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Attribute-based design perceptions and consumer-brand relationship: Role of user expertise

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ABSTRACT

Why do consumers love certain brands but not some others? A major reason is the design of products made by such brands and the quality of experience. By developing a measure of product design perception as well as resultant experience, this work explores how design can be a pertinent source of strong consumer–brand relationship, operationalized as consumer-based brand equity. Literature of product design, though very rich, is still anchored to the utilitarian–hedonic value derived paradigms, with little attribute-oriented design measurement efforts, a gap this work attempts to fill. Additionally, a multi-dimensional scale is developed for an exhaustive operationalization of a product's design. A rigorous scale development process reveals five design perception dimensions, namely visual, functional, kinesthetic, interface, and information. Strong relationship between design perception, user experience and brand equity is observed providing strong advisory to designers and managers to focus on innovative experiential designs for a stronger consumer-equity.

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1. Introduction

Products and brands represent two sides of the same coin. Great brands are adept in making great products with designs that are not only innovative but also offer great user experience. Everyday interaction of consumers with objects leads to subjective evaluation of their design (Luchs and Swan, 2011). Positive interactions driven by great designs lead to satisfying experiences, which in turn helps the brand increase its equity with the user, enhancing the strength of consumer–brand dyad (Keller, 1993). Design thinking philosophy lends credence to this sequence, with satisfaction of consumer needs and positive brand implications as important outcomes to design thinking implementation (Brown, 2008; Noble and Kumar, 2010). While the strength of consumer brand relationship is well understood in literature through consumer based brand equity and its antecedents as well as consequences, design perception, as a cause, remains largely an abstract concept, especially in marketing domain (Luchs and Swan, 2011). Marketing scholars have yet to go beyond the design-derived value paradigm to develop scales for measuring design perception, a case in point being recent works by Homburg, Schwemmle, and Kuehnl (2015) and Kumar and Noble (2016). This work attempts to disassociate design, manifested through product attributes, from the values by developing an attribute-oriented design perception scale, with an analysis of its effects on design derived experience, operationalized through Holbrook's (2002) experiential value framework.

Extant marketing literature considers product design's importance to various consequences—as a source of strategic advantage (Jung, Kim, and Lee, 2014), affect (Seva and Helander, 2009), experience (Pullman and Gross, 2004), and an inherent quality that generates utilitarian and hedonic benefits for the user (Batra and Ahtola, 1991; Chitturi, Rajagopal, and Vijay, 2008; Sheng and Teo, 2012). Yet, there is no coherent framework that can present the consumer's perception of design, capturing the essence of all design aspects holistically and more so, how it has a conclusive effect on the brand that manufactures the product. A recent effort in form of conceptual design value framework (Noble and Kumar, 2010) which considers overall design perception as compartments made up of additive product features, and which put together shape consumer values and subsequent outcomes like loyalty and commitment, calls for more work in this domain. Further, role of individual variables, one of them expertise, is also instrumental in modulating user-experiences from product design, and hence explored

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as a moderator (Alba and Hutchinson, 2000; Zielfe, 2002). Next sections review relevant theories and literature supporting conceptualization of design perception and its consequences, followed by the framework itself, empirical analysis, discussion and implications.

2. Design and its consequences

Product design is a collective output of all the production processes within an organization, serving as the first interface between a product, and consequentially the brand, and a user. Specially in case of consumption contexts, few studies model effect of product design on consumption experiences (Luchs and Swan, 2011). A well-designed product creates plethora of meanings and experiences, as a user shapes specific attributes of a product as attitudes manifested through abstract perceptions (Gutman, 1982; Hekkert and Leder, 1998). These means–end chains aptly describe hierarchy of perceptions, with product features at a lower level and associated benefits and other consequences, like brand attitudes, at a higher level. Means–end theory implies that subjective interpretations of a product design help users attain values, be it a positive experience or an enhanced attachment to the brand (Graeff, 1997). Design attributes act as levers, which a design team can manipulate, in creating a product that attempts to meet design goals which range from providing superior user-performance to establishing great brands (Noble and Kumar, 2010, p. 645). Additionally, consumer based brand equity literature discusses benefits accrued through product attributes and resultant user experiences, as pre-requisites to brand image and brand associations, put together as consumer-based brand equity (Keller, 1993). Hence, there is strong theoretical support to explore the effect of product design and its perception on consumer–brand relationship, mediated by quality consumption experiences.

3. Dimensions of design perception

As mentioned earlier, two conceptualizations provide foundation for developing the framework for design perception: design value theory by Noble and Kumar (2008, 2010) and web design schematic by Garrett (2003). Product design, in the former, implies visual aesthetics, features, graphics and ergonomic value derived from a product's geometric form. Specifically, for interactive devices, now more ubiquitous than ever, Garrett's (2003) framework for web design provides two other facets of design besides visual, functional and kinesthetic design, in form of interface and information design (Sonderegger and Sauer, 2010). Thus, literary evidence points to five dimensions that should describe design completely by a user. The first well-discussed design aspect in literature is the outer appearance or *visual design* perception of a product. Represented as the surface of product design levels by Garrett (2003), visual design represents the first interface to overall product pre and post use perception and plays not only an important role during product purchase, but also stays relevant, though not so much, during actual consumption (Bloch, 1995; Creusen and Schoormans, 2005). Holbrook (1981) refers to visual design as an esthetic value that's serves to impart pleasure just from observing the product, without consideration of utility in a consumption set-up, also referred to as the visceral level of product design (Norman, 1991; Kumar and Noble, 2016). Next, perception of product functionality, expressed as *functional design*, finds various representations in literature in form of utilitarian benefits (Chitturi et al., 2008; Batra and Ahtola, 1991; Petruzzellis, 2010), functional quality (Kekre, Krishnan, and Srinivasan, 1995), and product features/functions (Seva, Gosiaco, Santos, and Pangilinan, 2011). All these works, though providing slightly different meanings to this concept, subscribe to the view that functional design represents hidden capabilities of a product that are useful during a consumption occasion. In the hierarchy of design dimensions, such capabilities imply hygienic requirements, as basic minimum that the product needs to offer, before a consumer seeks more (Jordan, 1998). Going ahead, representing comfort of product usage, *kinesthetic design* is studied abundantly as an important part of product design in various forms like ergonomics (e.g., Creusen and Schoormans, 2005), affordances (e.g., Norman, 1991), and human factors (e.g., Noble and Kumar, 2008). As a common theme cutting across, this work considers kinesthetic design as a set of attributes that ensures comfort, safety, and intuitiveness along with reduced cognitive and behavioral loads during usage (Creusen and Schoormans, 2005; Zielfe, 2002). Outside these three core design sub-dimensions, an interactive device has two more facets that are important during usage—*interface and information design*. User-interface as the input–output space, facilitates seamless user–device interaction and is important for usage satisfaction (Oppermann, 2002; Salmi and Sharafutdinova, 2008). Further, information design facilitates information access and flow to the user and is a strong determinant of product consumption experience (Aoki and Downes, 2003; Chau, Au, and Tam, 2000).

