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Does product design matter? Exploring its influences in consumers' psychological responses and brand loyalty

Does product
design matter?

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Abstract

Purpose – Unique product design is a highlight of sustainable branding. The purpose of this paper is to investigate whether product design affects customers' psychological responses (i.e. cognitive and affective responses) to smartphones, and, in turn, affects their brand loyalty (i.e. attitudinal and behavioral brand loyalty), further advancing the knowledge of product design and brand management.

Design/methodology/approach – This work used survey data from 456 Taiwanese with experience using smartphone. Structural equation modeling was employed to test the proposed model and hypotheses.

Findings – The results indicate that the product design significantly affects both cognitive response and affective response, which, in turn, significantly affect both attitudinal brand loyalty and behavioral brand loyalty. The findings also suggest that the moderating effect of product involvement on the relationship between product design and affective response is statistically significant, although it does not positively and significantly moderate the link between product design and cognitive response.

Research limitations/implications – This study has two main limitations. First, this study was conducted in the context of smartphones, thus potentially constraining the generalization of the results to other industries. Second, the data in this study were obtained from a cross-sectional design.

Practical implications – These findings can permit companies to generate more brand loyalty in their customers and guide their management of assets and marketing activities.

Originality/value – This paper presents new insights into the nature and importance of product design in brand value.

Keywords Perceptions, Smartphone, Product design, Brand loyalty, Brands, Cognitive response, Technology adoption, Product involvement, Design research, Affective response

Paper type Research paper

1. Introduction

In a highly competitive market, product design is regarded as a way of communicating product meaning to consumers (Crilly *et al.*, 2008), as a source of competitive advantage (Noble and Kumar, 2010), and as “an integrated practice fundamental to firm strategy and market success” (Luchs and Swan, 2011, p. 327). Product design can induce purchase intention in consumers (Homburg *et al.*, 2015) and improve their loyalty (Chitturi *et al.*, 2008), thus raising firm performance (Candi, 2010). Peters (2005, p. 39) also suggested that “design is the only thing that differentiates one product from another in the marketplace.” Product design is thus a crucial means by which products are made differentiable in today's competitive market (Homburg *et al.*, 2015). Additionally, Bednall *et al.* (2012) noted that product design allows a firm to distinguish its products from those of competitors, while serving as a brand identifier. In this context, it can be understood that why product design is seen as a key strategic tool underlying the success of companies like Apple, BMW, and Target (Brunner *et al.*, 2008), and one that less flourishing companies, such as Dell, can apply to distinguish themselves from competitors (Jana, 2008). Therefore, in order to



achieve successful product differentiation, designers can take different principles that users value into consideration when designing a new product in order to generate positive psychological responses and subsequent brand loyalty.

Homburg *et al.* (2015), however, noted that product design is generally measured in limited ways, and usually just by referencing aesthetics (Landwehr *et al.*, 2013) to examine a product's hedonic and utilitarian dimensions (Chitturi *et al.*, 2008). By contrast, recent research extends further than one- or two-dimensional measurements and deems product design to be a three-dimensional concept (e.g. Homburg *et al.*, 2015) comprising the three dimensions of aesthetics, functionality, and symbolism. Brunner *et al.* (2016) found that product design positively influences consumer evaluations of a product, which then affect their decision whether or not to purchase it. As such, this study uses this three-dimensional conceptualization, consistent with the work of Homburg *et al.* (2015), to focus on a single product category (i.e. smartphones). To the best of our knowledge, this is the first time this approach has been adopted in this context.

The impact of specific design dimensions on consumer preferences and product evaluation has been discussed in prior research (e.g. Patrick and Hagtvedt, 2011). The design of a product is viewed as a means of communicating information to consumers (Nussbaum, 1993), creating a unique impression, and generating inferences with regard to other product attributes (Berkowitz, 1987). For example, iPhones communicate with a strong visual product form, hedonic qualities, functionality, and symbolic meaning, which further helps to develop company identification as well as brand identification. As Forty (1986) has stated, firms have different design philosophies that allow them to create and strengthen their recognizable company character. Specifically, the perception of aesthetic design may create a pleasurable effect for consumers, while the perception of functionality may increase consumers' awareness of the product's performance. As to the symbolic aspect of a product, design can arouse varied relations, comprising those linked with a certain place or time (Creusen and Schoormans, 2005), and further explain the values and moods an individual feels in relation to the focal item, or serve in helping users to form their personal identities (McCracken, 1986). Moreover, Bloch (1995) developed a conceptual model to investigate the effects of product design on psychological and behavioral responses. Specifically, product design can evoke a variety of psychological responses from consumers. Bitner (1992) explains that these psychological responses include both cognitive and affective responses, and they may occur simultaneously. Numerous studies have shown that psychological responses can affect consumer behavior (e.g. Abarbanel *et al.*, 2015; Agarwal and Malhotra, 2005; Bekk *et al.*, 2016; Da Silva and Syed Alwi, 2008; Grimm, 2005; Korhan and Ersoy, 2016). Ranganathan *et al.* (2013) described how evaluations are followed by affect, which is then followed by behavioral intentions. For this reason, it is necessary to explore the impacts of cognitive and affective responses on subsequent consumer behavior (Bloch, 1995).

In addition, consumers generally consider how valuable and interesting a product is when deciding whether to purchase it (Palazon and Delgado-Ballester, 2013). This implies that consumer purchase behavior varies depending on the level of product involvement. Such involvement is more likely to arise when the product is seen as reflecting the consumer's self-image, and when a perceived high cost is associated with a greater decisional risk (Petty and Cacioppo, 1981). Moreover, the extent of product involvement impacts the degree of decision importance in the purchasing process, as seen in factors such as consumers' cognitive and affective responses. In addition, customers with greater product involvement are more likely to have more attitudinal and behavioral loyalty. As such, the degree of product involvement is used as a moderator to examine its influence on this study's model. In summary, within this context, it is essential to understand how product design influences consumers' psychological responses, which, in turn, enhance

brand loyalty, and how the relationships between product design and psychological responses are moderated by the construct of product involvement.

