

# DESIGN AND INNOVATION: INSIGHTS FROM A CONSUMERS' PERSPECTIVE

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## ABSTRACT

Design is able to emphasize a unique selling proposition for new products and thus constitutes a success factor for innovations. Yet it is recently incorporated as a major theme in marketing, especially in new product development literature. This paper examines relevant dimensions of industrial design from a consumer-behavior perspective, namely product form and how that influences a variety of perceived product qualities. A consumer typology regarding design attitudes is developed and the interactions between design and other product attributes are investigated. An experimental study reveals that consumers' perceptions of new products depend both on design by itself as well as on its interactions with technical functions and brand of the new product. The paper thus hints towards the existence of a "Golden Fit" for design and technical features as well as for design and brand. Conclusions are presented from the view of marketing and implications for the design process of new products are provided.

*Keywords: Dimensions of Industrial Design, Consumer Typology, Interaction of Design and Technical Function, Interaction of Design and Brand, Golden Fit*

## 1 INTRODUCTION

Design has become an upcoming topic in marketing research and practice and is in this context regarded as a promising success factor of increasing importance. In contrast to branding strategies the design of a product is able to communicate directly the emotional values of a new product. Branding focuses on the corporate strategy while product design supports a single new product and its features. The marketing functions of design are not limited to offering emotional surplus for the customer, but extent to long-term objectives as the ability to connect the consumers to the enterprise. Despite the need for relatively high initial investment, a well designed product pays off [2]. Design does not only offer potential to differentiate single products from competitors but helps as well to create long-lasting consumer relationships. Furthermore, design fulfills the function of signaling hidden product characteristics, which is especially important for new product diffusion. Quality and newness signals provided by product design are used to communicate new product benefits and thus to increase the rate of survival for innovations. Accordingly, design has become a success factor especially in new product development [14].

This study investigates the relationship between design and technical features as well as design and brand. The affinity for design, technical features as well as brands is expected to be heterogeneous across consumers. While functional aspects of design are likely to be more homogeneous assessed across consumers, both the emotional and symbolic functions of design are likely to be context-dependent. At the same time, these latter two dimensions are especially closely linked to innovation marketing, as they provide meaning to products [17]. Three aspects can be identified which seem to be of special importance for innovation marketing issues: (1) Emotional functions of design may be captured by the aesthetic fit of a new product. (2) Symbolic design effects may influence the assessment of non-visible product attributes, especially for the valuation of the innovativeness of a product. Finally, design may exert a direct impulse to purchase new product offerings. Instead of technical function the aesthetic appearance is supposed to be one of the greatest impulses to purchase at the point of sale. For this reason the paper focuses mainly on the aesthetical fit function of design and do not cover issues like ergonomics or other technical functions.

Three functions of design, which are constitutive, can be aligned along a sequential process of preference formation and purchase decision (Figure 1). First, the Design acts as an eye-catcher for the new product. This is called the aesthetic fit which is based on the emotional and symbolic value of the innovation. The first function of the design stimuli is followed by the perception of innovative non-visible product attributes by the customer. The aesthetic fit as well as the perception of innovativeness should lead to an activation of the customer. This should result in the purchase of the product. They are considered in the following analysis regarding the relationship of design, technical functions and brand. In a first step, they are used to typologies the consumer behavior regarding design. Following this, the relative meaning of design is evaluated in a simulated purchase situation (see section 2). Functional differentiation is supposed to influence the customer choice and meet their expectations in a second step in the meaning of design [12].