4. User experience and brand equity

Customer experience derives its meaning from the larger concept of customer value and is a customer's perception based upon interactions "involving either direct usage or distanced appreciation of goods and services" (Hansen and Christensen, 2003, p. 390). Based on Holbrook's (2002) typology, three values measuring user experience emerge — usability, social value and usage pleasure. Nielsen (1994)defines *usability* through efficiency, learnability, memorability, errors and satisfaction and represents a broader construct integrating perceived ease of use (PEOU) and perceived usefulness (PU), discussed well in literature as a measure of utilitarian value (Kumar and Noble, 2016; Sheng and Teo, 2012). Usability has always been studied for information systems with its quality as a core requisite of satisfaction from consumption experiences (Jordan, 1998). Next, representing sociability benefit (Leung and Wei, 2000), *social value* accrues to the user because of possession of a particular product (Kumar and Noble, 2016; Sheth, Newman, and Gross, 1991). Through novel designs, products portray peoples' values and personality and helps showcase users' social status (Jung et al., 2014). Ownership of fashion products is an aftermath of the motivation for seeking social identity along with socio-psychological benefits, implying importance of this value shaping overall experience (Petruzzellis, 2010). Finally, *pleasure in use* forms the third important experiential value and is referred to as soft functionality of a product representing hedonic value that defines emotional relationship of a user with a product (McDonagh-Philp and Lebbon, 2000). A product's capability to create affect for the consumer has received tremendous attention in literature, specially design literature, and has seen manifestation of emotion in various forms — experiential needs (Holbrook and Hirschman, 1982), affective responses (Derbaix and Pham, 1991), and pleasure (Jordan, 2000). Sweeney and Soutar (2001) contend that these three value dimensions don't exist independently as hedonic and utilitarian components of attitude have a two-way causal relationship. Also, Holbrook's (2002) framework is conceptualized such that different experiential values exist simultaneously and the only variation lies in the degree of existence of each. For this work, hence, user experience is conceptualized as a higher order construct reflecting usability, social value and usage pleasure.

Design is also a strategic branding tool and is imperative in improving the competitiveness of products and firms (Jung et al., 2014). Competitive advantage for brands comes greatly from product design making it pertinent for manufacturers to design products which customers find of value, so as to maximize satisfaction and beat competitors coupled with profitability. It's then clear that designers also need to achieve *brand equity* amongst its users for better bottom-lines (Brakus, Schmitt, and Zhang, 2014). Consumer based brand equity is taken forward as a unidimensional construct measuring consumer–brand relationship in this work.

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4.1. Design perception, experiential value and brand equity

Meaningful user experiences are critical to product success with product design as a key driver (Kekre et al., 1995). Product design, as defined here, has direct correspondence to usability and is well documented (Thompson, Hamilton, and Rust, 2005). Product visuals not only help a user estimate its usability (referred as apparent usability), but also have a large role in upping the social status of a user coupled with positive emotions (Bloch, 1995; Brakus et al., 2014). Similarly, effective information and interface design, affect the quality of product–user interaction and shape overall user experiences (Sonderegger & Sonderegger and Sauer, 2010; Cyr, Head, and Ivanov, 2006). An effective interface, with qualities like naturalness and consistency, coupled with useful and relevant information makes a device intuitive for a consumer (Kekre et al., 1995). Finally, literature dealing with cognitive ergonomics emphasizes heavily on complete experience driven by kinesthetic and functional design (Desmet, 2003). Thus, based on relevant research, it is evident that product design perception should also affect all three aspects of user experience.

H1. A positive consumer design perception, manifested by visual, functional, kinesthetic, interface and information design, will lead to richer experiential values, represented as usability, social value and pleasure in use.

Strength of consumer–brand relationship hinges on effective building of brand equity (e.g. Chang and Chieng, 2006). Positive experiences, reflecting usability, social value and usage pleasure, have been well researched as antecedents to brand equity, causing active referral and increased profitability for the brand (Morrison and Crane, 2007). For example, meaningful experiences encourage brand equity by creating utilitarian and emotional connections through an engaging, compelling and consistent context. Further, literature in luxury brands suggests that prestige of a brand ultimately serves as a signal of symbolic consumption, attracting consumers who wish to enhance their social status (Baek, Kim, and Yu, 2010). Such highly self-expressive prestige brands encourage a high level of brand equity for the proud owner (Chaudhuri and Holbrook, 2001). Thus, a brief review of the relevant literature suggests that usability, social value, and pleasure in use, are expected to affect brand equity (Garrett, 2003; Keller, 1993; Noble and Kumar, 2008). Additionally, with Keller (1993) proposing product attributes as an antecedent to consumer-based brand equity, direct effects of design perception on consumer-based brand equity need exploration, serving to examine the mediating effect of experiential value.

H2. Richer experiential values, reflecting usability, social value and pleasure in use, will result in higher consumer-based brand equity.

H3. A positive consumer design perception will result in higher consumer-based brand equity.