This study has two primary objectives as follows:

- (1) to understand the influences of product design on the cognitive and affective responses of consumers to smartphones, and in turn, how these affect attitudinal and behavioral brand loyalty; and
- (2) to understand the moderating effects of product involvement on the relationships between product design and both cognitive and affective responses.

The smartphone industry in Taiwan is used as the research context to examine these issues. Smartphones are perhaps the leading consumer electronics product, having quickly displaced more basic cellphones on the market, with vendors shipping a total of 334.9 million such devices worldwide in the first quarter of 2016 (Information Data Center, 2016). Moreover, a recent survey published by eMarketer (2015) stated that the expected penetration rate of smartphones in Taiwan was 86.8 percent in 2016. Since the smartphone market has experienced a very rapid growth in Taiwan, as elsewhere, and product design and branding are crucial factors in the related marketing (Arruda-Filho *et al.*, 2010), this research context is very suitable for the broader issues being considered. The findings of this study may thus provide useful strategic suggestions for both smartphone development and marketing.

The remainder of this paper is organized as follows. First, the literature on product design, psychological responses (i.e. cognitive and affective responses), brand loyalty (i.e. attitudinal and behavioral brand loyalty), and product involvement is reviewed in order to shed light on their underlying concepts. The research framework is then introduced and a set of hypothesized relationships is proposed. The research method is described in Section 3, including pilot testing, measurement development, assessing measurement properties, and examining common method variance. Section 4 reports the empirical results. These results, including their academic and managerial implications, are discussed in Section 5. Finally, the research limitations and directions for further research are presented in Section 6.

2. Theoretical development and proposed research hypotheses

The current literature offers a rich foundation with which to create a research framework and investigates the impacts of product design on loyalty through psychological responses as well as the moderating role of product involvement. Figure 1 shows the research framework used in this study. The specific components of the research framework and related hypotheses are discussed in more detail below.

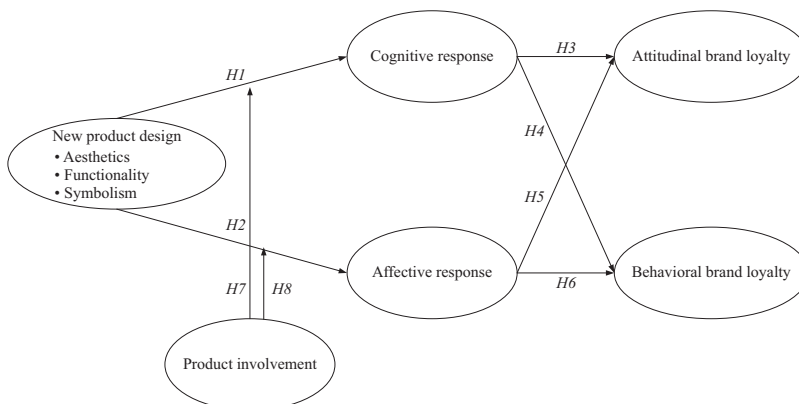


Figure 1.
The research framework

2.1 Product design

Homburg *et al.* (2015, p. 42) stated that product design is “a product’s properties or characteristics and/or holistic dimensions, with which atomistic properties can be combined” after following the procedure used by Luchs and Swan (2011). Previous studies have used several dimensions to assess product design. For example, Bloch (2011, p. 378) used the three dimensions of utilitarian, hedonic, and semiotic benefits, whereas Luchs and Swan (2011, p. 338) applied those of form, function, and holistic properties of the integrated form and function. By contrast, Homburg *et al.* (2015, p. 42) reviewed 271 articles with a focus on the dimensions of product design, and then allocated these to six categories: aesthetics, functionality, symbolism, shape, ergonomics, and others, which included those dimensions that did not fit into the other five categories. Nonetheless, Homburg *et al.* (2015) omitted “shape” as a category, as this implies atomistic processing, and thus they did not include this into their product design measurement considerations. Furthermore, they omitted the “others” category, as only three dimensions were mentioned twice. The “ergonomics” category was also omitted, as it is related to and is subsumed under the “functionality” category. The final three dimensions of product design were aesthetics, functionality, and symbolism. Homburg *et al.* (2015, p. 44) also defined product design as “a set of constitutive elements of a product that consumers perceive and organize as a multidimensional construct comprising the three dimensions of aesthetics, functionality, and symbolism.” This definition is derived from the Gestalt theory, according to a literature review of the definitions and dimensions of product design, as well as consumer interviews. Product design can be used to serve as a source of information on which consumers base inferences regarding the product (Yamamoto and Lambert, 1994). The aesthetic dimension, as Homburg *et al.* (2015) emphasized, is an integrative alternative, which means that a product has attributes that create a perception of beauty for the beholder, as Leder *et al.* (2004) indicated. Aesthetics are used to depict the form of objects, people, or consumption environments in consumer psychology (Patrick and Hagtvedt, 2011). Srinivasan *et al.* (2012) stated that product aesthetics include sensorial cues that affect the product’s appearance, such as colors, shapes, and materials. Furthermore, as Bloch (2011) and Boztepe (2007) emphasized that the functional dimension refers to whether consumers perceive that the product is able to accomplish its intended purpose. Srinivasan *et al.* (2012) stated that functionality implies product attributes such as performance and durability. As to the symbolic dimension, it refers to the perceived message that a product communicates about a consumer’s self-image to both the focal consumer and others on the basis of visual elements (Aaker, 1999; Belk, 1988; Bloch, 2011). Verganti (2008) also indicated that the symbolic dimension is as important as the utilitarian perspective, as products often reflect consumers’ desire to show their extended selves (e.g. Belk, 1988; Holt, 1997; Kleine *et al.*, 1993). Finally, it is appropriate that this study uses the definitions and the three dimensions of product design from Homburg *et al.* (2015), because the subject of this study (i.e. smartphones) is the same in both works.