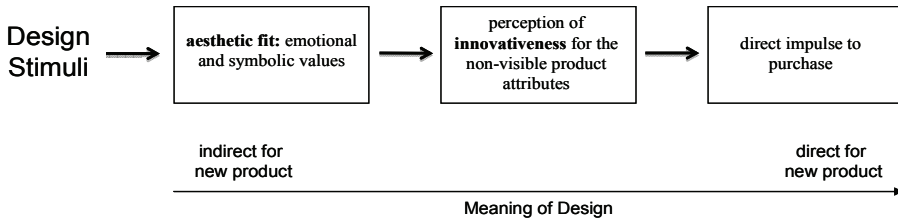


Figure 1. Framework for design, cognition of innovativeness and intention to purchase

The empirical study consisted of two parts to analyse the antecedences of consumers' new product experiences. Choice behavior of potential consumers was investigated by a standardized questionnaire which based on established scales. The consequences of design experience on new product assessment were simulated in a conjoint experiment. The probands were asked to evaluate hypothetical camera stimuli in a simulated purchase situation. 181 persons between 17 and 67 years participated in the study which consisted of a standardized questionnaire and a conjoint analysis. Excluding observations with missing values, 171 responses were further processed in the following analyses.

## 2 ANTECEDENCES OF CONSUMERS' NEW PRODUCT DESIGN EXPERIENCE

In this section the conceptual background of the underlying study is described. An explorative study about the meaning of design especially for new products was derived. Key dimensions of the design were discussed by experts for the topic. Following scales to measure consumer-behavior perspective about design are introduced and used to evaluate relevant constructs to identify a segmentation of costumers' attitudes about design. Differences between consumers should be characterized and systematized. This characterization of design from the consumers' perspective, the segmentation of the dataset and the exploration of the expected interactions will be undertaken in the following sections.

### 2.1 Conceptual background

Relatively little is known about the relationship between marketing and new product design on innovation success. Nevertheless, marketing and design by themselves are recognized as key contributors in the new product development process [18]. Especially new products are a relevant factor for business success and competitiveness. In this context design opens up new markets and poses interests for products in mature markets [1].

Design enables companies to reposition existing products by introducing newly designed versions of an already established product [8]. Well designed products are able to communicate an enhanced product or service quality and support a company image [1].

Design is a more or less hedonic attribute of a product and therefore not quantifiable like other product attributes as the price or technical features. To capture the relevant dimensions of design, we identified scales, which have been proved for their influence on consumer behavior linked with design. Relevant constructs of design were identified by an explorative study with design experts. Scales which have

been used for this study were derived from established scales published in previous studies. The following explanations reveal the key-findings about design:

1. Design is able to communicate a message about the product [1], the enterprise and its ethical values.
2. In addition design is perceived as emotional and innovative [12].
3. Design could be influenced by actual trends and cognition of product attributes.
4. Design is supposed to have a visual influence at the point of sale. In this context visual design is the closest element aligned with what design means to most observers [12].
5. Customers without specific product knowledge are assumed to be compulsive in their shopping behavior [3].

These propositions about design from a consumers' perspective are used to specify underlying constructs. They describe the relevant consumer behavior regarding design.

## 2.2 Measurement Scales

The relevant dimensions of design have been identified by an explorative study regarding design and marketing. We used a multi-measure approach to operationalize our theoretically derived constructs. Both exploratory as well as confirmatory factor analysis were used in order to reduce dimensions of design: This allowed us to condense 39 items into 10 constructs. Validity and reliability of the latent constructs were tested by statistical tests. The cronbach's alpha for novelty seeking is 0.882 (including seven items), product knowledge 0.874 (six items included), design affinity 0.834 (five items including) and compulsive buying 0.766 (including four items). Thus, all measurement scales are acceptable up to good [13].

In the following analyses, we excluded constructs for emotional cognition, fashion leadership and price/quality perception. Due to the fact that these constructs are not been processed in the cluster analysis, which is examined in the next section, they will not be explained any further. Out of these results the following scales were chosen to be reliable indicators for the consumer behavior linked with design (Table 1):

Table 1. Extract of tested constructs in the study

Construct	Source
Novelty seeking	Manning, Bearden, Madden (1995): Innovativeness: Consumer innovativeness [10]
Product knowledge	Kleiser, Mantel (1994): Expertise: Consumer expertise [6]
Design affinity	Lynn, Harris (1997): Uniqueness: Desire for unique consumer products [9]
Compulsive buying	Valence, D'Astous, Fortier (1988): Compulsive buying scale [16]