4.2. Moderating role of expertise

User expertise is the capability of doing specific tasks effectively, with different consumers having different cognitive faculties for using complex products (Alba and Hutchinson, 2000). Experts have a higher conceptual understanding about product's design and working, have better evolved mental-maps, as well as are better endowed to assimilate new product information, compared to novices (Johnson and Kieras, 1983). Expertise has recently found good exposure in literature as a factor moderating consumer behavior in different contexts, like for loyalty with ski resorts and trust for advice acceptance, and thus, has a major consequence on the preference and response to a product during purchase and usage (Thompson et al., 2005; Matzler, Füller, and Faullant, 2007; White, 2005). Consequently, this work proposes that a user's expertise will have a moderating role on derived experiential value based on product's design, hypothesized as:

H4. Relation between design perception and experiential value will be positively moderated by expertise such that the relation will be stronger for experts compared to non-experts.

While standard scales are used to measure constructs of user experience, brand equity, and user expertise (as a mix of four different scales given by Mitchell and Dacin (1996)), and highlighted in Appendix B, absence of an attribute based design perception scale requires development of one for this work.

5. Developing the design perception scale

This work executes item generation using qualitative research clubbed with three stages of quantitative data collection and analysis, for scale validation and testing the structural model. While smartphone is the context for scale validation in the first two quantitative stages, the third stage was done with a mix of interactive devices, detailed later, to provide generalizability check for the scale. Items for other model constructs form part of all three quantitative stages.

5.1. Item generation

To ensure that the items not only represent consumer vocabulary for design but also have evidence in literature, exploratory interviews along with literary examination to frame the items are necessary (Healy and Perry, 2000). Overall, three interviews, each of seventy-five minutes, were conducted in sequence, each with seventy respondents, in a disguised environment at a marketing fair organized by a business school. The fair sees inflow of retail-level consumers with diverse demographics, important for robustness of the scale developed (Bello, Leung, Radebaugh, Tung, and Van Witteloostuijn, 2009). Using systematic random sampling, after the first randomly selected respondent, every ninth visitor (another number randomly selected) with smartphone ownership, was recruited. For the first two interviews of a respondent, the setup simulated reality shows involving one-to-one interaction, of which the first one concealed the interviewer while the second did not. The third interview put the same respondent in a real choice environment in a dummy mobile shop. The purpose of creating different environments was to manipulate the interviewer–interviewee interaction for richer and more diverse elicitations (Scheurich, 1995). After the interviews, a thorough review of the relevant literature was done to create a list of items that are mutually exclusive and could be possibly used to measure each design sub-dimension. Each item from literature was matched with consumer voices to create an item for a particular design sub-dimension, leading to a total of seventy-eight such items created across the five dimensions. This list was taken to forty-five separate respondents who were asked to freely associate these items in five separate buckets, each corresponding to a design sub-dimension, not explicitly revealed (Holloway and Jefferson, 2000). A correspondence analysis, on such a data using SPSS, exposed associations between items and buckets, interpreted by relative proximity of items to relevant constructs (Ares, Giménez, and Gámbaro, 2008). Those items that were wrongly associated were dropped, leaving a reduced set of items for each design dimension, details of which are presented in Table 1, along with literary evidence.

5.2. Empirical testing of the items and dimensions

Before taking these items in a survey for quantitative validity, for face and content validity, a panel of three designers and a market researcher were asked to rate the applicability of the items on a five-point scale ranging from “not applicable” (1) to “very applicable” (5). Applicability rating was high with pairwise correlation between any two raters for each item above 0.7 (Slater and Narver, 2000). The panel suggested that functional design needs a composite measure, as it cuts across different facets of product functionality (Diamantopoulos, Riefler, and Roth, 2008). The

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Table 1
Proposed items for each design dimension.

Prominent mentions in qualitative exercises	Item	Item code	Evidence in literature (context)
Visual design			
Smartphone should be elegant/smartphone design should be simple and sober	My phone styling looks elegant	VD1	Ohanian (1990)/model: Elegant
The phone should be of right size/shape should be attractive/eye catching/soft edges	My phone's appearance is eye catching	VD2	Cyr and Bonanni (2005) website: The screen design (colors, images, layout) is attractive
Phone looks good overall/everything looks good together/the whole package looks excellent/good overall impression	Various elements of my phone go well together	VD3	None
Color combination should be right/it should be easy on eyes	My phone has proper contrast in form of right color combinations	VD4	None
Phone should have the right personality/personality matching with mine	My phone matches my personality	VD5	None
Functional design			
Latest features/features like wi-fi, NFC, etc./latest technology	The phone offers a lot of latest features	FD1	Chang, Lai, and Chang (2007)/car: This car has special functions
Should have basic features/I like my phone as it's primarily a phone/my phone has minimum features to make it usable for me/has all features that I need	My phone offers the right amount of basic features that I need	FD2	Jung, Kim, and Chung (2004)/website: The website functionality is suitable to my use
Loaded with features/more features than competition/best in the class in terms of features	My phone is loaded with more features compared to its competitors	FD3	None
Phone is smooth/my phone hangs a lot and is slow/mike change mike to my. phone runs like butter/	My phone offers seamless performance	FD4	Chang et al. (2007)/car: The running performance of this car is good
Can open more than two applications/phone should allow multitasking/can work on 3–4 applications simultaneously	Technical specifications of my phone allow for running two or more applications	FD5	Chang et al. (2007)/car: This car has multipurpose use
Long service life/should not break down when needed/always there when needed/ reliable	I can depend on my phone's performance	FD6	Chang et al. (2007)/car: The car is safe to drive
Phone broke once when dropped/my phone is a scratch magnet/Nokia phones used to be so rough and tough/my phone feels so fragile	The quality of my phone is tough and can take a lot of abuse	FD7	Alpert (1971)/pen: Durability of the pen
Kinesthetic design			
Should be easy to hold in one hand/can operate by one hand/one hand usability/small size/light weight	The shape and size of my phone makes it easy to hold in one hand with good grip	KD1	None
Fits in one pocket/can carry in jeans or trouser pocket	The size of my phone makes it easy to fit and carry around in a pocket	KD2	None
Buttons should be large in size/easy to type/gaps between buttons should be large/qwerty keypad to make typing easy	Phone facilitates easy working without fatigue to fingers	KD3	None
Interface design			
The interface should be responsive/there should be no lag/it should not hang	The interface of the phone is smooth	UID1	Lewis (1995)/website: The interface has all the functions and capabilities I expect
The interface should suit me/interface should not confuse me	The interface suits my requirements	UID2	Chang and Chen (2009)/website: The website is tailored according to me
Makes me feel in control/always does what I ask	The user interface of my phone does what I want it to do	UID3	None
Interface should be easy to get used to/it should be intuitive/navigation should be easy/intuitive	The user interface of my phone looks very easy to navigate	UID4	None
It's easy to use/I can find things easily/most prominent apps are upfront	The user interface of my phone makes it easy to find what I need	UID5	None
Information design			
Information on the phone should be clear/information should be easy to read/number of buttons should be large	Information provided by the phone is very clear	ID1	Lewis (1995)/website: The information (such as online help, messages, etc) are clear
The language suits my requirements/it appears the information is tailor made for me	The information provided by my phone is sufficient to meet my requirement	ID2	None
Phone should provide feedback/error messages should be there	The phone provides me error messages that helps me fix problems	ID3	Lewis (1995)/website: System gave me error messages telling me how to fix problems
Messages are brief/instructions are not long and thus easy to read	The instructions in my phone are concise and appropriate	ID4	None
The information is useful to me/it's as per my expectations/info helps me in my day to day routine	The information in my phone is effective in helping me complete tasks	ID5	None