2.2 Psychological responses: cognitive and affective responses

Previous studies stated that human behavior is affected not only by cognitive responses, but also by affective ones (Bloch, 1995; Syed Alwi and Kitchen, 2014). According to Chiu (2002), the term “cognitive” denotes what we recognize about an object, whereas the term “affective” implies how we feel about the object. Furthermore, Bitner (1992) noted that the product itself may evoke both cognitive and affective responses from consumers, and these may occur at the same time. Consumers’ beliefs may be influenced by certain product characteristics, such as ease of use, durability, and prestige. Designers are thus often encouraged to create the desired beliefs by applying particular design

elements (Berkowitz, 1987). The creation of beliefs derived from design may be fully unexpected for consumers, and Bloch (1995) proposed that complex designs or those with conflicts among their various elements tend to evoke the most elaborate cognitive processing. Bloch also indicated that products with such design attributes may cause positive responses, such as liking. Similarly, Dumaine (1991, p. 86) explained that good product design “makes you fall in love with the product,” and creates strong emotional responses among consumers. Affective responses are typically related to positive effect and enjoyable experiences. The purpose of product designers is to elicit positive responses among consumers who experience their creations. On the other hand, managers must also realize that negative affective reactions may also stimulate consumer perceptions. Therefore, product design should aim to evoke more positive than negative responses among consumers, especially those in the target segment.

2.3 Brand loyalty: attitudinal and behavioral brand loyalty

This study focuses on the loyalty that existing customers demonstrate toward a brand. Keeping and strengthening relationships with existing customers is very important, due to their tremendous impact on a firm’s financial performance (Oliver, 1999). As such, some studies (e.g. Calvo-Porrall and Lévy-Mangin, 2016; Deng *et al.*, 2010; Sayil *et al.*, 2016) noted that retaining current customers and strengthening their loyalty is crucial to obtaining a competitive advantage. Additionally, Reichheld (2001) stated that the cost of retaining current customers is lower than that of acquiring new customers, and that retaining existing customers may be crucial to ensuring the success of a business. According to the previous studies, product design is critical for developing a basis for customer behavior (e.g. Homburg *et al.*, 2015). Specifically, product design may evoke customers’ psychological responses, including whether or not they remain loyal to the brand. This study thus examines brand loyalty by focusing on the influence of product design on customers’ psychological responses.

Brand loyalty is defined as “a deeply held commitment to re-buy or re-patronize a preferred product/service consistently in the future, thereby causing repetitive same-brand or same brand-set purchasing, despite situational influences and marketing efforts having the potential to cause switching behavior” (Oliver, 1999, p. 34). According to the literature (e.g. Bandyopadhyay and Martell, 2007, Bilgihan *et al.*, 2016; Cossio-Silva *et al.*, 2016; Huang, 2017), brand loyalty can be divided into two classes: attitudinal and behavioral. Cheng (2011) suggested that attitudinal brand loyalty is a psychological construct, while behavioral brand loyalty is a substantive element. Specifically, attitudinal brand loyalty implies that customers recommend the focal product to other customers (Kursunluoglu, 2011), while behavioral loyalty is a way of behaving, such that making repeated purchases (Cossio-Silva *et al.*, 2016). Overall, past studies have suggested that brand loyalty includes both attitudinal and behavioral dimensions (Aaker, 1991; Chaudhuri and Holbrook, 2001; Huang, 2017). Dick and Basu (1994) thus claimed that the simultaneous consideration of attitudinal and behavioral loyalty and the identification of their respective casual antecedents are important for firms to achieve the long-term maintenance of loyalty. A clear understanding of both of these forms of loyalty not only increases the predictive ability of brand loyalty, but also provides important managerial implications regarding the proper locus of managerial attention. This study also takes the simultaneous consideration of attitudinal and behavioral loyalty into the research model. Attitudinal brand loyalty elucidates a dispositional commitment that results from certain preferences with regard to some unique value related to the brand, whereas behavioral brand loyalty measures the patronage that derives from repeated purchases of the brand over time (Chaudhuri and Holbrook, 2001). Consistent with the literature, this study measures brand loyalty as attitudinal and behavioral

loyalty, and this issue is one that previous works have noted deserves more attention, due to its importance with regard to developing sustainable companies (Gremler and Brown, 1996).

2.4 Product involvement

The concept of product involvement has long been examined in the consumer behavior domain (Drossos *et al.*, 2014; Hong, 2015; Kwon and Chung, 2010). Several studies have found that product involvement is an important factor in consumers' product choices (Behe *et al.*, 2015; Mitchell, 1986; Pan, 2014). In addition, the examination of a low product involvement condition, as opposed to a high one, is both important and interesting (Kwon and Chung, 2010; Lee *et al.*, 2015; Song *et al.*, 2016). However, previous studies have diverged on the issue of how best to define the construct of product involvement (Behe *et al.*, 2015), although they have commonly focused on the relevance of a product to a consumer, in spite of some differences on the specifics of this (Hong, 2015). Mitchell (1979, p. 194) defined product involvement as "an individual level, internal state variable whose motivational properties are evoked by a particular stimulus or situation." Kwon and Chung (2010, pp. 524-525) defined product involvement as "the personal relevance to the individual consumer or importance of a product category." Involvement with these different objects and processes generates different responses (Behe *et al.*, 2015). Specifically, product class can affect product involvement. Dholakia (2001) also indicated that product involvement has a significant impact on consumers' responses due to different marketing stimuli. Browne and Kaldenberg (1997) noted that consumers with high levels of product involvement tend to have more extended decision-making processes with a series of consecutive stages, focusing on looking for more information and then comparing alternatives. Product involvement is thus positively associated with information searches and evaluation activity (Hong, 2015). Some studies have also shown that product involvement significantly influences consumers' attention to both product and product choice (e.g. Behe *et al.*, 2015). In line with previous studies (Hong, 2015; Suh and Youjae, 2006; Josiassen, 2010), our research uses the common view of product involvement as the perceived significance of an object to an individual based on their intrinsic interests, needs, or values.

