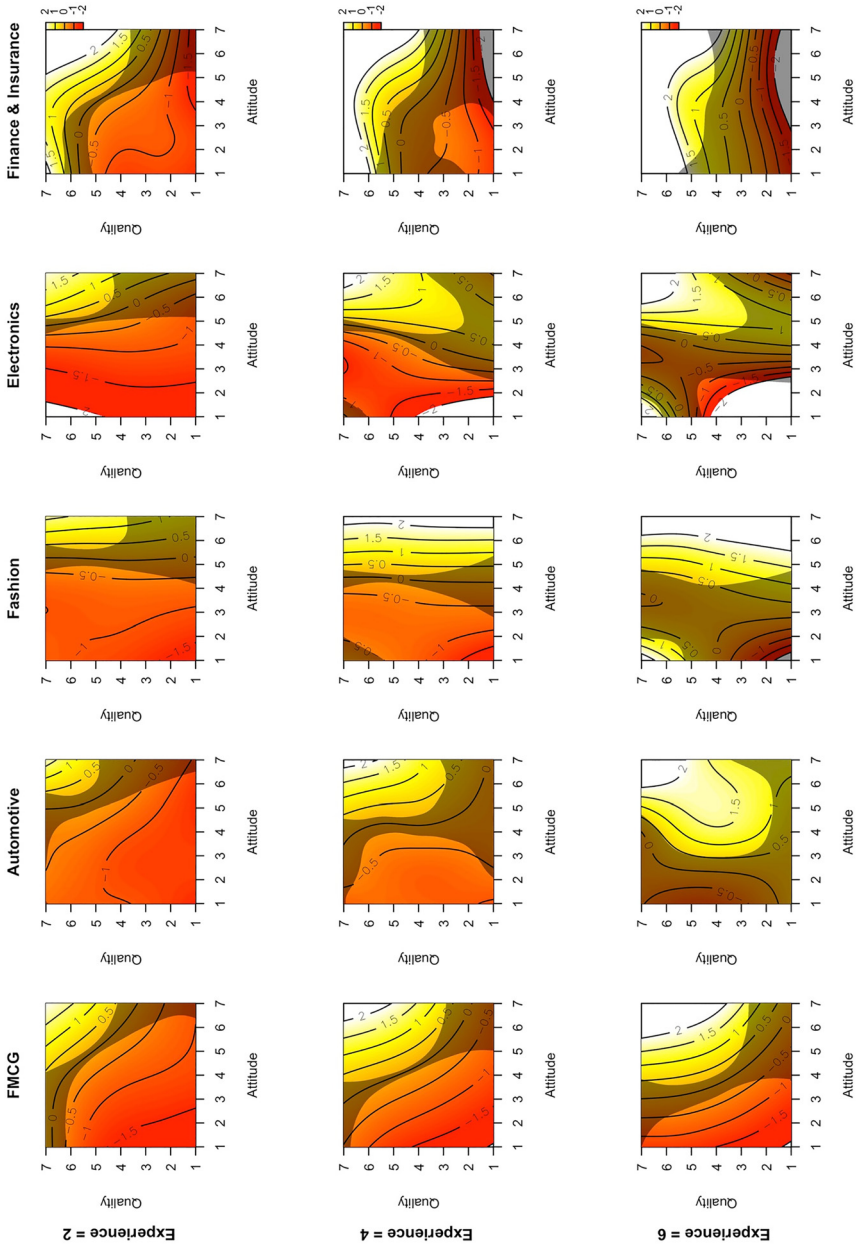


Figure 6: Fitted smooth effects of the three-way interaction effect model separately for industries. Note. Two-dimensional visualization of simultaneous partial interaction effects on brand loyalty for altitude*quality by holding experience constant regarding low experience (2), moderate experience (4), and high experience (6) separately for different industries. The shaded areas show significant differences from zero.

Kim, Morris, and Swait 2008; Rubinson and Baldinger 1996), perceived quality (Akoglu and Özbek 2022; Buil, Martínez, and de Chernatony 2013; Çifci et al. 2016; Hyun, Park, and Hong 2024; Olsen 2002; Pappu, Quester, and Cooksey 2005; Yoo and Donthu 2001), and brand experience (Bae and Kim 2023; Brakus, Schmitt, and Zarantonello 2009; Huang 2017; Husain, Paul, and Koles 2022; Iglesias, Singh, and Batista-Foguet 2011; Pina and Dias 2021; Ramaseshan and Stein 2014). Our results show that attitude impacts brand loyalty strongest among all three predictors.

While our findings align with previous research, we extend the existing literature by a more data-driven linkage between psychological determinants of brand loyalty in terms of nonlinearity and interactions. Our results indicate that more than the most commonly used linearity assumption is needed to reveal the nonlinear and interactive relationships between brand loyalty and its determinants. Hence, a nonlinear interaction approach may better understand the genuine connections between consumers' brand loyalty and psychological precursors. We found strong evidence for nonlinearities and demonstrated that substantial interaction effects exist between attitude, perceived quality, and experiences with a brand. Thus, it is essential to take potential nonlinear and interactive effects into account when uncovering the determinants of brand loyalty. For example, although attitude is the most potent predictor of brand loyalty, if brand experience and perceived quality are both high, there is always a positive impact on brand loyalty regardless of positive or negative attitudes toward the brand. Nevertheless, if the brand experience is high and the attitude is positive, perceived quality has no negative impact on brand loyalty, even if the perceived quality is poor. We also observed industry-specific effects that emphasize the crucial role of attitudes for fashion brands, perceived quality for finance/insurance brands, and brand experience for automotive brands. Such complex patterns in terms of linearity and interaction can only be revealed if researchers account for their data's interactive and possibly nonlinear nature.