Items created from the perspective of smartphones, the context of this study, only to be generalized later.

items were plugged into an online survey measured on a five point Likert scale. Smartphone users on Facebook were targeted, allowing a great access to the population, targeting done with Facebook Ads (their online advertisement platform), which randomly exposes members of a population to the advertisement, containing the questionnaire link (Thomson and Ito, 2014). Two advertisements were run for six months in sequence with a check that the same respondent did not respond to both surveys. In the two waves 2613 and 2238 people clicked on the advertisement respectively and were exposed to the questionnaire of which 300 and 312 completed questionnaires were received with response rates of 11.5% and 13.9% respectively.

Exploratory factor analysis (EFA) was conducted for both samples to understand the factor structure with items of functional design not considered as it is conceptualized as a formative measure. Following EFA, a confirmatory factor analysis (CFA) using MLE-based structural equation modeling (SEM) was conducted to check the unidimensionality of individual constructs. Table 2 summarizes the EFA and CFA results across the samples for the reflective constructs.

It is evident that the loadings are significant (>0.50) and overall fit measures are reasonable (Hu and Bentler, 1999; Tabachnick and Fidell, 2007). For functional design as a formative measure, indicator validity signifying relevance of an item is evaluated by the outer weights

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Table 2
EFA/CFA results.

Item	EFA								CFA							
	Visual design		Kinesthetic design		Interface design		Information design		Visual design		Kinesthetic design		Interface design		Information design	
Study	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
VD1	0.75	0.77							0.67	0.69						
VD2	0.79	0.77							0.79	0.70						
VD3	0.63	0.53							0.75	0.65						
VD4	0.72	0.73							0.75	0.81						
VD5	0.73	0.76							0.80	0.86						
KD1			0.76	0.76							0.75	0.66				
KD2			0.50	0.76							0.64	0.62				
KD3			0.72	0.57							0.75	0.83				
UD1					0.66	0.64							0.87	0.79		
UD2					0.83	0.79							0.82	0.83		
UD3					0.53	0.74							0.80	0.81		
UD4					0.85	0.78							0.80	0.77		
UD5					0.65	0.76							0.85	0.86		
ID1							0.60	0.73							0.79	0.81
ID2							0.79	0.67							0.73	0.55
ID3							0.80	0.75							0.88	0.86
ID4							0.81	0.82							0.89	0.91
ID5							0.61	0.77							0.72	0.85

EFA1: Eigen Values (Factor 1:6.804; Factor 2: 2.232; Factor 3:1.347; Factor 4:1.034); Cumulative Variance Explained: 63.425%; EFA2: Eigen Values (Factor 1:6.353; Factor 2: 2.145; Factor 3:1.479; Factor 4:1.239); Cumulative Variance Explained: 62.311%.
CFA1: $\chi^2 = 433.2$ ($p = 0$); $\chi^2/df = 2.78$; IFI: 0.88; CFI: 0.88; TLI: 0.86; RMSEA = 0.08; RMR = 0.06.
CFA2: $\chi^2 = 339.4$ ($p = 0$); $\chi^2/df = 2.33$; IFI: 0.93; CFI: 0.93; TLI: 0.91; RMSEA = 0.06; RMR = 0.05.
S1: Sample 1; S2: Sample 2.

and loadings computed by PLS based SEM (MacKenzie, Podsakoff, and Jarvis, 2005). Each sample is run with 300 bootstrap samples and 300 cases, closely matching the sample size (Hair, Hult, Ringle, and Sarstedt, 2013). Both item weights and loadings are found significant, implying non-redundancy of items (Hair et al., 2013). For both samples, composite reliability as well as Cronbach alpha of the constructs is above 0.7. For functional design, a check of absence of multicollinearity signifies item reliability (Hair et al., 2013), and for each of seven items, for both samples, none of the variance inflation factor (VIF) values is above 3.00 (Diamantopoulos and Siguaw, 2006). Convergent validity for reflective measures is established by the fact that not only factor loading of each item to each construct is above 0.5 but also the values of average variance extracted (AVE) for each construct is above 0.5 (Fornell and Larcker, 1981; Tabachnick and Fidell, 2007). Evidence of discriminant validity for both samples is secured by comparing AVE values (on the diagonal) with squared latent construct correlations as shown in Table 3.