Customers indicating to search for innovations must have a certain understanding of design. Therefore the scales for novelty seeking will have to identify consumers' affinity to design from the innovative point of view. Exemplary underlying items are *'I often seek out information about new products and brands'*. Product knowledge includes design as a part of the entire bundle of product attributes. Customers, who have detailed knowledge about a product need to have specific information about all relevant product attributes, especially design. Underlying items for product knowledge construct are for example *'I can recall almost all existing brands of cameras from my memory'*. Also customers which have a certain affinity to a product need to have a certain affinity to its design. Logically design affinity (items included like *'I am very attracted to rare objects'*) is one of the most important constructs to explain the importance of design for new products. Design could make the choice at the point of purchase as design has visual influences. So design could be the factor for an impulsive choice for purchase. One item indicating compulsive buying is *'I am often impulsive in my behavior'*. These constructs are an extract of possible consumer-behavior dimensions regarding design derived from explorative study (see section 2.1).

### 2.3 Segmentation of consumers'

The relevant constructs of consumer-behavior dimensions were used to characterize different consumer types. These results are derived through cluster analysis [5]. This statistical method is able to segment a dataset in respect to its underlying variables. These variables should be ex-ante qualified to differentiate the considered objectives in the dataset.

We specifically applied a hierarchical cluster analysis using ward-method for segmentation [11]. The constructs of typologies were used as cluster variables (see section 2). These were named novelty seeking, product knowledge, design affinity and compulsive buying. The following Table 2 shows the results of the segmentation process with hierarchical cluster analysis. The displayed mean values for the underlying constructs indicate the relative emphasis on the four dimensions of design attitude at the segment level. To test their statistical discriminance, F-tests were performed. All cluster variables reveal to be highly significant with a p-value of 0.000 for the between groups comparisons.

Table 2. Results of hierarchical cluster analysis

Cluster		Novelty seeking	Product knowledge	Design affinity	Compulsive buying
Novelty seekers N=44	Mean	0.635	-0.196	-0.278	-1.033
	Std. Deviation	0.826	0.639	0.905	0.722
Enthusiastics N=66	Mean	0.048	-0.544	0.505	0.533
	Std. Deviation	0.831	0.604	0.774	0.629
Category-specialists N=29	Mean	0.078	1.740	0.237	0.180
	Std. Deviation	1.168	0.632	1.081	0.953
Conservatives N=32	Mean	-0.981	-0.051	-0.995	0.314
	Std. Deviation	0.678	0.558	0.573	0.899

Four distinct consumer segments could be identified from underlying dataset: (1) The novelty seekers are highly focused on innovative products. For example, a reliable item of the novelty seeking construct is named '*I am searching continuously for new products*'. (2) The enthusiasts are characterized by a high design affinity as well as high compulsive buying behavior. Thus it could be considered that these consumers are visually driven, highly impulsive and spontaneous at the point of sale. (3) The category-specialists are described by especially high product knowledge, some design affinity and a bit of compulsive buying behavior. (4) Finally, the conservatives are characterized by rejection of both novelty seeking as well as design affinity. Therefore, this segment is not expected to be design-oriented.

Altogether, the segment of enthusiasts seems especially attracted by design. Interestingly, this segment constitutes as well the largest part of our (non-representative) sample. This underlines the importance of design on consumers' valuation of new products.

## 3 CONSEQUENCES OF DESIGN EXPERIENCE ON NEW PRODUCT ASSESSMENTS

The following section delivers a detailed discussion of the conceptual background. Based on these considerations the subsequent section describes the experimental study including the overall findings. Our research results refer to the analysis of interaction effects between design and technical functions as well as design and brand interactions. Finally the results will also be discussed on a segment level.

### 3.1 Conceptual background

New functional product feature are not easy to recognize by customers. Innovative product features will be difficult to launch without an adequate communication of these improvements. Design marks a

salient way to outline innovative product features. Hence design has a signaling function for new products with innovative technical features and has to be integrated in new product development process.