2.5 The relationships between product design and psychological responses

It is acknowledged in the current research that product design can affect consumers' intentions and behaviors through their psychological responses. Product design, such as the aesthetic dimension, influences consumers' psychological evaluation of the focal product (Homburg *et al.*, 2015). Some researchers (e.g. Chung and Tan, 2004; Fazio *et al.*, 1994; Huang, 2003; Tractinsky *et al.*, 2000) pointed out that aesthetics can evoke cognitive and affective responses, and these can, in turn, positively influence overall evaluations of the object. Additionally, esthetic design can influence consumers' emotions (Bloch, 1995; Candi *et al.*, 2017), and the positive perceptions of an aesthetic design component may generate the perception of superiority with regard to other or all design features (Derbaix and Pham, 1998; Tan and Sie, 2015). Coursaris and van Osch (2016) confirmed that aesthetics positively affects cognitive and affective response. Moreover, elements of product design, such as the functional portion of the product, can be "a reliable indicator of functional performance" (Hoegg and Alba, 2011, p. 346), and thus can improve consumers' cognitive and affective attitudes. In addition, product design, such as the symbolic portion, can help consumers maintain or protect their self-concept (Belk, 1988; Tian *et al.*, 2001). When consumers are able to foster an understanding of who they are, products and product designs that are linked with this self-supporting function have better psychological responses. Kim *et al.* (2016) also confirmed that product design is significant and exerts a positive impact on

cognitive or affective evaluations when purchasing and using a product. Accordingly, the following hypotheses are proposed:

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H1. Product design positively influences cognitive response.

H2. Product design positively influences affective response.

2.6 *The relationships between psychological responses and brand loyalty*

Within the conceptual model set out by Bloch (1995), the current paper describes product design as being associated with psychological and behavioral responses. Specifically, it is noted that product design will affect cognitive and affective responses, and, in turn, affect consumers' approach or avoidance of the product. Furthermore, Chaudhuri and Holbrook (2001) found that product design makes consumers joyful, happy, or affectionate, and thus evokes greater attitudinal and behavioral loyalty. In addition, Chang (2015) confirmed that customers' overall valuation of the utility of a product will affect their loyalty to free mobile applications. When customers have a more favorable cognitive and affective perception of the product, they will generate both preference and intention, and so be more likely to continue purchasing products or services from this application. Pappas *et al.* (2016) confirmed that customers' cognitive and affective responses affect purchase behaviors. Additionally, Giovanis and Athanasopoulou (2018) and Lam *et al.* (2004) showed that recommendations are influenced by customers' affective response and that re-patronage is driven by both cognitive and affective responses. In addition, Luu *et al.* (2016) proposed that customers' attitudinal loyalty and behavioral loyalty will be influenced based on their evaluation with a cognitive or affective perspective. Thus, the following hypotheses are proposed:

H3. The cognitive response positively influences attitudinal loyalty.

H4. The cognitive response positively influences behavioral loyalty.

H5. The affective response positively influences attitudinal loyalty.

H6. The affective response positively influences behavioral loyalty.

2.7 *The moderating effects of product involvement*

Involvement is generally conceptualized as "enduring in nature, and it is argued that characteristics of the environment and temporary situational changes encountered by a consumer do not directly lead to changes in or affect involvement levels" (Chen and Tsai, 2008, p. 1168). O'Cass (2000) referred to product involvement as the interaction between a person and an object, which denotes the relative strength of consumers' cognitive structure in relation to a focal object. Zaichkowsky (1985) proposed that product involvement is the relevance an individual attributes to an object within its product class based on their intrinsic needs, values, and interests. As such, the level of product involvement mostly determines the cognitive effort users assign to handle and appraise the relevance and usefulness of products (Brown, *et al.*, 1998). Antil (1984) proposed that exposure to a highly involved product induces more elaborate cognitive processing that causes users to notice a product that they associate with themselves. In addition, based on the elaboration likelihood model, proposed by Petty and Cacioppo (1986), people with high levels of involvement apply more elaborate processes to assess the focal information, in contrast to the less elaborate processes used by low involvement customers. Therefore, as noted in the research work of Rodríguez-Molina *et al.* (2015), when involvement is high and consumers know the kind of information they are looking for, they follow the central processing route. In contrast, low involvement customers are the peripheral route, which is generally related to the pursuit of

hedonic needs. Moreover, the degree of product involvement impacts the degree of decision importance in the purchasing process, as seen in the factors such as consumers' cognitive responses (Knox and Walker, 2003) and affective responses (Lee *et al.*, 2015). Drossos *et al.* (2014) also proposed that product involvement is related to the tension between the cognitive and affective properties involved in the decision-making process. Additionally, Candi *et al.* (2017) indicated that product involvement moderates the relationship between consumers' evaluation of the product design and their responses. Therefore, in the current work the degree of consumers' product involvement is hypothesized as having a moderating role in the effects that product involvement has on the relationships between product design and psychological responses. The last two hypotheses of the study are thus as follows:

- H7.* Product involvement moderates the effect of product design on the cognitive response. Specifically, in the case of consumers with a high level of product involvement, the product design entails more cognitive responses compared with the case of consumers with a low level of product involvement.
- H8.* Product involvement moderates the effect of product design on the affective response. Specifically, in the case of consumers with a high level of product involvement, the product design entails more affective responses compared with the case of consumers with a low level of product involvement.