Furthermore, for functional design, the highest correlation it has with other constructs is 0.57 (less than 0.71), indicating sufficient discriminant validity (Fornell and Larcker, 1981; MacKenzie et al., 2005). Additionally, for cross-validity of design perception scale across samples, measurement invariance of the measurement model, involving only reflective constructs, is measured under different kinds of constraints with results depicted in Table 4.

Fit measures suggest that the model fits well across all types of constraints. Additionally, CFI has not changed more than 0.01 for constraints involving measurement weights and structural covariances, implying measurement model invariance (Byrne, 2009). The final scale items, generalized for all interactive devices to be taken forward in next stage of this work, are depicted in Appendix A.

Table 3
Discriminant validity.

Constructs	S1	S2	S1	S2	S1	S2	S1	S2
	VD		KD		UID		ID	
VD	**0.56**	**0.57**						
KD	0.34	0.03	**0.51**	**0.50**				
UID	0.27	0.28	0.11	0.10	**0.67**	**0.66**		
ID	0.13	0.11	0.19	0.09	0.48	0.34	**0.64**	**0.66**

Figures on diagonal (in Bold) represent AVE (Average variance Extracted) for a construct, while off-diagonal elements are squared-correlations.
S1: Sample 1; S2: Sample 2.

6. Design perception as a latent construct

As suggested by Bagozzi and Heatherton (1994), the proposed design sub-dimensions are also tested for presence of a higher-order factor explaining the majority of common variance across them. The partial aggregation model is tested with all five dimensions as total disaggregation model would not include a formative construct. Not only are factor structures checked for each sample but invariance of the models is also examined across the samples. Table 5 presents the results of the partial aggregation model for each of the samples respectively.

Analysis depicts that the fit measures obtained at the partial aggregation level are satisfactory, explaining the existence of these five different dimensions of design perception (Hu and Bentler, 1999). When the factor loadings are constrained to be equal for samples, the fit measures degrade, signaling the independent existence of different effects of these dimensions. Comparing the equality of the factor loadings across the two groups lead to a result of χ^2_d (4, $N_1 = 300$; $N_2 = 312$) = 11.2, $p > 0.01$ and $\Delta CFI = 0.00$, implying equivalence of measures across the groups.

7. Structural model

To provide for a nomological validity check of the scale and the model, the two samples for developing the scales, also had items of user experience and brand equity and the model was tested for both individually. Additionally, for model generalizability across product categories, an additional data of 596 respondents was collected for a mix of interactive devices, composed of computers (46%), washing machine (18%), automobiles (21%), refrigerator (8%) and printers (7%), using Facebook Ads. The items for design perception, experiential value and brand equity were altered to ensure contextual fit, by altering the word *phone/mobile/smartphone* to *device* in the questionnaire. The

Table 4
Measurement invariance: measurement model.

Constraints	NPar	χ2	df	p	χ2/df	SRMR	GFI	NFI	IFI	CFI	RMSEA
Unconstrained	84	737.7	258	0.00	2.86	0.053	0.88	0.86	0.91	0.91	0.055
Measurement weights	70	780.1	272	0.00	2.87	0.061	0.87	0.85	0.90	0.90	0.055
Structural covariance	60	793.1	282	0.00	2.81	0.063	0.87	0.85	0.90	0.90	0.055
Measurement residuals	42	853.9	300	0.00	2.85	0.062	0.86	0.84	0.89	0.89	0.055

NPar: Number of parameters.

choice of device to answer the questionnaire for, was left to the respondents based on ownership.

Initially, a measurement model is run to check for the loadings of items to respective reflective constructs. For all three samples, the loadings are good and above the cutoff value of 0.32 (Tabachnick and Fidell, 2007). Since, functional design was formative, a summated score of first order constructs is created for running a partial disaggregated path model (Bagozzi and Heatherton, 1994). Results for structural model for each sample are depicted in Fig. 1 with figures separated by commas corresponding to each sample.

The fit measures obtained for the three models are reasonable, at NFI = 0.88; IFI = 0.90; CFI = 0.89; and SRMR = 0.06 for sample 1, NFI = 0.89; IFI = 0.91; CFI = 0.91; and SRMR = 0.05 for sample 2 of the smartphones and significantly improved for the third sample at NFI = 0.93; IFI = 0.94; CFI = 0.94; and SRMR = 0.05 (Hu and Bentler, 1999). It is quite clear that experience is a mediator for developing brand equity from design perception, as the direct path from design perception to brand equity is found to be insignificant for all the three samples (Baron and Kenny, 1986). Also, the loadings of all five design dimensions on the overall design perception construct are significant, revalidating the robust nature of the conceptualization and scale-development process.

7.1. Test for moderation

User expertise proposed as a moderator in the relationship between design perception and experiential value, is tested using the hierarchical moderated regression analysis (HMRA) technique (Sharma, Durand, and Gur-Arie, 1981). Items of sub-constructs of experiential value have been summated into experiential value, as each of those the three first order factors had very high loadings (Mohr, Fisher, and Nevin, 1996). Additionally, HMRA is based on multiple regression and thus, a unified experiential value dependent variable with five design dimensions as independent variables and expertise as a confounding one, makes the test feasible. All variables are mean centered and type of moderation is classified based on the significance of the coefficients of the interaction term as well as those of predictor and moderator variables (Aiken, West, and Reno, 1991). Table 6 summarizes the output of HMRA for all the three samples.

Moderation test presents mixed results. While for samples 1 and 2, the interaction terms are positive and significant, it is not so for sample 3. This implies a positive moderation effect of expertise on the relation between design perception and experiential value for the smartphone sample thus, concurring hypothesis 4 in this context. However, a mixture of devices and lower perceived complexities, compared to a smartphone, may lead to absence of moderation effect in the third sample.

8. General discussion and theoretical implications

This work investigates the relationship between design perception and consumer based brand equity formation, composed of three stages — design perception leading to experiential values, which in turn affect overall consumer based brand equity. It also examines the importance of user expertise in altering this relationship. Absence of an attribute-based design perception scale required a scale development effort, which culminates into conceptualization of consumer design perception as five dimensional constructs reflecting visual,

Table 5
Partial aggregation model results.

