Virtual issue editorial

Designing the future:

Past and future trajectories for design innovation research

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Introduction

In this article, we focus on design innovation, that is, innovation in the external appearance of a product. Design has become an important competitive tool for managers and a fruitful area of research for scholars. The term design is rather elusive, having been attributed very different meanings. For example, when design is defined as an outcome, it has been conceptualized as enhancing product functionality, ease of use, and/or appearance (e.g., Homburg, Schwemmle and Kuehnl, 2015; Noble and Kumar, 2010). When examining design as an activity, it has been conceptualized in terms of sketching, prototyping, and form giving (e.g., Hise et al., 1989). A detailed description of how to define design from a descriptive or normative perspective is beyond the bounds of this article. Ultimately, what is an appropriate definition of design is dependent on one’s research aims. In the context of this virtual issue, we conceptualize design in terms of a product’s external appearance, which is determined by a specific configuration of visual elements such as colors, shapes, lines, proportions, and materials (Rubera and Droge, 2013). The presence of design innovation is subsequently determined by the degree to which a product’s external appearance deviates from prior designs in a given product category: the more
a design is similar to prior, competing designs, for example in terms of color, shape, and proportion, the less innovative it is (Gemser and Leenders, 2001; Mugge and Dahl, 2013; Talke, Salomo, Wieringa, and Lutz, 2009). Conceptualizing design innovation in terms of new product appearance allows us to make a clear distinction between design innovation versus technological innovation (which focuses on the product’s technologies and related functionalities) and builds on prior conceptualizations of design innovation (e.g., Dan, Spaid, and Noble, 2018; Mugge and Dahl, 2013; Noseworthy and Trudel, 2011; Rubera, 2015; Rubera, Griffith, and Yalcinkaya, 2012; Rubera and Droge, 2013; Talke et al., 2009).

One of the early studies demonstrating the importance of design for differentiating new products was by Berkowitz (1987). In subsequent studies, the influence of design on the success of new products, services, or companies has been further corroborated (e.g., Candi, 2010; Candi and Saemundsson, 2011; Hertenstein, Platt, and Veryzer, 2005). Over the years, researchers have identified specific factors impacting the influence of design on performance. One prominent factor identified as influencing performance is the degree to which design is innovative, being more than a simple refinement or extension of extant design (e.g., Gemser and Leenders, 2001; Rubera, 2015; Talke et al, 2009). An often-used example of innovative design which gathered commercial success is the Apple iMac3, launched in 1998, whose design included the use of translucent colors and soft round forms, revolutionizing the ‘look and feel’ of PCs (e.g., Dell'Era, and Verganti, 2007; Eisenman, 2013; Talke et al., 2009). Another well-cited example is the successful ‘Family Follows Fiction’ product range from Italian household goods manufacturer Alessi, where ordinary kitchenware were materialized as playful, toy-like products, using plastic materials, translucent surfaces and bright colors (Dalpiaz, Rindova and Ravasi, 2016; Dell'Era, and Verganti, 2007; Verganti, 2008). A more recent example is the Cybertruck, from Tesla, an angular, stainless steel, all-electric pickup truck, which has been described in the popular press as ‘revolutionary’ in design. Although its commercial success is uncertain, pre-orders for the truck bode well (Mehta, 2019). Overall, a global increase in the number of design patents (Chan, Mihm, and Sosa, 2018; Filitz, Henkel, and Tether, 2015; Rubera, 2015) suggests that investing in novel designs is a general trend across industries, making research on the effectiveness and management of design innovation of particular interest.

In the last twenty years, research on the innovativeness of design has gathered the interest of researchers resulting in valuable insights. However, an organized review of the research on this topic is lacking. This article, and the accompanying virtual issue on design innovation, was developed with two objectives in mind. First, to conceptually clarify design innovation and
provide an overview of its evolution, particularly within the *Journal of Product Innovation Management* (JPIM) which has been one of the most active of business journals in publishing articles in this space. As part of the evolution, we discuss important knowledge garnered about design innovation, clustering this information into four broad research themes. Second, we aim to encourage future research in the area by highlighting fruitful research opportunities that can help progress the field. To reach our objectives, we performed an analysis of research on design innovation as published in JPIM and other relevant academic journals. Based on this analysis, we wrote our editorial and created a virtual issue, composed of prior published articles in JPIM that illustrate relevant research on design innovation.

In what follows, the approach for selecting the articles included in this editorial and concomitant virtual issue is outlined. The paper then proceeds with the insights derived from the analysis of the selected papers, a set of research priorities, and concluding remarks.

**Methodology**

To develop a list of articles on design innovation that are of relevance for this virtual issue, we first conducted a search of JPIM from January 1984 through the last issue published in 2018 in the *Business Source Complete* database. For our search, we used keywords that relate to product appearance or variations of this concept. Thus, initially, the search for relevant articles was relatively broad, capturing both research on product appearance, in general, and novel product appearance, in particular. The following keywords were selected: product appearance, industrial design, product shape, aesthetics, product design, design-driven innovation, design innovation, aesthetic innovation, stylistic innovation, new design, hedonic radicalness, and design newness. These keywords should have been included in the article title and/or the article abstract. *Perspective* and *From Experience* articles, editorials, and/or commentaries, were excluded because they are not peer-reviewed, full-length research articles. This initial search resulted in n=86 articles.

Next, we read the title and abstract of the 86 articles to ascertain those that focused on design innovation in terms of degree of change in product appearance. In cases of uncertainty, the full paper was read to determine whether or not it should be included. To be included in this second step, the article had to directly address the topic of design innovation, where design innovation could either be the main focus of the paper or could be addressed as a subtopic. Some papers were excluded because they equated design with new product development in its entirety and/or conceptualized design purely in terms of functionality or technology. Other papers were
excluded because they did not explicitly distinguish between innovative versus imitative design. Our procedure led to a database of n=25 articles that were published in JPIM.

We supplemented the database of relevant JPIM-articles with articles from other academic journals. The 20 academic journals we examined are included in the Top 50 Financial Times research rank list, covering the field of marketing, entrepreneurship, management, or organizational behavior. Utilizing the same keywords used in our search of JPIM, we examined the presence of any of the keywords in the article title and/or abstract. Similarly, we used the time frame of January 1984 to December 2018 to match our JPIM search. This step resulted in 132 journal articles. To sift through these articles, we followed the same procedure as for the JPIM search, examining the abstract and sometimes the article in its entirety to determine its relevance for this editorial on design innovation. This led to the selection of 21 articles which are all referred to in our editorial.

Expanding our search to other business journals allowed us to provide a broader perspective on design innovation research. Insights generated from the articles in our database, covering both articles published in JPIM and those published in other business journals, were grouped into four overarching research themes based on the type of research question(s) the articles addressed on design innovation. The first author identified the four research themes after reading all the articles in the database and having iterative rounds of discussions with the second author. The identified themes are as follows:

1. **The WHAT**: This research theme covers conceptualizations of design innovation, measurements and operationalizations, and theoretical foundations.
2. **The WHY**: This research theme is about why design innovation is relevant and important. It covers research on the degree to which design innovation has an impact on product or company performance, on brand recognition, and/or on consumer response.
3. **The WHEN**: This research theme relates to the question as to when it is effective to invest in design innovation, focusing on external industry or technology evolution.
4. **The HOW**: The final research theme relates to how to develop innovative design, and includes research on relevant design processes, practices, techniques, or tools for design innovation.