The congruence of innovativeness for design and functionality as well as brand of a new product could be marked as a “Golden Fit” [15]. Design should communicate the costumers which new features a product includes. Furthermore, the characteristics of a certain design generate expectations about technical features of the innovative product. For example, consumers will perceive a new automobile only as environmentally friendly if the design is able to communicate this technical product feature. Design thus sets expectations about technical functionality. If a new product has an innovative design but misses any new technical features, it is likely to disappoint consumers.

A couple of examples from the automobile market may underline this relationship: (1) The Ford Edsel was launched in the 50<sup>th</sup> and offered a complete innovative product design. However, this new product design was not accompanied by upgraded technical features of the product and became a well-known market flop. On the contrary, VW Lupus constitutes an especially environmentally friendly car whose design did not fit to the outstanding technical innovations of the product. Again, there was a misfit between design and technology and the product did not succeed on the market. On the contrary, the Toyota Prius could fulfill the expectations from customers about a couple of futuristic technical features which were indicated through equally futuristic design. The relaunched Mini Cooper is another example for the successful fit of design and technical features. Yet, the relaunched Mini Cooper connected the old design with a low lever of technical innovations. The following Figure 2 shows these fit considerations between design and technical function:

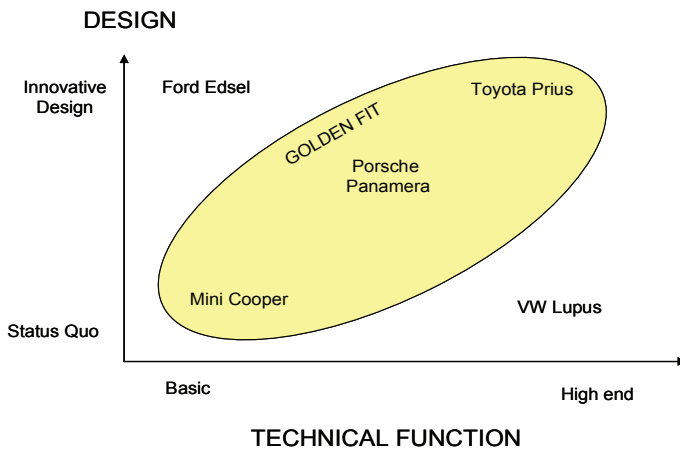


Figure 2. Visualization “Golden Fit” for design and technical function

As a consequence, interactions between quantifiable product attributes are assumed to have a high relevance for the design of new products. For instance it could be assumed that the more technical features a new product comprises the more focus should be taken on the design of a new product. The same could be supposed for brand assessment. Product design may lead to positive brand evaluation [7]. This relations call for a “Golden Fit” between design, technical feature and brand [15].

To identify the relevant aspects on product design, interactions between design, brand and technical functions will be identified in the following sections. Three different measures of consumer response will be investigated: The intention to purchase, emphasis of fit and cognition for innovativeness. Expected is a triad between design, technical function and brand like shown in the following Figure 3:

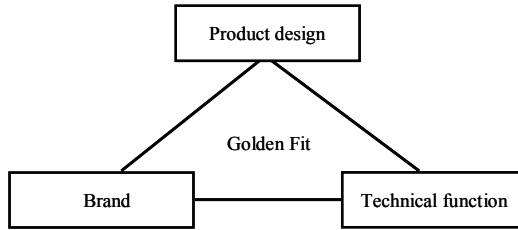


Figure 3: Triad between design, technical function and brand

### 3.2 Experimental study

An experimental study was performed for the empirical investigation. The survey consisted of two parts: The antecedences of consumers' new product experiences were investigated by a standardized questionnaire which based on established scales. The consequences of design experience on new product assessment were simulated by a conjoint experiment [4]. Hypothetical descriptions of new cameras were used as stimuli in order to assess the importance of design in new product development.