3. Methodology

3.1 Pilot test

This study collected data via a survey questionnaire to empirically test the proposed hypotheses. The survey questionnaire consisted of measures developed by iterative validation steps. In the beginning, this work generated the preliminary version of the measurement items for the model's constructs based on a review of previous studies, as summarized above. We then obtained comments on these items from a panel of experts consisting of three university professors, a product designer, a graduate student, and a PhD student. Based on the feedback from these individuals, a number of the items were revised to better fit the intended meaning of the construct, or enhance readability. The original version of the survey instrument was then pilot tested on smartphone users in Taiwan. All items were confirmed based on a reliability analysis of the pilot test data. The final survey questionnaire items are shown in Table AI. All of the items were measured using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

3.2 Research context, sample, and its profile

In line with the method used by Hajli (2014), this study applied paper- and web-based questionnaires to maximize the number of samples. As many people use smartphones in Taiwan, a convenience sampling approach was used to collect data from individual volunteers. This approach has also been recommended for use with quantitative methods. Data for the main study were collected in Taiwan in 2016 by asking smartphone users to complete a paper questionnaire or inviting them by e-mail to complete in an online version of the same questionnaire. The pilot study samples were omitted from the main test. This study only targeted smartphone users, and thus the first question was used as a filter question to select only those respondents who had experience of using a smartphone.

In designing the webpage for the questionnaire, we considered a number of different issues in order to attract more participants, such as they use of good graphic design and easy to navigate questionnaire items, as well as distribution of a link to this webpage via throughout many forums and online communities, such as Facebook. The goal was to

attract a large and varied sample of participants. We thus obtained a total of 456 usable responses to both the e-mail and paper questionnaires for data analysis. The demographics details of valid respondents are presented in Table I.

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3.3 Measurement development

All focal constructs in this study were adopted or developed from the extant literature. As shown in Table AI, we conceptualized product design as a second-order construct with three first-order dimensions: aesthetics, functionality, and symbolism. This study adopted Homburg *et al.*'s (2015) scale to assess all three dimensions. The scales for cognitive and affective responses were both developed from Bloch (1995) and Overby and Lee (2006). To measure brand loyalty, we used a two-dimensional approach that reflects attitudinal and behavioral loyalty by adopting scales from Chaudhuri and Holbrook (2001). To analyze product involvement, three survey items were adapted from Cho *et al.* (2001). All constructs were measured by using multiple items and using fully anchored, five-point, Likert-type scales ranging from "strongly disagree" to "strongly agree."

3.4 Assessing measurement properties

To evaluate measurement quality, we used both item-total correlations and confirmatory factor analysis (CFA). Specifically, this study applied item-total correlations to purify the measurement items (Gerbing and Anderson, 1988). As shown in Table AI, one item of product involvement with low correlations was eliminated. After the refinement process, this research adopted CFA to evaluate the quality of the measurement model, and the resulting χ^2 is 676.771 while the degrees of freedom (df) is 227. Further, the comparative fit index (CFI) is 0.945, Tucker-Lewis index (TLI) is 0.933, normed fit index (NFI) is 0.920, and the root mean squared error of approximation (RMSEA) is 0.066. Overall, the measurement model indicates a satisfactory fit with the data. Product design was conceptualized as a second-order construct with three first-order dimensions: aesthetics, functionality, and symbolism. We thus also used CFA to examine the second-order representation of product design, with the model results offering evidence for the second-order representation of this construct[1].

The Cronbach's α and composite reliability (CR) values all exceeded the threshold of 0.7, thus indicating that our measures have acceptable internal consistency and reliability (see Table II). Moreover, as shown in Table AI, all factor loadings were positive and significant at the 0.001 level, supporting the constructs' convergent validity (Anderson and Gerbing, 1988). The average variance extracted (AVE) for each construct was also greater

Characteristics	Numbers	Percentage
<i>Gender</i>		
Male	218	47.8
Female	238	52.2
<i>Age</i>		
≤20	89	19.5
21-40	277	60.7
≥41	90	19.7
<i>Education level</i>		
High school or below	53	11.6
College	355	77.9
Graduate school or above	48	10.5
Note: Sample size = 456		

Table I.
Demographic statistics

than the threshold of 0.5. These results thus provide evidence for the convergent validity of the constructs. The square roots of AVE were used to test discriminant validity (Fornell and Larcker, 1981), and the results for each construct were all greater than the correlations with other constructs, indicating a good level of discriminant validity (see Table II).

3.5 Examination for a potential common method bias

Common method bias could be a potential issue when the measures are collected from a single source, and so we utilized two *post hoc* techniques to test the extent of this.

We first used CFA to examine the common method bias (Murray *et al.*, 2011), and all the measures were designated as the indicators for a single factor on behalf of common method effects. The results indicated inadequate model fit, with $\chi^2 = 3,481.467$, $df = 249$, CFI = 0.604, TLI = 0.561, NFI = 0.587, and RMSEA = 0.169, and thus no evidence for common method bias. In addition, we used the marker variable technique proposed by Lindell and Whitney (2001) to assess the same issue. We included a construct that is theoretically irrelevant to the focal constructs in the model, which was “the degree of your confidence in the development of Taiwanese smartphone brands in the next four years.” The calculated correlations between this marker variable and the dependent variables (i.e. attitudinal and behavioral loyalty), ranging from 0.03 to 0.04, are not significant. As such, common method bias is not a serious problem in this study.