For the purpose of the virtual issue, we selected ten articles previously published in JPIM that exemplify the four research themes. These articles, hopefully, will provide a steppingstone to those seeking to further their knowledge on this topic. An overview of the selected articles with...
brief details and classification into the research themes can be found in Table 1. The following criteria were used to select the articles:

- **Content**: We selected JPIM articles that illustrated one or more of the four research themes identified. Selected articles delivered new insights in terms of a new perspective or way of thinking and/or delivered a more complete view on the respective research theme.

- **Research method**: We chose JPIM articles based on the nature of the research method used, seeking a mixture of qualitative, quantitative as well as conceptual studies among the selected articles. Such a mixture was considered important as each type of method provides for different types of insights.

- **Impact**: We designated JPIM articles based on the (potential) impact of the research. To this end, we examined academic citation rates using data from the Social Sciences Citation Index (Web of Science). Of the selected articles, two articles can be labeled ‘classics’ (Biemans, Griffin, and Møenaert, 2010) having more than 100 citations (i.e., Gemser and Leenders, 2001; Verganti, 2008). Another three articles had between 50 to 100 citations (i.e., Dell’Era and Verganti, 2007; Kalogerakis, Lüthje, and Herstatt, 2010; Talke et al., 2009). The remaining selected articles had less than 50 citations; however, these papers are recently published and thus their impact in the field is still to be determined. Overall, we sought a balance between selecting articles that have already made an impact on the field and those that have the potential for future impact.

**INSERT TABLE 1 HERE**

In the sections below, we will discuss the four research themes in greater depth, going from the ‘what’, to the ‘why’, the ‘when’ and, ultimately, the ‘how’ of design innovation. Figure 1 visualizes the different research themes. We will discuss the top-ten articles listed in Table 1 as well as the other relevant articles that emerged from our search on design innovation research.

**INSERT FIGURE 1 HERE**

**Findings**

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The WHAT: Terminology, Empirical Method, and Theoretical Underpinnings

For many years, within the JPIM community and elsewhere, innovation was predominantly conceptualized from the point of view of new technology (and hence function). There was some early recognition that design could be a valuable element of a company’s innovation strategy (e.g. Berkowitz, 1987; Yamamoto and Lambert, 1994). However, its ascribed role tended to be limited to the embodiment of new technology; design itself was not assigned innovative qualities. Over time, recognition grew that innovation could be present in the form of new design (e.g., Capetta, Cillo and Ponti, 2006) and that design innovation can play an essential role in gaining and maintaining a competitive advantage (e.g., Gemser and Leenders, 2001). To conceptually distinguish design innovation from technological innovation, authors have suggested that design innovation relates to novel external product appearance, while technological innovation refers to novel technology and resulting functionality (e.g., Dan et al., 2018; Mugge and Dahl, 2013; Noseworthy and Trudel, 2011; Rubera, 2015; Rubera et al., 2012; Rubera and Droge, 2013; Talke et al., 2009).

In Table 2, we provide an overview of the different ways in which design innovation has been defined and operationalized as well as how it has been distinguished from technological innovation, when available. Table 2 is not an exhaustive overview of design innovation definitions and operationalizations; instead, it provides a sample of the different ways in which researchers approached design innovation and was motivated by the desire to show variation rather than replication.

INSERT TABLE 2 HERE

The studies included in Table 2 refer to design innovation in terms of a product’s visual appearance or ‘language’. Several studies though, have adopted a broader view (e.g., Moon, Miller and Kim, 2013; Moon, Park and Kim, 2015). For example, Moon et al. (2015), define ‘innovative product design’ as including innovative product appearance as well as ‘features’ and ‘ergonomics’, thus blurring the lines between design innovation and technological innovation. This definition is problematic as it suggests that we cannot or should not distinguish between design and technological innovation. Yet, research has shown that design innovation can take place without technological innovation, making the distinction between form and function “nontrivial” (Chan et al, 2018), and that both types of innovation have different types of effects.

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To determine whether or not a design is innovative, authors have examined the perceived degree of change or deviation in a product’s appearance, using labels such as degree of novelty, newness, atypicality, radicalness, or originality (see Table 2). In terms of the benchmark used to measure change, researchers may examine whether the design is new to the organization that developed it, new for the market, or new-to-the-world. When measuring design innovation and performance outcomes, the degree of change in design is commonly measured in terms of the degree to which the design is perceived to deviate from other competing designs introduced to the market in that product category (e.g., Gemser and Leenders, 2001; Micheli and Gemser, 2016; Mugge and Dahl, 2013; Talke et al., 2009). Such a perspective implies that when the design is perceived to be very similar to prior designs, the design can be described as an imitation - even when the design is new to the organization that introduced it to the market. To measure the degree of design deviation compared to extant designs, authors have used perceptions from consumers (e.g., Moon et al. 2015; Mugge and Dahl, 2013; Talke et al., 2009), industry experts (e.g., Dell’Era and Verganti, 2007; Rubera, 2015), or company respondents (e.g., Gemser and Leenders, 2001; Liker, Collins and Hull, 1999; Micheli and Gemser, 2016). Others have measured design innovation via the presence of design patents (e.g., Chan et al., 2018; Dan et al., 2018; Filitz et al., 2015; Rubera and Droge, 2013). Design patents are a form of intellectual property protection which are normally granted for new, original designs that are not necessary for the product’s proper functioning. Thus, the scope of design patents is limited to a product’s visual features including its shape, configuration, patterns, and ornamentation (Chan et al., 2018; Rubera and Droge, 2013).

Verganti and colleagues (e.g. Dell’Era and Verganti, 2007; Verganti, 2008) suggest that an examination of design novelty should focus on whether a product adopts a ‘design language’ that is in line with the current evolution of sociocultural models and aesthetics paradigms or breaks with it. Breaking with existing sociocultural norms and aesthetics requires a significant reinterpretation of product meanings by consumers which may take time to diffuse (Dell’Era and Verganti, 2007; Verganti, 2008). While interesting as a concept, actually measuring this new product meaning may be challenging. One possible approach could be to measure consumers’ perceived learning cost inferences (i.e., the cognitive effort that is required to understand and effectively use a product), as applied by Mugge and Dahl (2013).

Methods used for research on design innovation are diverse, covering the full range from conceptual to qualitative to quantitative. To examine consumer response to design innovation, researchers tend to create and execute laboratory experiments with consumers (e.g., Goode, Dahl...
and Moreau, 2013; Mugge and Dahl, 2013; Noseworthy and Trudel, 2011) or use consumer surveys (Mugge, Dahl and Schoormans, 2018; Truong et al., 2013). The effects of design innovation on company performance is predominantly determined by the use of company surveys (e.g., Gemser and Leenders, 2001; Micheli and Gemser, 2016) or analyzing relevant secondary data (e.g., Rubera, 2015; Rubera and Droge, 2013; Talke et al., 2009). Research that provides insight into how to create innovative design tends to be conceptual (Verganti, 2008; Veryzer and Borja de Mozata, 2005) and qualitative, based on case study research or interviews with informants (e.g., Hargadon and Sutton, 1997; Kalogerakis et al., 2010).