Model	Sample 1			Sample 2		
	Goodness of fit	Test of hypothesis	Key parameters	Goodness of fit	Test of hypothesis	Key parameters
M1:Null	$\chi^2(10, N = 300) = 533.6$	NA	NA	$\chi^2(10, N = 312) = 517.3$	NA	NA
M2: Baseline	$\chi^2(5, N = 300) = 49.18$; GFI = 0.94; NFI = 0.91; IFI = 0.92; CFI = 0.92; RMSEA = 0.18	NA	$\lambda_1 = 0.61^{**}$ $\beta_1 = 0.28$ $\lambda_2 = 0.69^{**}$ $\beta_2 = 0.21$ $\lambda_3 = 0.52^{**}$ $\beta_3 = 0.26$ $\lambda_4 = 0.84^{**}$ $\beta_4 = 0.15$ $\lambda_5 = 0.76^{**}$ $\beta_5 = 0.27$	$\chi^2(5, N = 312) = 31.12$; GFI = 0.96; NFI = 0.94; IFI = 0.95; CFI = 0.95; RMSEA = 0.13	NA	$\lambda_1 = 0.69^{**}$ $\beta_1 = 0.25$ $\lambda_2 = 0.82^{**}$ $\beta_2 = 0.13$ $\lambda_3 = 0.42^{**}$ $\beta_3 = 0.28$ $\lambda_4 = 0.81^{**}$ $\beta_4 = 0.18$ $\lambda_5 = 0.60^{**}$ $\beta_5 = 0.42$
M3: $\lambda1 = \lambda2 = \lambda3 = \lambda_4 = \lambda5$	$\chi^2(9, N = 300) = 107.3$; GFI = 0.88; NFI = 0.80; IFI = 0.81; CFI = 0.81; RMSEA = 0.19	M3–M2 $\chi^2_d = 58.12$; $p < 0.01$	$\lambda_1 = 0.68^{**}$ $\beta_1 = 0.26$ $\lambda_2 = 0.68^{**}$ $\beta_2 = 0.19$ $\lambda_3 = 0.68^{**}$ $\beta_3 = 0.27$ $\lambda_4 = 0.68^{**}$ $\beta_4 = 0.22$ $\lambda_5 = 0.68^{**}$ $\beta_5 = 0.32$	$\chi^2(9, N = 300) = 94.2$; GFI = 0.89; NFI = 0.82; IFI = 0.83; CFI = 0.83; RMSEA = 0.17	M3–M2 $\chi^2_d = 63.08$ $p < 0.01$	$\lambda_1 = 0.69^{**}$ $\beta_1 = 0.25$ $\lambda_2 = 0.69^{**}$ $\beta_2 = 0.15$ $\lambda_3 = 0.69^{**}$ $\beta_3 = 0.30$ $\lambda_4 = 0.69^{**}$ $\beta_4 = 0.21$ $\lambda_5 = 0.69^{**}$ $\beta_5 = 0.41$

** $p < 0.05$

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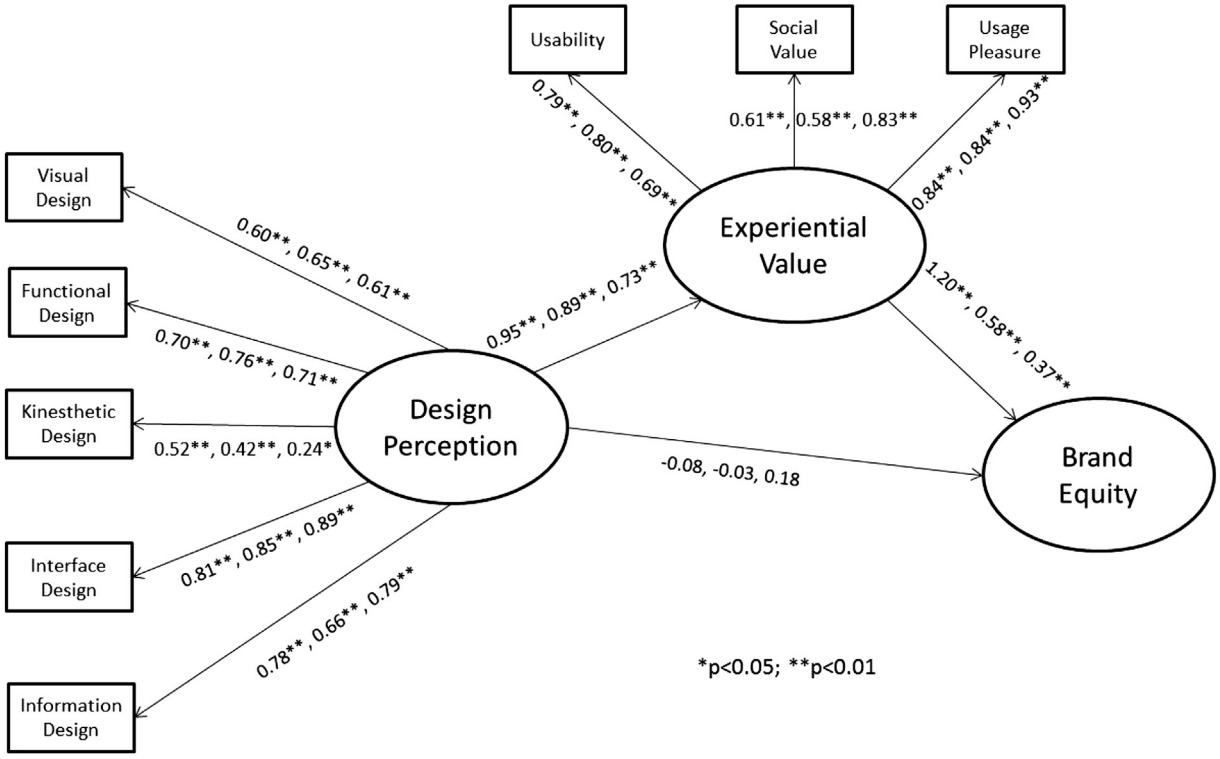