4. Empirical results

4.1 Direct effects of product design and psychological responses

The hypothesized model relationships were investigated using structural equation modeling (SEM). Because the mediation and moderation effects are simultaneously examined in our proposed model, SEM is preferred to regressions for testing (Gatignon, 2014; Iacobucci *et al.*, 2007). The path structural model showed a good fit, with $\chi^2 = 282.062$, $df = 77$, CFI = 0.955, TLI = 0.939, NFI = 0.940, and RMSEA = 0.077. Table III summarizes the coefficients of all variables and paths, as well as the results of the hypotheses testing.

As predicted in *H1* and *H2*, product design is positively and significantly related to cognitive ($\beta = 0.590$, $p < 0.001$) and affective responses ($\beta = 0.740$, $p < 0.001$). Further, cognitive response is significantly related to attitudinal ($\beta = 0.184$, $p < 0.01$) and behavioral brand loyalty ($\beta = 0.294$, $p < 0.001$), supporting *H3* and *H4*. On the other hand, affective response also positively relates to both attitudinal brand loyalty ($\beta = 0.704$, $p < 0.001$) and behavioral brand loyalty ($\beta = 0.553$, $p < 0.001$), in support of *H5* and *H6*.

Table II.
Measure correlations, means, standard deviations (SD), Cronbach's α , composite reliability (CR), and average variance extracted (AVE)

Variables	1	2	3	4	5	6	7	8
(1) Aesthetics	<i>0.894</i>							
(2) Functionality	0.546	<i>0.847</i>						
(3) Symbolism	0.537	0.449	<i>0.879</i>					
(4) Affective response	0.469	0.409	0.547	<i>0.721</i>				
(5) Cognitive response	0.298	0.365	0.369	0.643	<i>0.717</i>			
(6) Attitudinal brand loyalty	0.418	0.441	0.472	0.707	0.548	<i>0.868</i>		
(7) Behavioral brand loyalty	0.401	0.505	0.365	0.659	0.558	0.817	<i>0.929</i>	
(8) Product involvement	0.437	0.453	0.423	0.441	0.347	0.402	0.365	<i>0.758</i>
Mean	3.898	4.141	3.122	3.268	3.480	3.155	3.593	3.800
SD	0.755	0.704	0.929	0.757	0.705	1.051	0.982	0.757
CR	0.922	0.884	0.910	0.809	0.801	0.860	0.926	0.802
Cronbach's α	0.923	0.898	0.912	0.849	0.834	0.865	0.929	0.797
AVE	0.799	0.717	0.772	0.521	0.514	0.754	0.863	0.575

Note: The italicized values on the diagonal are the square roots of the AVE for each construct

	Full mediation model	Partial mediation model	Does product design matter?
<i>DV: Cognitive response</i>			
Product design	0.590 (9.384)***	0.589 (9.360)***	
<i>DV: Affective response</i>			
Product design	0.740 (12.093)***	0.733 (11.906)***	
<i>DV: Attitudinal loyalty</i>			
Cognitive response	0.184 (2.729)**	0.192 (2.868)**	
Affective response	0.704 (9.843)***	0.633 (7.050)***	
Product design		0.082 (1.248)	
<i>DV: Behavioral loyalty</i>			
Cognitive response	0.294 (4.433)***	0.300 (4.543)***	
Affective response	0.553 (8.142)***	0.500 (5.821)***	
Product design		0.062 (0.978)	
<i>Overall model fit</i>			
χ^2	283.062	281.476	
df	77	75	
CFI	0.955	0.955	
TLI	0.939	0.937	
NFI	0.940	0.940	
RMSEA	0.077	0.078	
Notes: DV, dependent variable. Standardized coefficients are reported with <i>t</i> -values. Two-tailed tests are used. ** $p < 0.01$; *** $p < 0.001$			

Table III.
Results of path structural models

4.2 Moderating effects of product involvement

This study applied a series of multi-group analyses to examine the moderating effects of on the structural model (Brockman and Morgan, 2003). The samples were first split at the median of product involvement into low and high groups. An “unconstrained” model was then assessed, in which the path coefficients were permitted to vary across the subgroup. Finally, a “partially constrained” model was examined, with only a specific path coefficient constrained to be equal across all groups. A moderating effect is supported in this context when a significant χ^2 difference exists between the χ^2 value of unconstrained model and the χ^2 value of constrained model (i.e. $\Delta\chi^2 = 2.71$, $df = 1$, $p < 0.1$), reflecting that parameter invariance is rejected. The results of the multi-group test of moderating effects are summarized in Table IV.

It was hypothesized in *H7* and *H8* that product involvement strengthens the effects of product design on both cognitive and affective responses. The results in Table IV indicate that the χ^2 difference tests regarding the moderating effect of product involvement on the

χ^2 Difference test (Moderating variable: product involvement)	Moderating effects			Hypothesis testing
	Low group standardized coefficient	High group standardized coefficient	Difference in χ^2	
<i>H7</i> : Product design → Cognitive response	0.461	0.626	1.714	Not supported
<i>H8</i> : Product design → Affective response	0.593	0.768	3.283*	Supported
Note: * $p < 0.1$				

Table IV.
Results of testing the moderating effects

relationship between product design and affective response is statistically significant, while the χ^2 difference tests regarding the moderating effect of product involvement on the link between product design and cognitive response is not statistically significant. These results thus support *H8* but not *H7*.