Theoretical underpinnings in research on design innovation are not always present or fully specified. Research on consumer response toward novel design has used psychological theories, particularly related to cognitive processing (e.g., Kreuzbauer and Malter, 2005; Liu, Li, Chen, and Balachander, 2017; Mugge and Dahl, 2013). Studies assessing the impact of novel design on company performance have used management theories such as the resource-based view or industry or technology life cycle theories (e.g., Gemser and Leenders, 2001; Verganti, 2008).

Research on design innovation and branding has referred to marketing theories such as signaling theory (e.g. Micheli and Gemser, 2016) or communication theories such as the theory of signs (e.g., Karjalainen and Snelders, 2010). Overall, theoretical explanations for findings on design innovation tend to be underdeveloped.

THE WHY: Design Innovation and Performance

Design innovation and product and company performance

One of the first studies demonstrating differential impacts of imitative versus innovative design was by Gemser and Leenders (2001). Their findings indicate that the introduction of designs which are new or original in the sense of being “truly different” from designs already on the market, enhance a company’s competitiveness to a greater degree than incremental, imitative designs, irrespective of the industry context. Similarly, Verganti (2008), in his conceptual paper, suggests that design innovation, in terms of introducing new product ‘meanings’ and ‘languages’ that influence a product’s symbolic and emotional value rather than its functional value, can provide companies with a competitive edge. Talke et al. (2009) provide further evidence that ‘design newness’, defined in terms of new visual appearance that deviates from the current design state in a certain product category, is an important driver of product performance in the German car industry. Rubera (2015), however, examining sales data of new car and motorcycle models introduced on the US market, finds evidence that initial product sales will be lower as
design innovativeness increases, but that, over time, the benefits in terms of sales for models with high design innovativeness become evident. This finding is ascribed to the fact that it is only over time that consumers are able to make sense of the new product form through a collective sensemaking process (Rubera, 2015). The results of Landwehr, Wentzel and Herrmann (2013), using experiments and real-world data on German car sales, show similar results: car designs that are atypical of their category may only be more successful in the longer run, when consumers have been more exposed to the atypical design.

In more recent years, authors have examined whether or not particular constructs mediate or moderate the relationship between design innovation and product or company performance. For example, Rubera and Droge (2013) explored the moderating role of a company’s branding strategy. Specifically, the authors found that for firms following a corporate branding strategy (i.e., using one overarching brand name for all products), increases in firm performance levels were related to increases in design innovation. However, firm performance was unrelated to design innovation for non-corporate branding. According to the authors, these results may be due to halo effects. When using corporate branding, the introduction of one design innovation may be sufficient to raise the image of all the company’s products while when using non-corporate branding, the positive effect of design innovation may be limited to the brand under whose name the innovation is introduced.

Micheli and Gemser (2016) examined the role of third-party attention as a mediator between innovative design and product performance, using a sample of Danish design-intensive companies. Their results suggest that innovative design tends to receive greater expert and media attention, which in turn, positively affects product performance. In addition, they find that the use of the label ‘Danish Design’ – indicative of adherence to a national design style- positively moderates the relationship between design innovativeness and product performance. The findings suggest that third-party attention and design style labels are quality signals, acting as enablers for market acceptance of innovative design. As suggested by Verganti (2008) and empirically demonstrated by Landwehr et al. (2013) and Rubera (2015), when design deviates considerably from prior, competing designs, it may take time to diffuse. In particular, very ‘deviant’ design is likely to be misinterpreted or underappreciated by consumers (Goode et al, 2013) and thus companies may need to invest in ‘preparing the ground’ for such ‘ground-breaking’ design (Verganti, 2008). The use of quality signals like familiar (national) brands or design style labels can help companies prepare the public by assisting consumers to make sense of these innovative designs (cf. Goode et al., 2013; Micheli and Gemser, 2016).
Design innovation and brand recognition

Companies can employ design to create visual recognition for their brands (Karjalainen and Snelders, 2010). Ultimately, using innovative design can result in true affection and loyalty for the brand, as exemplified, for example, by the Apple brand (Kumar, Townsend and Vorhies, 2015). To create, and subsequently preserve, brand recognition, consistency rather than novelty in design language is needed (Karjalainen and Snelders, 2010; Kreuzbauer and Malter, 2005; Schreiner et al., 2017). However, as observed by Karjalainen and Snelders (2010), consistency can also ‘incite boredom’ and reduce customer attention. Novel design, on the other hand, can help revitalize brands and keep them current (Beverland, 2005).

The research of Dell’Era and Verganti (2007) provides some interesting insights into company strategies to balance design consistency and novelty for brand recognition. In their research, the authors examined ‘design languages’ as used by Italian furniture firms, in terms of products’ color, shape, materials and surface. They found, counterintuitively, that companies recognized for introducing radical new design, tend to have lower variety in terms of the design languages used than more imitative companies. According to Dell’Era and Verganti (2007), innovators may avoid proposing a wide range of design languages “to protect brand identity” (p. 595). The more imitative companies, on the other hand, may lack research capabilities to effectively interpret emerging sociocultural trends and thus introduce a wider variety of design languages (Dell’Era and Verganti, 2007).

Design innovation and consumer response

Design innovation affects company performance by influencing psychological and behavioral responses from consumers (Moon et al., 2015; Noble and Kumar, 2010). As to why and how novel design may influence consumer responses, two explanations have dominated the academic discussion: attention drawing and ease of categorization.

First, novel design can capture customers’ attention by differentiating the product from others on the market (e.g., Creusen and Schoormans, 2005; Moon et al., 2015), thereby stimulating their interest and curiosity. Whether consumers are attracted to novel design is, in part, dependent on individual characteristics. For example, Truong et al. (2014) find that a consumer’s global propensity to adopt innovations positively moderates the relationship between innovative design and consumers’ purchase intention. They also find that consumers with greater design acumen - defined in terms of their ability to recognize, categorize and evaluate design - tend to hold more favorable beliefs toward innovative design. While their results indicate that consumers with
greater design acumen are not more likely to purchase innovative designs, these consumers may serve as opinion leaders and thus help diffuse innovative design.

While novel design may capture consumers’ attention, consumers’ cognitive efforts to assess (the value of) the new design may be high (Mugge and Dahl, 2013). Cognitive effort may particularly be high if design innovations are hard to classify into consumers’ existing cognitive category schemas (Liu et al., 2017). High cognitive efforts or ‘learning costs’ may, in turn, have a negative impact on consumers’ response (Mugge and Dahl, 2013). Indeed, prior research suggests that on the one hand, design must be unique and different to enhance consumer response. On the other hand, design must be familiar to the consumer and resemble the product category to which it belongs (e.g., Hekkert, Snelders, van Wieringen, 2003; Liu et al, 2017).

To measure the degree to which a product appearance is familiar, scholars have examined the typicality of design, which refers to the degree to which a design is representative of the category to which it belongs (Veryzer and Hutchinson, 1998). The impact of design typicality on consumer response has been studied extensively, also outside the JPIM community, particularly for product form and shape (e.g., Hekkert, Snelders, van Wieringen, 2003; Kumar and Garg, 2010; Landwehr et al. 2013; Liu et al, 2017; Mugge and Dahl, 2013; Noseworthy and Trudel, 2011; Veryzer and Hutchinson, 1998). Product graphics have been studied less (e.g., Celhay and Trinquecoste, 2015). Results suggest that, ultimately, the degree to which consumers appreciate typical or atypical design, is dependent on the presence of moderating variables (e.g., Celhay and Trinquecoste, 2015; Hekkert et al., 2003; Landwehr et al., 2013; Mugge and Dahl, 2013; Noseworthy and Trudel, 2011). Celhay and Trinquecoste (2015), for example, examined the preference for typical versus atypical design of wine labels in terms of their typography, layout, colors, and illustrations. Their findings indicate that consumers who are an ‘expert’ in the wine category, who display a strong tendency toward innovation, who are relatively young, and who have a high level of education tend to prefer atypical wine labels. Moreover, their results show that consumers are more likely to accept atypical wine labels when the level of perceived risk at the time of purchase is low. Thus, next to individual variables, situational variables -in this case, the level of perceived risk at the time of purchase- can have a moderating effect as well.