A conjoint study was conducted analyzing the effects of design on the intention of purchase, emphasis of fit and innovativeness. Through this analysis the influence of design, technical functions as well as brand on three different consumer responses were investigated: As dependent variables, respondents articulated the (a) aesthetic fit, (b) perceived innovativeness and finally (c) purchase intention for the presented product stimuli. The method was a full-profile, traditional conjoint analysis. Design as well as technical function were varied by two levels, brand by three levels, leading to a full-factorial design of 12 different stimuli (see Table 3). The ratings were provided on a 7-point Likert-scale.

Table 3. Design of the experimental study

Attribute	Level 1	Level 2	Level 3
Design	Functional design	Stylish design	./.
Technical functions	Ordinary technical functions	Innovative technical functions	./.
Brand and price	Unbranded discount product	Medium-priced brand	High-priced brand

### 3.3 Overall Findings

Analysis of user needs is necessary to gain insights from customers [17]. Using conjoint analysis and ordinary-least square regression the following results were identified: Over all persons design was found to be the most relevant aspect for intention of purchase, emphasis of fit and innovativeness regarding the considered new product (photo-camera). Especially for the intention of purchase, design is highly important (1.066) compared to technical function (0.232) and brand (0.140 for brand in medium prize segment). The values represent not standardized regression-coefficients in the regression analysis. Regarding possible interactions between these aspects, following effects were investigated:

1. Interaction of design and technical function
2. Interaction of design and brand

Concerning the purchase intention the interaction between design and technical function was found to be significant for a value of 0.114 (see Table 4). The interaction between design and technical function as well as the interaction between design and brand for the emphasis of the fit are highly significant and represent the highest values over all interactions regarding purchase intention, fit and innovativeness. The value of design for the emphasis of fit is decreasing comparing to purchase intention and innovativeness. Furthermore the coefficient of the interaction for design and brand is significantly negative. Consumers obviously demand an innovative product design when purchasing a high-priced brand camera and don't consider it as an innovative product.

Table 4. Regression coefficients for purchase intention, fit and innovativeness

	Purchase intention		Fit		Innovativeness	
	Not Stand.	Sign.	Not Stand.	Sign.	Not Stand.	Sign.
	B	p	B	p	B	p
(Constant)	3.385	0.000	3.952	0.000	4.066	0.000
<b>Design</b>	<b>1.066</b>	<b>0.000</b>	<b>0.738</b>	<b>0.000</b>	<b>1.329</b>	<b>0.000</b>
Technical function	0.232	0.000	0.218	0.000	0.355	0.000
Medium-priced brand	0.140	0.000	0.031	0.415	0.198	0.000
High-priced brand	-0.330	0.000	-0.239	0.000	0.007	0.853
<b>Design * Technical function</b>	<b>0.114</b>	<b>0.000</b>	<b>0.301</b>	<b>0.000</b>	<b>0.000</b>	<b>0.987</b>
<b>Design * Brand</b>	<b>-0.023</b>	<b>0.477</b>	<b>0.293</b>	<b>0.000</b>	<b>-0.105</b>	<b>0.001</b>

As shown in table 4 the interactions of design and technical functions are significant for purchase intention and emphasis of fit. In contrast to these findings the interactions between design and brand are significant for emphasis of fit and innovativeness. Implications for future research should be the detailed analysis of both interactions for purchase intention and cognition of innovativeness. The following Figure 4 captures thus one very important result of the study: Both interactions for emphasis of fit shows that design and technical function respectively design and brand need to fit. Otherwise for example a high-technical function does not fit with the functional design. This combination will be penalized by customer action, as non-purchase.