4.3 Mediating effects of psychological responses

To examine the robustness of the mediating effects of psychological responses (i.e. cognitive and affective responses) on the link between product design and brand loyalty link, an alternative structural model that investigates the direct paths between product design and the two brand loyalty outcomes (i.e. a partial mediation model) was tested (Morgan *et al.*, 2012). As shown in Table III, both the full (i.e. the proposed model) and partial mediation models have satisfactory overall fit. However, of the two extra product design-brand loyalty paths included in the partial mediation model, neither are significant. The results thus show that the direct impacts of product design on both attitudinal and behavioral brand loyalty were not significant ($\gamma = 0.082, p > 0.05$; $\gamma = 0.062, p > 0.05$). In addition to these two paths for the direct impacts, the results for the path coefficients and their significance levels in the partial mediation model are similar and stable with regards to the full mediation model. Accordingly, the full mediating effects of psychological responses are supported.

5. Discussion and implications

This study contributes to the literature addressing the role of product design in the product development and brand management literature by developing and empirically assessing a theoretical framework informed by the perspective of consumers' psychological responses. Previous research indicates that product design is not only a way of communicating product meaning to consumers (Crilly *et al.*, 2008), but also an integrated practice fundamental to the marketing strategies and commercial success (Luchs and Swan, 2011), with the results of this study offering new insights as to how firms apply product design through the aspects of aesthetics, functionality, and symbolism to achieve superior product and brand performance.

First, since product design emphasizes the integration of organizational efforts to effectively differentiate one product from another in the marketplace, it should have a positive impact on product success. However, according to the perspective of consumers' psychological responses, product design is a precursor to the development of positive psychological customers' responses in that product design advantages have only potential value in generating superior product and brand performance (Bloch, 1995; Homburg *et al.*, 2015). Collectively, simply assessing the product design-brand loyalty relationship fails to seize the core concept of the perspective of consumers' psychological responses. By focusing on the mediating roles of psychological responses, we find that cognitive and affective responses fully mediate the effect of product design on brand loyalty metrics (i.e. attitudinal and behavioral brand loyalty). This not only validates our proposed sequential links of "product design \rightarrow psychological responses \rightarrow brand loyalty," but also underlines the claim that product design may contribute to brand performance insofar as it elicits consumers' psychological responses (Bloch, 1995). Therefore, including those previously ignored, yet important variables of psychological responses contributes to a better understanding of how product design realistically affects brand loyalty.

Second, while extant research on product design mainly focuses on the influence of product design at the product level such as purchasing intention of a single product (Homburg *et al.*, 2015), relatively little research attention has been paid on the benefits of product design at the brand level. By addressing the role of product design in brand loyalty, this research expands the domain of product design research.

Third, although both attitudinal and behavioral brand loyalty are important brand performance indices, they have quite different implications (Dick and Basu, 1994). Previous studies seldom perform simultaneous investigations of these two types of brand loyalty (Chaudhuri and Holbrook, 2001). In this regard, the current work study provides further insights by examining the comparative strength of the total impact of product design on attitudinal and behavioral brand loyalty. As shown in Table III, the total effect of product design on attitudinal brand loyalty is 0.652, with an indirect effect of 0.572 ($0.73 \times 0.63 + 0.59 \times 0.19$) and a direct effect of 0.08, while the total effect of product design on behavioral brand loyalty is 0.542, with an indirect effect of 0.09 ($0.73 \times 0.50 + 0.59 \times 0.30$) and a direct effect of 0.06. By comparing these total impacts, this research suggests that product design has more impact on attitudinal brand loyalty than on behavioral brand loyalty.

Fourth, despite the importance of both cognitive and affective responses, affective response seems to act a more influential role in the product design-brand loyalty relationship. Specifically, as indicated in Table III, those on attitudinal brand loyalty are relatively stronger for affective response ($\beta = 0.704, p < 0.001$) than for cognitive response ($\beta = 0.184, p < 0.01$), and the impacts on behavioral brand loyalty are also greater for affective response ($\beta = 0.553, p < 0.001$) than cognitive response ($\beta = 0.294, p < 0.001$). In addition, the effect of product design on affective response ($\beta = 0.740, p < 0.001$) appears to be stronger than its effect on cognitive response ($\beta = 0.593, p < 0.001$). These reveal that the affective mechanism behind the product design-brand loyalty link is more impactful than the cognitive mechanism.

Fifth, insights are provided by exploring the interaction between product design and product involvement in explaining consumers' psychological response. The results demonstrate that the moderating impacts of product involvement on the links between product design and psychological responses are mixed. Specifically, the prediction that product design has a stronger impact on the development of affective response is supported for increased levels of product involvement. This indicates that product design's effect on stimulating consumers' affective response is contingent on the consumers' product involvement. In other words, product design is especially important for consumers with high product involvement in generating positive affective response. In practice, when developing new products that focus on consumers with high product knowledge or motivation, brand managers should be careful when engaging in matters of product design, because unsuccessful or inappropriate design elements could reduce consumers' favorable attitudes and affection toward a brand. Furthermore, the insignificant moderating effect of product involvement on the product design-cognitive response relationship also reveals that the role of product design in improving cognitive response is stable across different levels of product involvement.

