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# A MULTIMODAL INVESTIGATION OF THE INSTITUTIONALIZATION OF AESTHETIC DESIGN AS A DIMENSION OF COMPETITION IN THE PC INDUSTRY

Micki Eisenman

## ABSTRACT

*The study applies a multimodal approach to position aesthetic innovation, i.e., the strategic use of aesthetic design attributes, such as color and shape, as an institutionalized aspect of competition, rather than as a firm-specific differentiation strategy, in settings that favor the symbolic meanings of products. Empirically, the study offers a detailed case study of the personal computer (PC) industry to examine the institutionalization of aesthetic innovation as a dimension of competition across industrial firms. The study examines the color and shape of PCs over the 1992–2003 period and situates changes to these attributes in the competitive conditions that characterized the industry, paying particular attention to the introduction of the Apple iMac in 1998. Furthermore, it examines the discursive manifestations of aesthetic innovation by content analysis of reviews of PCs and*

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*interviews with industry executives. Findings demonstrate that, in a period coinciding with a decline in demand for PCs and an overall mature market as well as with the introduction of the iMac, the majority of firms engaged in aesthetic innovation and used a greater number of aesthetic words in describing their PCs.*

**Keywords:** Aesthetic innovation; visuality; multimodality; personal computer industry; institutionalization; incremental innovation

Aesthetic product design – the visual design attributes of a product such as its shape and color, as well as the sensory, emotional, and cognitive responses these attributes elicit – is increasingly recognized as a strategic product attribute (e.g., Bloch, 1995; Celhay & Trinquescoste, 2015; Eisenman, 2013; Hertenstein, Platt, & Veryzer, 2005; Ravasi & Stigliani, 2012; Rindova & Petkova, 2007; Utterback et al., 2006; Verganti, 2009). Specifically, aesthetic design allows firms to communicate with their users (customers, analysts, journalists, shareholders, etc.) by highlighting the products’ potential uses and merits (Creusen & Schoormans, 2005; Norman, 2004; Rindova & Petkova, 2007; Talke, Salomo, Wieringa, & Lutz, 2009). Also, aesthetic attributes communicate various symbolic and cultural meanings that allow users to express aspects of their identities, such as income or social status, through their consumption choices (cf. Belk, 1988; Bourdieu, 1984; McCracken, 1986; Solomon, 1983).

Empirical work on the strategic use of aesthetic design – aesthetic innovation – has examined how specific firms increased their products’ value and differentiated their offerings (e.g., Djelic & Ainamo, 2005 on Nokia; Ravasi and Lojaco, 2005 on Bang & Olufsen; Talke et al., 2009 on Dyson; Verona and Ravasi, 2003 on Oticon; Utterback et al., 2006; Verganti, 2009). Interpreting consumers’ design choices as an expression of their identities suggests, however, that aesthetic design not only offers a means of differentiation, but also allow firms to promote conversations about the links between designs and the identities of their users (Verganti, 2009). This idea positions design not merely as a means of firm differentiation, but as an industry-level aspect of competition that is likely institutionalized in settings in which communication through consumption is important (e.g., Bourdieu, 1984; Diehl & McFarland, 2010; McCracken, 1986). However, research typically confines such institutionalized aesthetic innovation to “cultural” settings that prioritize the delivery of symbolic

value and meaning (e.g., Bourdieu, 1984; Verganti, 2009). Consequently, research has yet to understand the boundaries of institutionalized aesthetic innovation.

To address this concern, aesthetic innovation in settings that are not pre-disposed to design is studied. The US personal computer (PC) industry is an intuitive example of an industry in which aesthetic design was unimportant at its inception, but became increasingly important over time. PCs were initially housed in bland beige boxes and were valued for their technological functionalities. But, more recently, attention to the design of PCs has become important, and PCs are more colourful and streamlined. Additionally, the language used to review PCs has increased its focus on design and its effects. For example, a not atypical headline of a review of PCs from *The New York Times* reads “*A Review of Ultrabooks: Sleek, Sexy and Oh So PC*” (2012). The firms being evaluated for their attempts to design aesthetically stimulating PCs include not only just those at the aesthetic forefront, such as Apple and Acer, but also those not typically associated with aesthetics, such as Dell and Lenovo (e.g., “*Dell Bets Splashy Design Will Sell Its New Laptops*,” Business Week, 2008). These headlines suggest that PCs have symbolic meanings and are not valued only as functional devices.