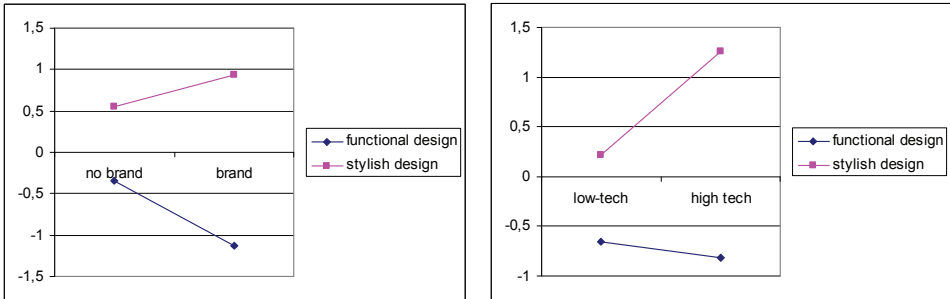


Figure 4. Visualization of interaction effects of design for fit assessment

Detailed results were derived by regression analyses on the segment level. Across all identified clusters, design influences the purchase intention most, followed by technical functions of the product. The fit assessment leads to the following findings: The interactions of design and technical function as well as design and brand are highly significant (with the exception of cluster four, see table 5). In segment one (novelty seekers) and segment four (conservatives) the cognition of innovativeness has a negative value due to the fact that a high-priced brand needs to fulfill customer expectations of an innovative design.

### 3.4 Segment-level estimates

The following clusters were identified in the clustering process (see section 2.3). A detailed view on each segment (see also Table 5) reveals that:

- Novelty seekers focus highly on design and technical functions. Also they have the highest coefficient for technical function. Regarding the interaction of design and technical function the purchase intention is confirmed (0.136). The emphasis of fit shows equal values for the interactions of design and technical functions (0.339) same as design and brand (0.313).
- The cluster of the enthusiasts shows that the coefficients for design, technical functions and brand is medium ranged compared to the other clusters. In contrast to cluster one the interaction

of design and brand (0.386) is slightly higher than the interaction of design and technical function (0.340) for the emphasis of fit.

- The category-specialists (cluster three) show the highest value for design regarding the purchase intention (1.364). The values for technique and brand reveal that this segment is more focused on cameras and brands than on technical details. Their affinity to brand cameras is approved by the highest value for brand (medium-price). Technical functions seem to be inferior due to the fact that the market for high price cameras is saturated. Few technical differences between high-price cameras are launched. Like segment two (enthusiastics) in this segment the interaction of design and brand (0.328) is higher than the interaction of design and technical functions (0.224).
- The final cluster was named the segment of conservative customers. They are characterized by the lowest coefficients for design, technical function and brand for there intention to purchase the new product. The interaction for design and technical function is confirmed for the emphasis of fit (0.237) and is significant in contrast to interaction of design and brand. The cognition of innovativeness is negative for the interaction of design and brand, which verifies the result that a brand needs to have a good design.