Sixth, some previous studies overemphasize the aesthetic dimension or merely adopt the utilitarian dimension to measure product design (e.g. Bloch, 2011; Desmet and Hekkert, 2007). Homburg *et al.* (2015) argued that evaluating a product design solely in terms of aesthetics, without considering functionality and symbolism, imposes constraints on the full potential of such a design. The current paper conducts an additional analysis and provides further empirical evidence to reinforce Homburg *et al.*'s (2015) argument. Specifically, by assessing the impacts of aesthetic, functional, and symbolic dimensions on cognitive and affective responses, this study finds that those on cognitive response are relatively stronger for the functional ($\beta = 0.235, p < 0.001$) and symbolic dimensions ($\beta = 0.242, p < 0.001$) than for the aesthetic dimension ($\beta = 0.04, p > 0.05$), while the impacts on affective response are greater for the symbolic dimension ($\beta = 0.386, p < 0.001$) than aesthetic ($\beta = 0.190, p < 0.001$) and functional ($\beta = 0.132, p < 0.01$) ones. The results echo the notion of Homburg *et al.* (2015) that all these design dimensions positively affect consumers' psychological responses but have different impact levels. Collectively, this research extends Homburg *et al.*'s (2015) work to support a three-dimensional view of product design.

Seventh, from a managerial point of view, while the concept of product design has obtained greater popularity in the management rhetoric, managers need to have a comprehensive view of the design of new products. The results of this study thus provide useful directions for managers to evaluate the quality of product design. It is evident that successful product design enables a firm to simultaneously generate positive cognitive and affective responses from consumers, thereby enhancing brand loyalty. In this regard, assessments of product design quality need to consider the aesthetic, functional, and symbolic dimensions. The nine-item product design scale, inclusive of its three dimensions adopted in our study, could be a good starting point for managers in evaluating and improving the quality of product design in their firms. By using this scale, firms may also use product design as a new brand performance indicator to improve the overall marketing effectiveness.

Eighth, although the results suggest that product design may improve brand loyalty, it is important to note that it is not product design *per se* that directly affects brand loyalty. That is, product design acts as a force that fosters the generation of positive consumer responses toward a brand, which then lead to greater attitudinal and behavioral brand loyalty. This demonstrates how product design only has a potential value with regard to improving brand loyalty performance. Managers thus need to help their firms transform positive consumer perceptions of product design into favorable cognitive and affective responses. In other words, managers should not only focus their attention on achieving successful product design, but also on continuously monitoring the underlying process (i.e. product design → psychological response → brand loyalty) so as to improve the company's overall marketing effectiveness.

Finally, by understanding successful product design in terms of aesthetics, functionality, and symbolism, top managers will know that appropriate product design activities need to integrate different functions within a firm, including those of marketing, design, and other relevant activities. Firms also need to actively support inter-functional communication and cooperation so as to improve the quality of product design and overall marketing effectiveness.

6. Limitations and future research directions

This study has a few potential limitations, which suggest possible directions for future research. First, this work was conducted in the context of smartphones, and this may limit the generalization of the results to other products. Future studies could thus expand the sampling frame to different industries, such as the design of other fast-moving consumer goods, to enhance the validity of our research results.

Second, self-reported measures were collected for this study, and so there is a possibility of a common method bias. Although several *post hoc* treatments were adopted, and these showed that there was only a small degree of common method bias, the potential that this may have impacted the results still remains. As such, future studies may use measures from different sources, or apply a longitudinal design to address this concern.

Third, due to the need for a parsimonious model, this work focused on brand performance in terms of attitudinal and behavioral brand loyalty. In order to extend the research model used here, follow-up studies could adopt consideration of a more comprehensive view of customer-based brand equity performance metrics. Specifically, future studies could examine how product design impacts various customer relationship and brand management performance metrics. For example, such research could explore other underlying consumer psychological mechanisms through which product design affects customer-based brand equity performance metrics, as this would provide a more comprehensive evaluation of the value creation process in relation to product design.

Finally, as well as considering the moderating effect of product involvement, future researchers could also examine the roles of additional moderators in the relationship between product design and cognitive and affective responses.

Note

1. This model was examined as a second-order construct (i.e. product design) with three first-order dimensions (i.e. aesthetics, functionality and symbolism). The results demonstrated an adequate fit with $\chi^2 = 74.231$, $df = 24$, $CFI = 0.984$, $TLI = 0.971$, $NFI = 0.977$, and $RMSEA = 0.065$. In addition, all the first-order and second-order item loadings were at the 0.001 level of statistical significance. The measures of product design constructs are thus appropriate for the second-order construct structure in our data.

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Further reading

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AppendixDoes product
design matter?

Items	Loadings
<i>Product design</i>	
Dimension 1: Aesthetics	
1. The product is visually striking	0.911
2. The product is good looking	0.895
3. The product looks appealing	0.875
Dimension 2: Functionality	
1. The product is likely to perform well	0.786
2. The product seems capable of doing its job	0.849
3. The product seems functional	0.902
Dimension 3: Symbolism	
1. The product would help me in establishing a distinctive image	0.845
2. The product would be helpful to distinguish myself from the masses	0.919
3. The product would accurately symbolize my achievements	0.871
<i>Cognitive response</i>	
1. The price of this smartphone is reasonable	0.465
2. When I purchase this smartphone, I save time	0.660
3. This smartphone I purchased is a good buy	0.895
4. This smartphone offers a good economic value	0.777
<i>Affective response</i>	
1. This smartphone entirely attracts my attention	0.851
2. This smartphone does not just sell products or services – it also entertains me	0.808
3. This smartphone helps me get away from it all	0.577
4. Purchasing the smartphone truly feels like an “escape”	0.610
<i>Product involvement</i>	
1. I am interested in smartphones in general	0.712
2. Smartphones are important to me	0.775
3. I get involved with what smartphones I use	0.786
<i>Attitudinal brand loyalty</i>	
1. I am committed to this brand of smartphones	0.884
2. When making decisions on buying smartphones, I would be willing to pay a higher price for this brand over other brands	0.852
<i>Behavioral brand loyalty</i>	
1. I will buy this brand the next time I buy a smartphone	0.901
2. I intend to keep purchasing this brand	0.956

Table AI.
Scale items**About the authors**

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