The WHEN: Timing for Investments in Design Innovation

Different research streams have examined when firms should invest in design, whether innovative or imitative in nature. The first research stream has examined this issue from the perspective of the maturity of the industry or technology. Research in this stream suggests that in
situations of mature technology, investment in design may be necessary to make up for scant technological innovation and to mitigate cost-driven competition (e.g., Candi and Saemundsson, 2011; Chan et al., 2018; Eisenman, 2013). The results of Candi and Saemundsson (2011), for example, indicate that design is more strongly related to company performance as the pressures of price competition (an indication of commoditization) in firms’ markets increase. However, as suggested by Gemsler and Leenders (2001) and further demonstrated by Candi and Saemundsson (2011), in the long run, investing in design may become an ineffective strategy to stand out in mature industries. Investing in design may become a ‘conditio sine qua non’ that is needed to compete but no longer provides a firm with a competitive edge. To escape such a situation where design has become commoditized by being adopted by a wide array of competitors in an industry, companies may need to invest in innovative rather than imitative design to enhance performance. The research of Cappetta et al. (2006) on fashion, suggest that, within an industry, the rate of change in design may be different over time: from ferment periods with much design change to periods of convergence on design resulting in incremental design change, similar to the process of technological change as described by Anderson and Tushman (1990). However, as emphasized by Cappetta et al. (2006), even during periods of incremental design change, when the majority of companies tend to adopt ‘convergent’ design, there are still companies that introduce innovative designs on the market.

The second research stream emphasizes the role of design as a mechanism to explain new technology and related new functionality (e.g., Eisenman, 2013; Mugge and Dahl, 2013; Rindova and Petkova, 2007). As conceptually elaborated by Rindova and Petkova (2007), design can help consumers to cope with technological novelty by providing a frame of reference for understanding what the new technology does and how to use it. Mugge and Dahl (2013) provide empirical support for this conceptual argument. Based on a laboratory experiment, Mugge and Dahl (2013) find evidence that for radical technological innovations, embodying the product with a low (versus high) level of design newness reduces perceived learning costs of consumers and positively affects consumer evaluations of these innovations. Analyzing real-world sales data, Rubera (2015) finds evidence that consumers initially react negatively to products that are both novel in terms of both aesthetics and functionality. Her findings support the argument that consumers’ perception of high learning costs negatively affect outcomes. To optimize revenues, it may be better to introduce novel design only when the new technology and related functionality is understood (Noseworthy and Trudel, 2011).

Others have, however, pointed to successful product cases where radical innovation in technology and design went hand-in-hand (e.g., Eisenman, 2013; Talke et al., 2009; Verganti,
In this context, the example of the successful Dyson DC01 vacuum cleaner is often mentioned, with its new vacuum technology and its atypical design including unconventional colors and a transparent body displaying its inner works (e.g., Eisenman, 2013; Noble and Kumar, 2010; Talke et al., 2009). To explain this and other successful cases combining radical technological and design innovations, it has been suggested that, by embodying new technology in a new product form, the perceived novelty of the technological innovation may be enhanced (Eisenman, 2013; Mugge, Dahl and Schoormans, 2018; Talke et al., 2009). Furthermore, investing in innovative design when new technology emerges can assist in setting an industry benchmark regarding the product form (a ‘dominant design’) to which other firms need to align (Eisenman, 2013). Relatedly, innovative design may actually be prompted or induced by the availability of new technology (Verganti, 2008).

The HOW: Processes for Creating Design Innovation

Much of the previous work on design published in business journals examined the outcomes of investing in design - be it innovative design or design in general. While there is a recognition that design needs to be effectively managed to enhance outcomes (Chiva and Alegre, 2009), little research has focused on how novel design can be created and/or sourced.

There are some insights on the role and activities of designers for the creation of new designs. For example, Bailetti and Guild (1991) argue that product designers should be actively involved in the identification of new product opportunities rather than using designers simply to translate opportunities, identified by other functions, into new products. Having designers formulate as well as execute new product strategy can result in benefits such as greater commitment from designers to agreed-upon solutions (and thus more effective implementation) and the generation of more creative ideas (Bailetti and Guild, 1991).

In their conceptual paper, Veryzer and Borja de Mozata (2005) suggest that a process termed ‘user-driven design’ can help companies to arrive at more innovative design solutions. According to these scholars, user-oriented design activities include envisioning new design directions that refer back to the user experience, an emphasis on early visualization and prototyping, and creating alignment around a (reframed) user-focused objective.

Verganti (2008) proposes a different conceptual point of view, arguing that an innovation process characterized by ‘deep analysis of user needs’, where customers are questioned to discover their needs and wishes, may not deliver very innovative design since customers cannot envision radical, new directions. His conceptual arguments are supported by empirical research.
of Candi et al. (2016), who find evidence that customers seem unable to provide relevant information when companies involve them to co-create products with new meanings. Verganti (2008) suggests an alternative way for creating ‘design-driven’ innovations. Rather than actively involving consumers in the innovation process, he proposes companies should actively involve ‘interpreters’. Interpreters are ‘use experts’ with in-depth knowledge on relevant sociocultural trends and developments and can be creative professionals such as designers, architects and artists but also, for example, suppliers of materials, universities or firms in related industries.

Research on ethnographic enquiry (Rosenthal and Capper, 2006) suggests that a ‘deep dive’ into how customers experience a product may result in the identification of ‘hidden’ opportunities for innovative designs. Such outcomes, however, may be conditional on following a well-designed ethnographic process characterized by a willingness to challenge initial assumptions, field observations of different types of users, and the involvement of designers with experience in interpreting and translating user insights in a creative manner (Rosenthal and Capper, 2006).

Several studies have explored the role of analogical reasoning in creating innovative design. In analogical reasoning (for innovation), knowledge gained in one domain is transferred to another domain to define and solve problems (Dahl and Moreau, 2002). On the basis of an ethnographic study of product design consulting firm IDEO, Hardagon and Sutton (1997) describe how analogical thinking helps designers create innovative products. Using experimental studies, Dahl and Moreau (2002) find evidence that analogical thinking facilitates originality in product concept ideation. Based on field data from 18 design and engineering consultancies, Kalogerakis et al. (2010) extend these findings showing that analogies characterized by a relatively large conceptual distance between the source and the target tend to result in novel solutions. Kalogerakis et al. (2010) furthermore find that, while analogies tend to be a vital part of product ideation in nearly all the sampled firms, useful analogies tend to occur in spontaneous, random ways rather than by means of a formalized, structured process.