To study the boundaries of aesthetic innovation, I analyze this increase in the importance of aesthetic innovation in the PC industry. I apply a multimodal approach because aesthetic innovation manifests visually and discursively, as suggested by the above examples. I ask how information conveyed along these visual and verbal modes works to construct meanings by taking advantage of the unique affordances of each mode and their interrelations (cf., Bell & Davison, 2013; Kress, 2010; cf., Meyer, Höllerer, Jancsary, & Van Leeuwen, 2013). Specifically, the study delineates between visual product design in terms of color and shape, which are important because users respond to them in an innate way (Rindova & Petkova, 2007; Ulrich, 2007) and verbal texts. Such texts both frame design as important (Barthes, 1983) and reflect the degree to which design is an institutionalized aspect of competition (Aldrich & Fiol, 1984; Green, 2004). I examine how firms in the PC industry affect the visual elements of PCs and how these visual changes interrelate with verbal texts meant to explain and frame the PC as both a functional artifact and a symbolic one. I embed these analyses in an interpretation of the competitive conditions in the PC industry – a clear, dominant technological design, and a saturated consumer market characterized primarily by incremental technological innovation – and offer a more precise understanding of the industry-level strategic relevance of aesthetic innovation. Findings show an increase in aesthetic innovation as

manifested in the use of color and the manipulation of shapes across industry firms, rather than in the context of firm-level differentiation. Additionally, findings link the increase in aesthetic innovation to the content of verbal descriptions of PCs. They show how visual dimensions of PCs are related to descriptions of users' identities and to emotions and sensations the PCs elicit. Furthermore, findings demonstrate that reviewing PCs for their visual merits has become an institutionalized industry practice.

While findings are specific to the PC industry, they advance organization theory in several ways. First, they extend our ability to understand settings in which the majority of firms are likely to engage to some extent in aesthetic innovation. In such settings, firms develop a product design language that manifests in products' visual attributes and in the verbal language used to discuss and describe the set of attributes that comprise the product. The study understands this product language in the broader context of the visual turn in organizational studies, which suggests that visual and material information illuminates the symbolic aspects of the underlying institutional logics of markets and organizations and of processes of social construction (Bell & Davison, 2013; Höllerer, Jancsary, Meyer, & Vettori, 2013; Jones, Boxenbaum, & Anthony, 2013). Additionally, the study situates attention to design in the context of a socio-cultural environment that appreciates design because of the ways it allows consumers to link consumption to identity and to use artifacts as props, i.e., a basis for identity attributions that users make about each other (e.g., Baudrillard, 1981; Diehl & McFarland, 2010; Featherstone, 1987). The study links this environment to a set of competitive conditions impelling firms to shift some of their attention from technological innovation to aesthetic innovation. Lastly, the study demonstrates the usefulness of a multimodal approach for investigating key dynamics in organizational research by demonstrating how visual and verbal texts work together. In so doing, the study contributes to a growing stream of research using multimodality as a lens that illuminates broader institutional-level effects (e.g., Cartel, Colombero, & Boxenbaum, 2018 on theorization).

The study starts with a description of aesthetic innovation and its strategic benefits. The subsequent section theorizes the contextual settings likely to promote the institutionalization of aesthetic innovation. The third section describes how the study was conducted, detailing the data that were collected, methods of analyses, and the findings. A final section discusses the findings' implications beyond the context of the PC industry and the overall contributions of this study.

## THE STRATEGIC BENEFITS OF AESTHETIC INNOVATION

Overall, aesthetic innovation is tied to users' reliance on products as a means of communicating their identities in the context of a post-modern consumer culture. Post-modern life is characterized by fragmentation and the requirement that individuals shift among multiple roles (Diehl & McFarland, 2010). In this context, individuals search for symbolic props that allow them to enact these roles (Baudrillard, 1981; Featherstone, 1987). This search increases their demand for aesthetically pleasing products and leads to an overall process of institutionalizing aesthetic innovation (Cova & Svanfelt, 1993; c.f. Dobers & Strannegard, 2005; Featherstone, 1987; Verganti, 2009). Importantly, from firms' perspectives, this trend is at the societal level, and aesthetic innovation is, in effect, an institutionalized awareness of the relationship between the product market and the symbolic meanings emanating from the goods. Thus, aesthetic innovation is not only a firm-level choice linked to differentiation but also a broader and joint interpretation of post-modern consumer culture, in which the majority of firms participate.