4.1 Limitations

Although our models showed clear and robust patterns, the findings are limited regarding the representativeness of our sample and, in particular, the impact of sociodemographic variables. As we used a convenient sampling method, our sample consisted mainly of female and relatively young participants residing in Germany. Hence, future studies need to replicate our findings with samples balanced in gender and age and for varying cultures to generalize our findings to other sociodemographic populations.

Although we observed interesting industry-specific effects, the clusters of brands were also not balanced regarding the number of brands per industry. Most

importantly, they did not cover all relevant brands of a particular industry. The level of involvement in an industry or category could be a moderator for loyalty to brands of a specific sector. Hence, future studies should take a complete list of industry-specific brands and balance the number of industry-specific brands.

4.2 Outlook

Our findings demonstrate that attitudes, perceived quality, and brand experience predict brand loyalty. We also found that substantial differences regarding the relative impact of these predictors exist. Furthermore, we observed differences in linearity between them. However, other critical psychological aspects are considered to significantly impact brand loyalty, indicating a need for future investigation to reveal the relative importance, linearity aspects, and interaction effect patterns.

Besides the investigated dimensions of the present study, various other branding concepts are related to psychological brand equity. For example, brand affect is a brand's potential to elicit a positive emotional response in the consumer due to its use (Sharawneh 2020). Since brand affect is an immediate and spontaneous reaction, it varies from attitude, which is a long-term evaluation of the brand and can show a more robust correspondence with the emotional component of the brand experience scale. Furthermore, attitudes are based on and share similar emotional processes with core affect (i.e. emotional valence). This is interesting because emotional valence lends itself to well-established experimental approaches (Gerdes 2010). Hence, future investigations of branding concepts and precursors of brand loyalty, in particular, may consider experimental methods to measure emotional responses in consumers more objectively, for example, with psychophysiological indicators of arousal (Höfling et al. 2020), electromyography (Höfling et al. 2021), or automatic facial coding (Büdenbender et al. 2023; Höfling et al. 2022; Küntzler, Höfling, and Alpers 2021), and could investigate the direct link between emotional responses toward advertisement and changes in brand evaluation (Höfling and Alpers 2023).

Brand attachment is also related to brand attitude and refers to an emotional attachment to a brand, which likely fosters a favorable attitude toward that brand (Chieng et al. 2022; Thomson, MacInnis, and Whan Park 2005). Brand love is a more recent concept that describes the degree of passionate, emotional attachment a satisfied consumer has for a particular brand (Carroll and Ahuvia 2006; Robertson et al. 2022). Brand likeability and brand love are also similar concepts to brand attachment. In this context, brand attitude is one core aspect of brand love (Batra, Ahuvia, and Bagozzi 2012) and probably is an essential component of other brand concepts. Brand likeability is seen as a precursor to brand love. Consumers first “like” a brand before they “love” it. Attractiveness, expertise, and credibility are also

essential aspects strongly associated with the likeability of a brand (Nguyen, Melewar, and Chen 2013, 2015). Accordingly, likeability and attitude are also related since both demand evaluative processes.

Besides the importance of emotional aspects for branding constructs, other parts of brand relationships that rely on more cognitive processing must be considered in future studies to predict consumers' brand loyalty (Khamitov, Wang (Shane), and Thomson 2019). For example, there is also evidence that, alongside perceived quality, a particular brand's trustworthiness significantly impacts the loyalty of consumers (Akoglu and Özbek 2022; Erdem and Swait 2004). Finally, according to the brand equity model (Keller 2003a), there might be essential dimensions like the brand awareness or benefits of the consumption or usage of products and services of a particular brand that have not been addressed in the present study and should be investigated in future studies.

4.3 Managerial Implications

We demonstrated that an advanced semi-parametric additive mixed modeling approach is useful for brand research. Specifically, we reported a strongly non-linear function between attitude toward a brand and brand loyalty. In contrast, the perceived quality of and experience with the brand showed a relatively linear impact on loyalty. Hence, one important practical implication of this research is the specific relational pattern between attitude toward a brand and reported brand loyalty. Attitude shows a more substantial impact on loyalty for positive compared to negative attitudes, indicating a high relevance for brand positioning not to let customers' attitudes fall below a neutral attitude toward a brand. Another important practical implication is regarding highly specific industry effects: The most substantial impact on brand loyalty is typically a combination of a highly positive attitude toward the brand and a high perceived quality, particularly for fast-moving consumer goods, automotive, and electronics. However, for fashion brands, attitude is more important than quality, and vice versa for finance/insurance brands, quality is more important than attitude. These innovative insights may inform practitioners about the importance of prioritizing brand positioning dimensions and the necessity of aligning branding strategies for specific product or service industries.

4.4 Conclusions

This is the first study that accounts for nonlinear and interaction effects in brand research in various industries. Specifically, attitudes toward the brand, perceived

quality, and brand experience predicted consumers' reported brand loyalty. We demonstrated that an advanced semiparametric estimation approach helps understand better the relationship patterns that impact brand loyalty. Our results show that attitude toward the brand is the strongest nonlinear predictor of brand loyalty. Furthermore, investigating relevant interactions revealed substantial industry-specific effects for fast-moving consumer goods, automotive, fashion, electronics, and finance. Such complex patterns would remain undetected if analysis exclusively relies on linear modeling approaches and can only be revealed if brand researchers account for the data's interactive and possibly nonlinear nature.

Research ethics: According to the local ethics committee, we were not required to complete an ethical assessment before conducting this study. We obtained informed consent from our participants.

Conflict of interest: The authors have no competing interests to declare that are relevant to the content of this article.

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