Table 5. Regression coefficients for the identified clusters

Coefficients	Cluster	Purchase		Fit		Innovativeness	
		Not Stand.	Sign.	Not Stand.	Sign.	Not Stand.	Sign.
		B	p	B	p	B	p
Novelty seekers	(Constant)	3.446	0.000	4.085	0.000	4.264	0.000
	<b>Design</b>	<b>1.101</b>	<b>0.000</b>	<b>0.693</b>	<b>0.000</b>	<b>1.382</b>	<b>0.000</b>
	Technical function	0.318	0.000	0.290	0.000	0.419	0.000
	Medium-priced brand	0.077	0.311	-0.006	0.938	0.213	0.002
	High-priced brand	-0.420	0.000	-0.324	0.000	-0.006	0.935
	<b>Design * Technical function</b>	<b>0.136</b>	<b>0.028</b>	<b>0.339</b>	<b>0.000</b>	<b>0.017</b>	<b>0.763</b>
	<b>Design * Brand</b>	<b>-0.098</b>	<b>0.136</b>	<b>0.313</b>	<b>0.000</b>	<b>-0.197</b>	<b>0.001</b>
Enthusiastics	(Constant)	3.392	0.000	3.909	0.000	4.074	0.000
	Design	1.012	0.000	0.663	0.000	1.264	0.000
	Technical function	0.249	0.000	0.234	0.000	0.393	0.000
	Medium-priced brand	0.133	0.034	0.017	0.780	0.214	0.000
	High-priced brand	-0.324	0.000	-0.241	0.000	0.019	0.745
	<b>Design * Technical function</b>	<b>0.140</b>	<b>0.006</b>	<b>0.340</b>	<b>0.000</b>	<b>0.014</b>	<b>0.770</b>
	<b>Design * Brand</b>	<b>0.020</b>	<b>0.713</b>	<b>0.386</b>	<b>0.000</b>	<b>-0.016</b>	<b>0.750</b>
Category-specialists	(Constant)	3.513	0.000	4.078	0.000	4.099	0.000
	<b>Design</b>	<b>1.364</b>	<b>0.000</b>	<b>0.897</b>	<b>0.000</b>	<b>1.653</b>	<b>0.000</b>
	Technical function	0.198	0.002	0.167	0.019	0.284	0.000
	Medium-priced brand	0.328	0.000	0.116	0.181	0.267	0.000
	High-priced brand	-0.091	0.255	-0.177	0.043	0.108	0.137
	<b>Design * Technical function</b>	<b>0.112</b>	<b>0.085</b>	<b>0.224</b>	<b>0.002</b>	<b>-0.020</b>	<b>0.734</b>
	<b>Design * Brand</b>	<b>0.054</b>	<b>0.434</b>	<b>0.328</b>	<b>0.000</b>	<b>-0.088</b>	<b>0.159</b>
Conservatives	(Constant)	3.168	0.000	3.746	0.000	3.746	0.000
	<b>Design</b>	<b>0.857</b>	<b>0.000</b>	<b>0.811</b>	<b>0.000</b>	<b>1.096</b>	<b>0.000</b>
	Technical function	0.112	0.121	0.133	0.064	0.255	0.000
	Medium-priced brand	0.074	0.401	0.031	0.721	0.082	0.336
	High-priced brand	-0.438	0.000	-0.176	0.045	-0.094	0.271
	<b>Design * Technical function</b>	<b>0.029</b>	<b>0.691</b>	<b>0.237</b>	<b>0.001</b>	<b>-0.031</b>	<b>0.653</b>
	<b>Design * Brand</b>	<b>-0.080</b>	<b>0.296</b>	<b>0.045</b>	<b>0.554</b>	<b>-0.178</b>	<b>0.016</b>

The following implications summarize the previous analyses and sketch the need for future research.



## **4 IMPLICATIONS**

Our exemplary study showed that the design exerts multidimensional influence on consumer behavior. Design impacts consumers' perspective in respect to various measures reaching from initial perception to final purchase situations. Within our experiment, design showed to be a key influence factor in all these stages of purchase decision process. Design was thus not only valued in an aesthetic context, it as well served as a signaling for non-visible product attributes (esp. innovativeness) and even provide a direct impulse for purchase. This underlines the different functions which design fulfills.

In addition, design does not only exert an effect by itself on consumer behavior, but it as well interacts with major product attributes. In particular, we observe interaction effects between design and brand as well as design and technical functions. Thus, design has to be aligned with the other product characteristics. Focusing on the fit of design the study delivered first implications for the interaction of design and technical functions and brand. These implications should be further analyzed in future research. Especially the interactions for cognition of innovativeness, which are directly impacted by the emphasis of fit and for the intention of purchase, should be revealed. Furthermore, the kind of investigated product (complex cameras) may have affected the results. For example, cameras are almost mature and domain specialists already know what the products are like and do not expect any novelty. Thus, future research is needed to examine whether the results can be replicated by different kinds of incrementally as well as radically new products.

To sum up, we conclude that design needs to be considered in a wider focus. Design should not be limited to just ergonomic or aesthetic aspects of new product development. Design impacts directly the valuation of invisible product attributes, brand and product image dimensions and consequentially the purchase intention at the point-of-sale. Furthermore, design influences consumers' expectations about new product features (like technical functions). This signaling effect of design differs across the various product attributes (like brand or technical function). Design does not always contribute as an excitement factor for consumers, but can as well serve hygienic functions. For example, a high priced brand is expected to offer an innovative product design.

A major implication for practitioners as well as for scholars is the need for high integration of all departments engaged in new product development. The disciplines of engineering, marketing and design (creativity) need to collaborate more intensely to ensure a consistent fit of product design, brand image and technical functionality.

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