While we know this to be true for industries in which design is central, such as furniture (Dell'Era & Verganti, 2007; Verganti, 2009), we know very little about the institutionalization of aesthetic innovation in settings not prone to design, such as technological markets. Yet aesthetic innovation should manifest in any industry that is embedded in post-modern consumer culture. Moreover, aesthetic innovation is likely to manifest in a variety of industries because it is strategically beneficial. The manipulation of aesthetic design attributes – those that appeal to users' senses, which are typically, but not necessarily, visual attributes – allows firms to affect users' perceptions about the product. Users respond innately and pre-verbally to certain aspects of design, such as detecting light, motion, shape, symmetry, or gloss. Then, they respond by recalling symbols from memory, but not necessarily in a cognitive manner (Ulrich, 2007).

Furthermore, design attributes communicate information about products and their uses (cf. Eisenman, 2013; Norman, 2004). For example, Black and Decker's sander is shaped like a mouse, with the electricity cord as a tail and grip knobs as eyes. These aesthetic attributes communicate the product's functionality for reaching small, tight spots (Noble & Kumar, 2010). Additionally, users interpret design attributes as signifiers that communicate meanings extending beyond their material embodiment (Krippendorff, 2006; McCracken, 1986; Verganti, 2009). For example, Creusen and Schoormans

(2005) found that users evaluated round shapes as more contemporary, expensive, and playful, while they evaluated angular shapes as outdated, cheap, and business like. Thus, aesthetic attributes evoke the positive affect and approach or negative affect and avoidance which often underlie consumers' choices (Bloch, 1995; Rindova & Petkova, 2007). Relatedly, aesthetic attributes allow firms to create a visible brand identity that appeals to particular social groups (Belk, 1988; Eisenman, 2013; McCracken, 1986). Finally, users believe that well-designed, beautiful products result from firms' attentive production and costly investments. Firms understand that users think this way (Ulrich, 2007).

These strategic benefits explain how aesthetic innovations imbue products with emotional (e.g., affect) and symbolic (e.g., status) attributes of value and why they ultimately increase users' willingness-to-pay (Gemser & Leenders, 2001; Hertenstein et al., 2005). For example, firms in the car industry have been using aesthetic innovation to increase their sales since the late 1920s (Dobers & Strannegard, 2005).

## THE INSTITUTIONALIZATION OF AESTHETIC INNOVATION

Overall, we can expect the institutionalization of aesthetic innovation to result from firms' continuous processes of comparison, which lead to collective cognitions about the finite set of attributes that structure competition within the market (DiMaggio & Powel, 1983; Porac, Thomas, Wilson, Paton, & Kanfer, 1995; White, 1981). Generally, firms decide which other firms are similar enough to them, monitor their choices to the extent these are visible, and orient themselves toward each other, maintaining both clarity about the relevant set of competitive attributes and a unique position in the context of their ability to deliver these attributes. Importantly, firms in the comparative set are not necessarily ideal types, but compete in terms of the attributes to a greater or lesser extent. Thus, in environments in which aesthetic innovation is perceived by some firms to be strategically useful, processes of mimetic isomorphism will drive the majority of firms to pursue aesthetic innovation to some extent. Further, these ideas will have a level of cognitive legitimacy, such that they are taken-for-granted strategic choices and this will be reflected in the industry discourse (Aldrich & Fiol, 1994; Green, 2004).

More specific to a technological context, we can expect the institutionalization of aesthetic innovation to manifest in mature product markets. As technological markets evolve, the underlying innovation characterizing

products becomes increasingly incremental in that it is based on relatively minor modifications to either the way a product operates or to how a product is manufactured (Anderson & Tushman, 1990; Utterback & Abernathy, 1975). At the same time, requirements for performance and reliability are satisfactorily met by industry competitors, and customers cannot differentiate among them (Christensen, 1997). Additionally, demand slows. In these competitive contexts, aesthetic innovations can invigorate competition by stimulating consumption (Christensen, 1995; Walsh, 1996). In making identifiable changes to new models, such as changes to color or shape, firms signal to users that the products are new (Eisenman, 2013). Furthermore, because these products look different, users often perceive them as novel and better (Abrahamson, 1996; Abrahamson & Eisenman, 2008; Lieberman, 2000). Moreover, to the extent that aesthetic innovation does not require extensive technological changes, it is in effect a form of incremental product innovation that is likely to manifest as an institutionalized competitive dimension in mature technological markets (Candi & Saemundsson, 2011; Eisenman, 2013). The following section develops these ideas using the case of the PC industry.