Fig. 1. Structural model.

functional, kinesthetic, interface and information design, well supported by literature (Garrett, 2003; Noble and Kumar, 2008, 2010; Sonderegger & Sonderegger and Sauer, 2010). Items are generated and validated for each of these sub-dimensions using mixed method approach, involving literature integration, qualitative and three stages of quantitative research. Next, the proposed model which related design perception to consumer based brand equity through experiential value is tested using data from not only the two samples used to develop the scale, but also from a third sample data with a mix of interactive devices, to ensure general validity of the scale as well as the model. Structural model results come out to be robust across all the three samples with strong relationship amongst design perception, experiential value and brand equity. The direct relation between design perception and brand equity is non-significant for all samples which indicates a strong mediation effect by user experience and confirms the importance of experiential consumption as discussed by Holbrook and Hirschman (1982) besides highlighting the role of product attributes and experiences as antecedents in shaping consumer-brand relationship (Keller, 1993). This work also examines the moderating role of user expertise in affecting design derived experiences, as suggested by Zielfe (2002), and proves so for smartphone users but not for the sample with other interactive devices.

The domains of consumption experience and brand experience (Brakus, Schmitt, and Zarantonello, 2009) have gone far in relating useful experiences with products and brands and their outcomes in form of positive brand relationships. This work takes the concepts forward by disaggregating design, user experience and brand equity and makes an attempt to relate the two from a consumer value vantage point. An examination of design perception to study its effects on user experience, itself conceptualized as a multi-dimensional framework, and consumer-based brand equity, makes the framework more relevant for academicians and practitioners alike, than those using the utilitarian–hedonic paradigm. The theory of brand experience by Brakus et al. (2009) entails feelings and emotions as a critical undercurrent and relates consumer–brand interaction in an experiential setting, yet it falls short of measuring the entire product usage experience, different from a brand. This work relates the two by drawing on consumption value theory (Holbrook, 2002) and brand equity theory (Keller, 1993) aligned with means end chains to germinate a novel model of product design and experience derived brand equity. Though a variety of works have made the effort to related product benefits to brand consequences (e.g. Sheng and Teo, 2012), this one empirically highlights the sequential process of brand equity formation, in a novel effort.

Table 6
Moderation test results.

Independent variables		Experiential value								
		Model 1 standardized β			Model 2 standardized β			Model 3 standardized β		
		S1	S2	S3	S1	S2	S3	S1	S2	S3
Main effects	Design perception	0.71	0.65	0.64	0.68	0.62	0.62	0.62	0.61	0.57
Moderator	User expertise	–	–	–	0.08	0.09	0.13	*0.01*	0.16	*0.07*
Interaction terms	Design perception × user expertise	–	–	–	–	–	–	1.49	0.59	*0.08*
R^2		0.50	0.42	0.41	0.51	0.43	0.43	0.97	0.43	0.43
Adjusted R^2		0.50	0.42	0.41	0.51	0.42	0.43	0.97	0.43	0.43
ΔR^2		0.50	0.42	0.41	0.01	0.01	0.02	0.46	0.00	0.00

Note: Nonsignificant values at 95% level of significance are in italics; S1: Sample 1, S2: Sample 2, S3: Sample 3.

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An important theoretical contribution of this work lies in proposing a novel framework to measure consumer design perception. Previous such efforts (e.g. Batra and Ahtola, 1991; Chitturi et al., 2008) were restricted to product attribute descriptions as source of utilitarian and hedonic benefits, without a thorough empirical initiative to generate a dimensionalized concept of design for a user, different from customer value. Present work articulates a comprehensive model representing different facets of design understanding derived from consumer voices and empirical validation. The five design dimensions as perceived by the user represent an integration and empirical confirmation of recent conceptual works and serve to answer such a call by Luchs and Swan (2011).

9. Managerial implications

In multitude of categories, the final product looks and feel relies solely on the designer's discretion. Many of such products stumble when there is incongruence between a designer's prescription for and a consumer's expectation from a well-designed product. Typical benefit based design perception scales are not of much use to a designer, as there are no clear way forwards about how to provide a certain benefit by means of tweaking a specific feature, as the feature is not associated with the benefit in that scale. An attribute-oriented framework to measure design supports designers as well as marketers, by not only offering ways to mold design perception of users but also suggesting how those tweaks will have a relative effect on user experience and subsequent consumer brand relationship. With modern consumer interacting with such products intensively, an exhaustive design perception framework serves to be a useful tool for manufacturers to ensure prolonged relationship of the brand with its consumers. The duality of abstract design constructs as well as specific, yet sufficiently generic items representing each of those, ensures that this framework can be readily adapted in contexts of other interactive products, which are not a part of this work. Even those devices that are not interactive (only one-way input from the user to the device), certain design dimensions, namely visual, kinesthetic, and functional, are still relevant and measurable as they are common to all products. This is because interface and information design, which represent interactivity, are not exquisitely ingrained in non-interactive devices. For example, for a cloth iron, an aspect of visual design (*item 3*) for a designer implies a product where parts integrate well seamlessly, through possibly modular design. Similar design cues can be interpreted from other items.

Analysis of design derived outcomes like experience and long lasting consumer-brand ties is important for marketers and designers alike. This work measures consumption experience as a concept comprising usability, pleasure in use, and social value. The simultaneous occurrence of these implies that experience designers need manipulate all three while designing their products. For example, just making a usable product will not guarantee a strong consumer–brand relationship, nor will a device that enhances social status but is poor in usability. The same implication goes for design as well, with a product good on all five aspects being perceived as well designed. Knitting together the two sets of implications, both product and experience designers need to develop products that are not only good holistically in terms of design, but also offer the consumer all three experiential values together, only then will a user tend to get attached to the contextual brand resulting in enhanced financial performance (Kim, Kim and An 2003). This work, thus, also illustrates the importance of design for its bottom-line contribution, a division traditionally treated as a cost center.