Schreiner et al. (2017) provide a concrete method to assess the degree to which design is different from or similar to extant design on the market. This approach can assist firms to find the right balance between design that is ‘unique’ yet ‘familiar’. The method makes use of multidimensional scaling, positioning designs in a perceptual space such that the distance between any two designs reflects the level of (perceived) similarity. To do so, it uses similarity judgments from consumers (who are asked to rate dis/similarity between pairs of objects), supplemented by assessments of design similarity via desk research and interviews with industry experts. The latter, more objective assessments, can assist in identifying which specific design
elements are actually most relevant to consumer similarity judgements. For example, in the case of automobiles, the design of the roof, headlights, and bumper appear to be more relevant for determining similarity by consumers than the design of the car’s tail lights or hood. Ultimately, the created perceptual space provides an overview of the competitive design landscape and allows for specific positioning of new designs.

A Future Research Agenda

Based upon our analysis of design innovation, we offer the following suggestions for future research in the area (see Table 3 for a summary).

The WHAT: Terminology, Empirical Method, and Theoretical Underpinnings

In terms of terminology, there seems to be a need to further explore the conceptualization of design innovation. Research on design innovation is built on the assumption that it captures a different phenomenon than technological innovation. To make a distinction, researchers have differentiated on the basis of a product’s technology and resulting functionality versus a product’s external appearance (see Table 2). However, prior research also suggests that product appearance may be used by consumers for functional inferences (e.g., Bloch, 1995; Creusen and Schoormans, 2005; Mugge et al., 2018). This suggests a link between design innovation and technological innovation that needs to be further explored. Design patent law may be helpful in this regard. Design patent law in general stipulates that, to obtain protection, a product’s external appearance must not be entirely dictated by the technical function of the product (see e.g. European design law, described in Filitz et al, 2015). This stipulation helps to make a distinction between what is protected under design patent law vs utility patent law. Building on this, to make a better distinction between technological innovation and design innovation, the latter may refer to those visual elements of a product that can be changed without having measurable technological or functional effects (cf. Wijnberg, 2004). As Table 2 suggests, current definitions and operationalizations of design innovation do not necessarily include this refinement.

In terms of empirical methods, there is a need for further scale development regarding how to measure design innovation. Studies that do not apply robust scales to measure constructs are
vulnerable to finding spurious results. Furthermore, having a theoretically and empirically sound scale will, hopefully, encourage scholars to conduct more empirical research, which will enable design innovation research to move to a more mature stage. A deeper reflection is, for example, needed on whether to measure design innovation as a reflective versus a formative construct. This decision depends on theoretical considerations—namely, do the construct indicators attempt to reflect the underlying construct or do the indicators collectively form the construct (Diamantopoulos and Siguaw, 2006). In the case of design innovation, the choice may, for example, depend on whether to measure only change in a product’s appearance or capture change in a product’s emotional and symbolic value as well, as suggested by Verganti (2009).

There have been attempts to develop and validate scales to measure new product design in extant literature (Moon et al., 2015; Homburg et al., 2015). However, these scales tend to include both aesthetics and functionality, making it difficult, as noted previously, to differentiate design innovation from technological innovation. Furthermore, these scales do not pay particular attention to measuring the degree to which a design is different from prior designs. Assessments of (perceived) differences can be obtained using the perspective of the company, the industry/market, the consumer, or experts. Assessments do not necessarily overlap; innovative design from a company perspective may not be innovative design from an industry/market perspective. Ultimately, the perspective taken will depend on the aim of the research. For example, when examining how to adjust internal processes for the manufacture of innovative design, innovative design may be measured in terms of design that is new for the company. By contrast, when measuring if innovative, rather than imitative, design results in sustainable competitive advantage, an industry or market perspective is more appropriate.

Next to scale development, there is also a need to examine more in-depth the use of appropriate variables in quantitative analyses, to strengthen the claim that design innovation is the likely cause of the observed effect in the dependent variable, most notably performance. For example, while design novelty and typicality (operationalized as being a “good example of a category”), from a conceptual point of view may be seen as constructs on opposite ends of a continuum, they actually measure different phenomena (Hekkert et al, 2003). Therefore, we advise researchers who measure design novelty to account for typicality separately—which is not common practice (for a noteworthy exception, see e.g., Mugge and Dahl, 2013).

Furthermore, while it is of great interest to have robust quantitative research, there is a need as well for more high-quality qualitative research. As noted earlier, research on how novel design can be created is relatively light. Qualitative methods like ethnographic research into work practices that result in innovative design would truly contribute to furthering the research field.
In order for design innovation research to mature, researchers may also need to utilize diverse theories so as to develop and test comprehensive models to explain when, why and how design innovation contributes to performance and how it can be created. Indeed, thus far the number of conceptual studies on design innovation are surprisingly few and leave ample room for further theoretical development (for notable exceptions, see e.g., Verganti, 2008; Eisenman, 2013). Appropriate theories and frameworks may be found by using more ‘indigenous’ innovation management theories or by using theories from other disciplines, depending on the focus of the research. For example, while research on consumer response to novel design may find appropriate underpinnings in theories on cognitive psychology, research on how to create or source for design innovation, may find its theoretical underpinnings in social or design theories such as structural holes theory or product semantics. Research on design innovation, performance and timing, in turn, may find its underpinnings in (innovation) management frameworks such as the technological trajectories and paradigms, the resource-based view or dynamic capabilities.

The WHY: Design innovation and performance

Innovative design enhances performance but comes at a cost. While creating new design may be less expensive than investing in new technology (Candi et al., 2016), the costs associated with the development and market introduction of innovative design can be substantive (Rubera, 2015) and can counteract the benefits it helps to create. Furthermore, the diffusion of an innovative design may take time and conscious marketing efforts to help the audience make sense of the innovation (Micheli and Gemser, 2016; Rubera, 2015; Verganti, 2008). Future research is thus needed that explicitly examines the costs of developing and launching innovative designs -as prior studies have not sufficiently accounted for these costs.

Future research may also further explore how companies can best facilitate and stimulate the diffusion of innovative design among customers. Prior research suggests that, external cultural agents such as journalists’ product reviews and cultural institutions such as those providing awards and recognition can reduce customers’ cognitive and emotive adoption barriers (Eisenman 2013; Micheli and Gemser, 2016; Rubera, 2015; Verganti, 2009) and facilitate consumers’ sensemaking process. The results of Rubera (2015) suggest that this sensemaking process differs depending on whether innovation is design or technology based, where the sensemaking process may be more of a collective nature for design and of a more individual nature for technology. However, we need to better understand what messages by which type of
cultural agents and institutions are particularly helpful in the diffusion of design innovation and how their effectiveness compares to company-based marketing efforts such as advertising. This would allow companies to make better use of their scarce resources and direct their marketing efforts to those activities shown to be most effective at enhancing consumer adoption of design innovations. It would also be of interest to further explore under which circumstances diffusion of design innovation among customers is strongly influenced by advocacy (or defamation) by cultural agents and institutions. Are these agents, for example, of particular importance for industries where products allow customers to display identity and social status (e.g. fashion)?

Intellectual property rights tend to be relatively ineffective for design innovation (Gemser and Wijnberg, 2001). In addition, design innovations are highly observable (Dan et al., 2018; Rubera et al., 2012). This makes copying by competitors relatively easy and the impact of design innovation on profitability to be potentially fleeting and short-lived. Future research could explore the impact of design innovation on more longer-term competitive advantages such as enhanced corporate reputation, brand loyalty, and the ability to attract top design talent.