### **AESTHETIC INNOVATION IN THE PC INDUSTRY: DATA, ANALYSES, AND FINDINGS**

To examine the institutionalization of aesthetic innovation as a dimension of competition in the PC industry, I first review the competitive environment in the PC industry. This analysis is essential to contextualizing the shift toward aesthetic innovation characterizing this industry. Specifically, it couches attention to aesthetic design as an institutionalized aspect of competition, one resulting from processes of mimetic isomorphism and patterns of technological competition. Then, I examine the design of PCs in the context of two distinct visual modes, color and shape, which serve as readily identifiable modes that industry actors, such as consumers, intermediaries, and competitors, are likely to recognize and understand in the context of aesthetic innovation. I use this analysis to assess the extent of aesthetic innovation in the industry and to assess the extent to which it was an institutionalized competitive dimension or a strategy for branding and differentiation. Next, I combine these analyses with analyses of texts about PCs that examine shifts in the attention to design. These analyses also assess the institutionalization of design in the context of competition in the PC industry. However, these analyses do so by



demonstrating the extent to which ideas about design-related attributes and the emotional and sensory reactions they elicit are prevalent in the industry discourse.

More specifically, the study consists of a historical grounding of the competitive environment in the industry, a content analysis of pictures of PCs and a content analysis of reviews of PCs during the 1992–2003 period, as well as interviews with industry executives during the 1999–2003 period. In this way, the analyses take a multimodal approach that appreciates the different affordances of visual and verbal modes and views them as working to generate a holistic affect in the context of the setting in which they occur (Jewitt, 2009; Kress, 2010; Kress & van Leeuwen, 2001). Additionally, the analyses pay special attention to a distinctive event – Apple’s introduction of the iMac, a product that clearly exemplifies strategic aesthetic innovation because of the round “gumdrop” shape of the machine and its use of colors such as blue and orange. This manipulation of shapes and colors stood out in the context of the generally rectangular, beige machines that characterized the industry in those years.

### *The Competitive Context of the PC Industry*

The PC industry is an industry characterized by technological stability: firms’ offerings are increasingly standardized and commoditized, and competition is rigorous, as it centers on cost reductions. Only very efficient firms are able to compete successfully (Anderson & Tushman, 1990). More specifically, the PC industry has a clear technological standard, the Microsoft Windows operating system with Intel-made processors (Wintel). An important occurrence in this context was the integration of a graphical user interface (GUI) into the Microsoft operating systems. Until 1990, the Windows operating systems used a DOS-based interface. As such, they were not quite user-friendly and required users to learn specific command formats in order to perform functions on the PC – in effect limiting the range of PC users to those who were more technologically savvy and specialized. A GUI-based Windows operating system was introduced in 1990 (Windows 3.0). This introduction significantly simplified the use of the PC and subsequently enabled a growing number of lay users to enjoy the benefits of PCs (Langlois, 1992). Thus, by 1991, the Wintel standard using a GUI was the established dominant design, manifesting an 85% market share (Hagedoorn, Carayannis, & Alexander, 2001).

Furthermore, the industry’s competitive environment is rigorous, as the industry has been undergoing intense consolidation, and competition is

focused on reducing costs. The market share of the top four firms grew from 37.02% in 1991 (Steffens, 1994) to 54.4 % in 2003 (Gartner Dataquest, 2004), with Dell, the most efficient manufacturer, increasing in size and profitability throughout the 1990s. Also, the industry went through a shakeout, indicative of maturing, standardized industries (Gort & Klepper, 1982). This shakeout resulted from radical price cuts by Compaq and was characterized by a sharp drop in the number of firms in the first half of the 1990s. Specifically, there was an approximately 60% drop in the number of firms, with the 1992 peak of 430 firms dwindling to the 169 firms still doing business since 1998.

Fig. 1 shows the post-shakeout decline in the number of firms listed in the *Thomas Register* as active PC manufacturers during the 1992–2003 period. In addition to this competitive pattern, the industry firms were facing a decline in growth and a decrease in their profitability from the last years of the 1990s onward, as indicated by the second line in Fig. 1. Specifically, from 1991 to 1999, there was an increase in the annual growth of PCs in use in the US market from 7.91% to 12.54%. This growth was driven mostly by increased penetration of the consumer market (Graham-Hackett, 1999). But, from 1999 onward, the rate of growth declined drastically, falling from 12.54% to 2.17%. Importantly, in the 1990s, competition was cost-based, and price declines were significantly larger than in the two previous decades (Berndt & Rappaport, 2001).