10. Limitations and future directions

A big drawback lies in the assumption of design as sole determinant of brand equity. Brand equity has been well discussed to be also determined by the marketing efforts of the same organization as well as offerings and marketing efforts of the competitors (Ailawadi, Lehmann, and Neslin, 2003). We have not factored or controlled for these parameters into the model causing them to possibly confound the effects that we could obtain, more so in the sample containing various product categories. Future studies can examine their relative effects on consumer based brand equity apart from product design.

The scale development process for design perception, though rigorous, has its limitations conceptually. For this work, design implies the product itself and how it is perceived by the user during consumption. But it is not always the case and sometimes, packaging and pricing are as critical to an offering as the product itself. For example, the package may be an integral part of the product during consumption and is also an important variable in design. Similarly, recent literature in pricing suggests that consumers do evaluate product derived experiences with the price they paid for it (Wadhwa and Zhang, 2015). These were consciously not chosen as part of design here as package is not always a consistent ingredient for all categories, while price, as a scientifically determined value, is mostly an outcome of design. Additionally, the moderator effects of expertise could not be excavated across the sample containing a mix of interactive devices, owing probably to varying complexity of devices in the group. A future study exploring the moderating effects of expertise, across individual devices, and where it is measure using an objective process, will be a better test for moderation (Ketelaar, Willemsen, Sleven, and Kerkhof, 2015).

Finally, this work only serves to provide initial guidelines to probe effect of individual differences affecting design perception and related experiences, a call given by Holbrook and Hirschman (1982) followed by Bloch, Brunel, and Arnold (2003), but yet to be taken up in empirical works significantly. A focused conceptual/empirical work with newer and better conceptualizations as well as operationalization of individual characteristics, with deeper literature review, needs to be investigated in future studies. A lead in this regard is provided by Lane and Manner (2011) who propose “big five” personality traits as more effective moderator to determine usage of products, an area of future research.

11. Conclusions

For success in a competitive environment led by products with great designs, it is important that designers not only understand consumer's expectations but also are able to offer them products that thrill them with meaningful experiences and elongate the tenure of the bond that the customer shares with the brand. It is ever so pertinent for them to design more effective and desirable products for their target group. This requires a two-fold exploration: one, how design is perceived by users and two, what is strength of its effect on experiences and consumer–brand relationships. Afterall, the means–end chain epitomizes this sequence by relating specific attribute perceptions to more abstract benefits, ultimately affecting consumer–brand association (Gutman, 1982). More so, when it comes to design, it is critical to know if design is an amalgamation of attributes put together or islands stored in a consumer's cognition, each evaluated separately. The current work investigates and establishes the relationship amongst design, experience and brand equity as well as provides a way to measure consumer's perception of design, with each dimension manifested through specific attributes.

Appendix A. Final design perception scale

Design perception	Scale item
Visual (reflective)	The styling of my device looks elegant. The appearance of my device is eye catching. Various elements of my device go well together. My device exhibits proper contrast through right color combinations. The personality of my device matches mine.

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(*continued*)

Design perception	Scale item
Functional (formative)	My device offers a lot of latest features.
	My device offers the right amount of basic features that I need.
	My device is loaded with more features compared to its competitors.
	My device offers seamless performance without glitches.
	Technical specifications of my device allow for running two or more applications.
	I can always depend on my devices' performance.
	My device is tough and can take a lot of abuse.
Kinesthetic (reflective)	The shape and size of my device makes it easy to hold in one hand.
	The size of my device makes it easy to fit and carry around in pocket.
	My device facilitates easy handling without fatigue.
Interface* (reflective)	The interface of my device is smooth.
	The interface of my device suits my requirements.
	The user interface of my device does what I want it to do.
	The user interface of my device looks very easy to navigate.
	The user interface of my device makes it easy to find what I need.
Information* (reflective)	The information provided by my device is very clear.
	The information provided by my device is sufficient to meet my requirement.
	My device provides me error messages that help me fix problems.
	The instructions in my device are concise and appropriate.
	The information in my device is effective in helping me complete tasks.

* relevant only for interactive devices

Appendix B. Items for measuring experience and brand equity

Construct (code)/type	Item code	Item	Scale source
Experiential value (usability)	US1	I use this device frequently.	System Usability Scale (Brooke, 1996)
	US2	I find the device simple to use.	
	US3	I can accomplish the task more quickly using my device.	
	US4	I frequently need the help of an expert to be able to use this device completely.*	
	US5	I find the functions of this device well integrated.	
	US6	I feel there is too much inconsistency in the device functions.*	
	US7	I find this device easy to learn.	
	US8	I find this device awkward to use.*	
	US9	I feel very confident using the device.	
	US10	I needed to learn a lot of things before I started using this device.*	
Experiential value (social value)	SV1	This device makes me feel acceptable in a group.	Sweeney and Soutar (2001)
	SV2	This device improves the way I am perceived.	
	SV3	This device makes a good impression on other people.	
	SV4	This device enhances my social status.	
Experiential value (pleasure in use)	PU1	This device is the one I really enjoy using.	Sweeney and Soutar (2001)
	PU2	This device always makes me want to use it.	
	PU3	I feel very relaxed while using this device.	
	PU4	This device makes me feel very good.	
	PU5	Using this device gives me great pleasure.	
Consumer based brand equity	BE1	It makes sense to choose device of this brand instead of any other, even if they are the same.	Yoo and Donthu (2001)
	BE2	Even if another device has the same features as this brand's, I would prefer to choose this one.	
	BE3	If there is another brand's device as good as this one, I prefer to choose this one.	
	BE4	If another brand's device is not different from this one in any way, it seems smarter to choose this one.	
User expertise	UE1	How familiar are you with smartphones.	Mitchell and Dacin (1996)
	UE2	How clear and idea do you have about which characteristics of the phone are important in giving you satisfaction.	
	UE3	How much do you know about smartphones.	
	UE4	How do you rate your knowledge of smartphones compared to rest of the population.	

* Reverse items.

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