Another interesting angle for future research would be to focus on strategies to keep the costs of design innovation down. For example, in the automobile industry, a product platform strategy where automobiles’ internal technology and their outer body operate relatively independently seems to facilitate, from a cost perspective, the introduction of new designs (Chan et al., 2018). Another strategy to keep costs down for design innovation, is to engage in ‘open innovation’ together with consumers rather than using design professionals. While this may reduce costs, the effectiveness of this strategy has been questioned (see below).

In terms of brand recognition, the trade-off between design novelty and design consistency needs further examination. Design consistency is needed for brand recognition (Karjalainen and Snelders, 2010; Kreuzbauer and Malter, 2005; Schreiner et al., 2017), yet design novelty is needed to keep the brand ‘fresh’ (Beverland, 2005; Liu et al., 2017). As the recent results of Liu et al. (2017) suggest, consumers tend to prefer design that is neither too similar to nor too different from the average look of a brand in the product category. Future research could explore more in-depth the tipping point at which too much design novelty hurts brand recognition or, relatedly, how to better prepare the audience for design changes for brand renewal. With regards to the latter, effective strategies to prepare the audience for design changes could, for example, be the release of ‘concept’ studies on future design, as commonly done in the automobile industry, or introducing design change slowly, over a longer period, in consecutive product versions (cf. Kreuzbauer and Malter, 2005).
In terms of consumer response, prior research suggests that both design novelty—in terms of originality and uniqueness—and design typicality—in terms of being typical for the category to which it belongs—influence consumer behavior. As indicated earlier, consumer characteristics such as consumers’ knowledge of the product category and consumers’ tendency toward innovation may influence a preference for design innovation and typicality (Celhay and Trinquemco, 2015). However, more research is needed on how particular situational factors may influence consumer preferences for design novelty and/or design typicality. For example, the degree to which a design is perceived as novel or typical may be dependent on the context in which it is presented (e.g., being displayed with other (a)typically designed products or not).

Another fruitful research direction is to examine, in more depth, which visual design elements in particular contribute to perceptions of novelty, typicality, and consumer acceptance. For example, to optimize design investments, it would be relevant to know whether and when a product’s shape or its graphic elements (like illustrations or typography) are salient attributes for determining perceptions of typicality, novelty, and consumer response.

The WHEN: Timing for Investments in Design Innovation

More empirical research is needed on the complementarities between design and technological innovation, as this research topic is underdeveloped, and the findings somewhat contradictory. On the one hand, research suggests that design should be low in novelty to make technological innovation more easily accepted in the market (e.g., Mugge and Dahl, 2013; Rindova and Petkova, 2007; Rubera, 2015). On the other hand, studies suggest that technology and design innovations may be synergistic complements (e.g., Verganti, 2008), particularly under certain conditions such as the type of branding strategy used (Rubera and Droge, 2013). Future research might further explore the conditions under which technology and design innovations are complementary. For example, the degree to which customers have relevant technological knowledge (e.g., ‘technologically savvy’ customers) may influence their response to combinations of technological and design innovations (Eisenman, 2013).

It may also be of interest to examine more in-depth the influence of industry context on design innovation emergence and success. While research suggests that design innovation may be particularly beneficial when an industry or technology has matured (Candi and Saemundsson, 2011; Chan et al., 2018; Eisenman, 2013), and when design as a competitive tool is widely adopted (e.g., Gemser and Leenders, 2001), it would be relevant to examine the influence of other industry characteristics as well. In her conceptual article, Eisenman (2013), for example,
proposes that design innovation may be more effective when operating in industries that allow for frequent introductions of new design, such as the mobile phone industry or car industry where new models are introduced on an annual basis. However, as is evidenced by cases such as Dyson, Alessi, and Apple, companies can actively change the nature of their industries with design innovation. Specifically, vacuum cleaners, kitchenware or personal computers were not necessarily seen as industries that allowed customers to express their identities until these companies introduced products with innovative designs. Future research could explore further the link between design innovation, industry context and proactiveness.

The HOW: Processes for Creating Design Innovation

There is some evidence that more organic, flexible working practices (Liker et al., 1999), methods such as analogical thinking (Dahl, and Moreau, 2002; Hardagon and Sutton, 1997; Kalogerakis et al., 2010) and ethnographic enquiry (Rosenthal and Capper, 2006), and early inclusion of designers (e.g., Bailetti and Guild, 1991) can facilitate the emergence of novel design. However, more systematic research is needed into the specific processes, activities, and techniques that enable (or hinder) design innovation.

Future research could further explore whether collaborating with external designers (versus internal designers) is more conducive to design innovation as empirical evidence is inconclusive. For example, while the design-innovative company, Alessi, uses predominantly external designers (Dalpiaz et al., 2016), and external designers seems common practice for innovative Dutch and Italian furniture firms (Gemser and Wijnberg, 2001), Apple, another design-innovative company, prefers to use internal designers to create novel design. Further, while the knowledge brokering capabilities of external design agencies like IDEO (Hargadon and Sutton, 1997) suggest their involvement may result in innovative outcomes, it seems that effective management of these relationships is needed to deliver design innovations. For example, Alessi created formal product development roles to protect “the integrity” of external designers’ ideas, while striving for efficient completion of product development projects (Dalpiaz et al., 2016).

With increased interest in open innovation, researchers could investigate the effectiveness of open innovation strategies for novel design creation. Some research suggests that co-creation with ‘ordinary’ customers will not result in innovative design (e.g., Candi et al., 2016; Verganti, 2008). Instead, lead users with advanced market knowledge and needs (Hienerth and Lettl, 2011) or external interpreters with deep domain knowledge should be involved (Verganti, 2008).

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However, ultimately, it is not only who is involved but also the type of open innovation process utilized that will determine outcomes. For example, ordinary consumers may be able to effectively contribute to design innovation with guidance by design professionals. Considering that open innovation may allow for the market introduction of innovative design in shorter time frames (Chan et al., 2018), knowledge about which particular open innovation processes lead to more innovative designs could be useful.

It would also be of interest to examine how companies can optimize collaboration between those responsible for technological versus design innovation, which are normally ascribed to different functions (normally R&D for the former and marketing or design for the latter). While both types of innovations can independently influence performance, design innovation may be stimulated by technological innovation (like the discovery of new materials and production techniques allowing for alternative product shapes and colors). Tentative evidence sustaining this argument comes from the research of Dan et al. (2018) who find that a firm’s R&D spending is positively related to its tendency to apply for design patents. Hence enhanced collaboration between R&D and design may be of benefit for design innovation, particularly since in many corporations, these functions do not collaborate well and tend to be functionally separated (Walsh, 1996).

**Conclusion**

Design innovation has recently captured the attention of innovation researchers and companies alike as a way to gain and sustain competitive advantage. As extant research suggests, design innovation is distinct from technological innovation, even though both types of innovation may interact. In this editorial, we have provided an overview of the current state of research on design innovation sourcing articles from JPIM as well as other influential academic business journals. Using the four themes identified from these articles – the What, Why, When, and How of design innovation- we selected ten JPIM articles that represent the diversity of research on this topic in the journal. We hope that researchers will be motivated and challenged by the research opportunities identified to help move the field of design innovation forward.
Table 1: Overview of Selected Articles (in order of publication)

<table>
<thead>
<tr>
<th>#</th>
<th>Author and Article</th>
<th>Reasons for Selection</th>
<th>Method</th>
<th>Dominant Research Theme(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gemser and Leenders (2001). How integrating industrial design in the product development process impacts on company performance. <em>JPIM</em> 18(1), 28-38.</td>
<td>Gemser and Leenders (2001) empirically demonstrate that innovative design has a different impact than more imitative design; they also show that design impact is different depending on industry circumstances.</td>
<td>Quantitative (survey)</td>
<td>The WHY &amp; WHEN: Design innovation and company performance; when to invest in design innovation</td>
</tr>
<tr>
<td></td>
<td>Authors</td>
<td>Title</td>
<td>Summary</td>
<td>Methodology</td>
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<tr>
<td>5</td>
<td>Kalogerakis, K., Lüthje, C., and Herstatt, C. (2010)</td>
<td>Developing innovations based on analogies: experience from design and engineering consultancies. <em>JPIM</em>, 27(3), 418-436.</td>
<td>Kalogerakis et al. (2010) focus on the use and benefits of analogies for design and engineering consultancies and find, among other things, that analogical distance is positively associated with solution novelty but that there is, in general, no formal process in place for finding effective analogies.</td>
<td>Qualitative (interviews)</td>
</tr>
<tr>
<td>6</td>
<td>Rubera, G. and Droge, C. (2013)</td>
<td>Technology versus design innovation’s effects on sales and Tobin’s Q: The moderating role of branding strategy. <em>JPIM</em>, 30(3), 448-464.</td>
<td>Rubera and Droge (2013) find that the impact of design innovation is moderated by a company’s branding strategy. They also find that that the potential synergistic interaction between design innovation and technological innovation is dependent on a company’s branding strategy.</td>
<td>Quantitative (secondary data)</td>
</tr>
<tr>
<td>7</td>
<td>Mugge, R. and Dahl, D. W. (2013)</td>
<td>Seeking the ideal level of design newness: Consumer response to radical and incremental product design. <em>JPIM</em>, 30 (S1), 54-47.</td>
<td>Mugge and Dahl (2013) provide empirical evidence that a product that is high in technical newness needs to have a design that is low in newness, to lower consumers’ learning cost inferences and to enhance consumers’ product evaluations.</td>
<td>Quantitative (laboratory experiments)</td>
</tr>
<tr>
<td>8</td>
<td>Celhay, F. and Trinquecoste, J. F. (2015)</td>
<td>Package graphic design: Investigating the variables that moderate consumer response to atypical designs. <em>JPIM</em>, 32(6), 1014-1032.</td>
<td>Celhay and Trinquecoste (2015) provide insight into individual and situational moderating variables that influence consumer response to (a)typical design, with a focus on graphic design -rather than product design, which has been studied more frequently.</td>
<td>Quantitative (survey)</td>
</tr>
<tr>
<td>10</td>
<td>Schreiner, T.F., Fanrich,T., Heitmann, M. and Talke, K. (2017). A novel approach for predicting and understanding consumers’ sense of design similarity. <em>JPIM</em>, 34(6), 790-820.</td>
<td>Schreiner et al. (2017) introduce a method to measure the degree to which design is perceived as dis/similar from extant designs. The method leverages survey data as an input for statistical models of the combined impact of objective design characteristics on subjective dis/similarity.</td>
<td>Quantitative (survey, secondary data, interviews)</td>
<td>The HOW: Processes for creating innovative design</td>
</tr>
</tbody>
</table>
Figure 1: A Framework on Design Innovation Research

- **Design innovation: How?**
  - Who to involve, when & how:
    - Involvement of expert and/or nonexpert actors
    - Use of organizational and management practices and structures
    - Use of tools like ethnographic enquiry, analogical reasoning, tools for assessing dis/similarly design

- **Design innovation: What?**
  - Novel product appearance
    - Operationalization & measurement
    - Difference with novel technology (and hence function)

- **Design innovation: When?**
  - Influence of context characteristics, including:
    - degree of technological innovation
    - degree to which design is commoditized

- **Design innovation: Why?**
  - Influence on:
    - company performance (market share, profitability, revenues,...)
    - product performance (sales, revenues, ...)
    - brand performance (brand recognition, brand revitalization, ...)
    - consumer response (attitude, purchase intent, ...)

**Theoretical Embedding**
(e.g., resource-based view; industry/life cycle theories; dynamic capabilities)
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Concept</th>
<th>Definition and Operationalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gemser and Leenders (2001)</td>
<td>Design innovation</td>
<td>Design innovation is defined as the market introduction of design that is new or original in the sense of “being truly different from comparison to the market introduction of design that is “(very) similar or even identical to designs developed at an earlier date” (p. 30). Design intensity was measured by examining investments in product appearance, design awards received, and the use of professional design innovation (defined as specified above) of their products in the last three years.</td>
</tr>
<tr>
<td>Cappetta, Cillo, and Ponti (2006)</td>
<td>Stylistic innovation</td>
<td>Stylistic innovation is not linked to “technological changes” or a product’s “function” but determined by examining the degree of change in design. Aesthetics relate to characteristics that determine “a product/service’s appearance, such as materials, proportion, color, or associations the product/service elicits” (p. 1275). Stylistic innovation is considered present by the authors when a product’s aesthetic and symbolic elements are combined in a way that has never been seen before.</td>
</tr>
<tr>
<td>Dell'Era and Verganti (2007)</td>
<td>Innovation of product language</td>
<td>Product language (also labelled ‘design language’) is defined as: “the combination of signs (e.g., form, colors, materials) that give emotional and sociocultural needs of the customer (compared to product functionality aimed to satisfy the operative needs of the customer) (p. 581). The degree of innovativeness (radical vs incremental) is defined in terms of whether the product language requires “significant reintegration of aesthetic frameworks and definitions of beauty”, proposing “messages in line with the existing sociocultural models” (p. 581). Product was nominated or won a prestigious Italian design award (Compasso d’Oro Award).</td>
</tr>
<tr>
<td>Talke, Salomo, Wieringa, and Lutz (2009)</td>
<td>Design newness (vs technical newness)</td>
<td>The authors focus on the “visual appearance” of a product’s design (p. 601). Design newness of a product depends on the degree of change in product category (p. 603). According to the authors, technical newness “takes a closer look at a product’s inside by focusing on what is inseparable of a new product (p. 602).</td>
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Design newness was measured by a sample of 50 ‘average’ consumers who rated numerous car model’s design newness relative to the segment point scale. Technical newness was determined by 40 industry experts who rated each of the car’s designs. The experts were asked if they achieved performance leap with new technology, made old technologies obsolete, and degree of induced technological change in the industry.

<table>
<thead>
<tr>
<th>Source</th>
<th>Innovation Type</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Eisenman (2013)</td>
<td>Aesthetic innovation</td>
<td>The author defines aesthetic innovation in terms of “tangible design attributes” (p. 333) which are “perceptible through the senses”. The author makes a distinction between product design versus “more technological avenues” for product differentiation (p. 333) that result in new “functional” versus “technological” performance. Conceptual paper so no measurements or operationalizations.</td>
</tr>
<tr>
<td>Rubera and Droge (2013)</td>
<td>Technology vs design innovation</td>
<td>A design innovation is “novel external appearance” (p. 450); “a novel blending of design elements including color, shape, proportion or technology” (p. 448). Technology innovation is measured by examining the number of utility patents while design innovation is operationalized by the number of “visual images” that a consumer finds innovative versus typical.</td>
</tr>
<tr>
<td>Mugge and Dahl (2013)</td>
<td>Design newness</td>
<td>A distinction is made between a product’s functional features (p. 37) versus its design, interpreted in terms of visual appearance (p. 37). Design newness is defined as a “deviation in a product design from the current design state of a certain product category” (p. 34). The fewer visual attributes a product has that are not typical, the more the product is perceived as novel or innovative (p. 35). To manipulate high versus low levels of design newness, consumers examined ‘3D line drawings’ (i.e. the product’s form/ shape) of products as old/novel, not original/original, and not innovative/innovative.</td>
</tr>
<tr>
<td>Celhay and Trinquecoste (2015)</td>
<td>Atypical vs typical design</td>
<td>Design is interpreted in terms of visual appearance (p. 1014). Design typicality is determined by the use of “visual codes” that typify the visual and graphic characteristics most often employed in the category (p. 1016), including, for example, shapes, colors, materials, typography, and other visual codes of its product category, the more consumers will perceive it as typical; conversely, the more design deviates from these visual codes, the more it is perceived as atypical and thus “visually innovating” (p. 1016). Degree of typicality is measured by asking consumers to rate visual images via an online survey (survey items to measure “perceived typicality”).</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Title</td>
<td>Definition</td>
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<tr>
<td>Filitz, Henkel and Tether (2015)</td>
<td>Design innovation</td>
<td>Design is described as a product’s external expression which is contrasted with a product’s “inner workings” (p. 1193). The authors explore “design innovation” and conclude that it does “offer some potential” (p.1203). For legal design protection, a design needs to be ‘new’ (EU design directive) that are not identical to designs already made public, and that have an individual character such that an “informed user” would not consider them to be features that are entirely dictated by the technical function of the product are normally excluded from EU design protection (p. 1195).</td>
</tr>
<tr>
<td>Rubera (2015)</td>
<td>Design Innovativeness</td>
<td>Design innovativeness is defined as “the degree of novelty in a product’s external appearance” (p.98). Technological innovativeness was not formally defined. Design innovativeness was measured by means of examining models of cars and motorcycles introduced in the US market and analyzed journals, focusing on wording such as ‘design’, ‘design language’, ‘look’ and ‘style’ (p. 114). Technological innovativeness was measured in terms of ‘features’, ‘functionalities’ and ‘technology’ (e.g. average fuel consumption’, ‘acceleration’, ‘new engine’) (p. 114).</td>
</tr>
<tr>
<td>Chan, Mihm and Sosa (2018)</td>
<td>Design innovation</td>
<td>A distinction is made between “function”, described as “how a product works” (p. 1230), versus how a product “looks” (p. 1231), interpreted in terms of appearance. Product designs that, when assessed holistically, are visually similar are labelled a “style” (p. 1232). US design patents are used as a proxy for the presence of new product forms and utility patents for new product functionality. Design newness (in terms of degree) is determined within the US legal framework where assessment of similarity of visual appearance across product designs “should be done by a person with ordinary skill in the relevant field, and who possesses reasonable familiarity with the designs” (p. 1233).</td>
</tr>
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</table>

Table 3: Design Innovation Research Suggestions
### The WHAT: Terminology, Empirical Method, and Theoretical Underpinnings

- Further conceptualizations and theorizing to distinguish design innovation from technological innovation
- Scale development for measuring design innovation: reflective vs formative measures; the degree to which a new design is different from existing designs
- Inclusion of both design novelty and design typicality in empirical models
- Qualitative research that explores how novel design can be created and develops new theory
- Better theoretical underpinnings, either by using ‘indigenous’ innovation management theories or bringing in theories from other disciplines, depending on the focus of the design innovation research.

### The WHY: Design Innovation and Performance

- Investigate more in-depth the costs of developing and launching design innovations
- Examine and compare various approaches for facilitating and stimulating diffusion of design innovations to determine their individual effectiveness and complementarity
- Explore the boundary conditions influencing the effectiveness of these different approaches to diffusion of design innovation
- Investigate the long-term advantages of design innovation, for example, on brand recognition, corporate reputation, and the ability to attract top design talent
- Examine the best strategies for reducing the costs associated with design innovation
- Explore the tipping point at which too much design novelty hurts brand recognition
- Investigate effective ways to prepare the audience for design novelty
- Examine in more-depth the relationship between consumer response to both design novelty and design typicality
• Explore how situational or contextual factors influence consumer preferences for design novelty and/or design typicality
• Investigate which visual design elements contribute (the most) to consumers’ perceptions of design novelty, typicality, and their response

The WHEN: Timing for Investments in Design Innovation
• Examine a variety of conditions under which technology and design innovations are complementary
• Explore additional industry characteristics to ascertain if and when design innovation is effective or ineffective and how this can change over time
• Investigate the links among design innovation, industry context, and proactiveness

The HOW: Processes for Creating Design Innovation
• Investigate into the specific processes, practices, and techniques that enable (or hinder) design innovation.
• Compare the effectiveness of using internal versus external designers for design innovation.
• Examine the best ways to manage relationships with external designers.
• Explore if and how different types of open innovation processes lead to greater design innovation as well as who should be involved in design innovation efforts.
• Investigate how companies can optimize collaboration between those responsible for design innovation versus technological innovation.
Endnotes

1. For reviews on different design definitions and how design influences outcomes see, for example: Bloch, 1995; Eisenman, 2013; Homburg et al., 2015; Moultrie and Livesey, 2014; Noble and Kumar, 2010; Walsh, 1996.

2. We highlight the articles we selected for the JPIM virtual issue on design innovation (see Table 1) in bold the first time each is cited or mentioned.

3. Journals included in the Top 50 Financial Times research rank list are journals that in general count towards the research rank of business schools. Of the journals included in the Top 50 Financial Times list, we restricted ourselves to journals that adopt a peer-review system (thus excluding Harvard Business Review and Sloan Management Review) and that, considering the subject area, can be expected to publish papers on design and innovation management. More specifically, we did a search in 20 academic journals falling within the subject area of either management, organizational behavior, entrepreneurship, or marketing: Academy of Management Journal; Academy of Management Review; Administrative Science Quarterly; Entrepreneurship Theory and Practice; Journal of Applied Psychology; Journal of Business Venturing; Journal of Consumer Psychology; Journal of Consumer Research; Journal of Management; Journal of Management Studies; Journal of Marketing; Journal of Marketing Research; Journal of the Academy of Marketing Science; Marketing Science; Organization Science; Organization Studies; Organizational Behavior and Human Decision Processes; Research Policy; Strategic Entrepreneurship Journal; Strategic Management Journal.

4. While we included articles on design innovation from other business journals in this editorial, JPIM virtual issues focus on how the research topic has been examined within the journal. Thus, the ten articles included in the virtual issue are solely articles previously published in JPIM (with design innovation articles published in other business journals excluded from selection). Furthermore, while we did expand our search to other business journals, with our editorial we sought to identify promising research directions that specifically help move forward the field of innovation management -JPIM’s focus- rather than management in general.

5. An article sometimes covered more than one research theme. Classification of an article into a research theme was then based on the main research question answered by the article. For example, while an article may provide a conceptualization of design innovation (the WHAT), when its main purpose was to examine the impact of design innovation on product performance, we would classify the article as examining the WHY. Sometimes, however, an article could have two main purposes and we would then classify an article accordingly. In case of substantial differences regarding classification, the two authors discussed and consolidated the research themes and classification(s) of each article in two rounds.

References


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