As such, the end of the 1990s and the early years of the following decade represented a difficult competitive period for industry firms and one amenable to aesthetic innovation: Demand slowed after periods of very strong growth driven by the proliferation of the Internet. Firms' revenues were declining in response to cost-based competition and users' understanding that processing capacity is likely to rise, while the cost of production is likely to decline. Furthermore, the industry standardized around the almost ubiquitous Wintel standard. In this context, users could hardly distinguish among products based on their functionality or overall technological qualities, such as processing speed or memory size.

In this challenging competitive environment, Apple introduced its iMac in 1998. Although Apple did not conform with the dominant standard in that it did not use the Windows operating system or Intel processors, the iMac was the top-selling machine through retail and mail order channels in the 1998 holiday season, and net sales for that quarter were \$574 million (The New York Times, 1999). This success enabled Apple to regain some of its lost market share in the PC industry as well as gain solid ground using the strategy of aesthetic innovation in other markets. The aesthetic aspects of the iMac were distinctive – its shape was very round, and Apple offered it in a variety of colors.

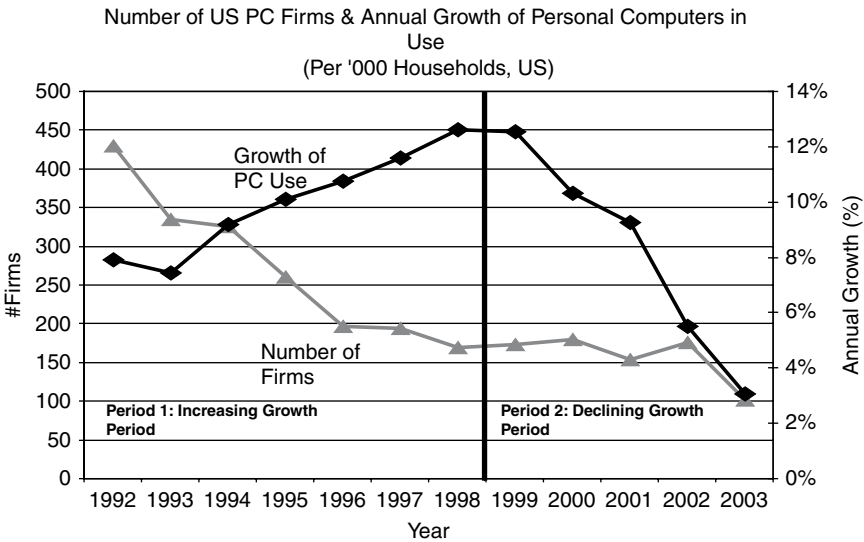


Fig. 1. Number of US PC Firms and Annual Growth of PCs in Use 1992–2003.

Source: Euromonitor Report (2005) and Filson (2001).

While the iMac presented various technological distinctions, such as a comparatively simple interface for connecting with the Internet and no floppy drive (then an industry standard), the aesthetic design of the PC stood out.

Possibly, Apple served as a market leader in the context of institutionalizing aesthetic innovation. Indeed, [Christensen \(1997\)](#) highlighted the idea that comparative parity among firms and the market's limit for absorbing some attributes creates the potential for one or a few firms to take the lead in introducing a new competitive attribute. So, in the context of aesthetic innovation, one market leader or a few firms may analyze the market and their capabilities vis-à-vis the benefits of aesthetic innovation. These firms realize that they can expect users to respond favorably to aesthetic innovation because of the increased relevance of post-modern consumption, the market's evolutionary stage, or their particular skill set. Firms watching these aesthetic innovators and including them in their comparative set are also likely to begin competing with aesthetic innovation. Subsequently, the group of firms pursuing aesthetic innovation is likely to grow, and aesthetic innovation is likely to become an institutionalized competitive dimension. The following section assesses these dynamics empirically.

### *Identifying Aesthetic Innovation*

The following sections use visual analyses of pictures of PCs as well as content analyses of descriptions of PCs to identify the extent of aesthetic innovation in the industry. These analyses aim to capture different modes of communication in the context of the aesthetic design of PCs and to assess the ways their social meanings changed in the context of viewing PCs both as machines with functional affordances and as artifacts that express various social meanings such as identity or social status. The analyses are based on several different data sets and analytic methods: they examine not only the visual attributes inscribed in PCs, and in this sense offer a direct analysis of these machines, but also the language used to describe PCs, and in this sense reflect an interpretation of the PC. However, the affordance inherent in the verbal mode allows us to capture perceived reactions to aesthetic innovation, such as the emotional responses to design or the link between design and identity. Together, the two analyses maximize the affordances of each mode to develop a more comprehensive understanding of aesthetic innovation in the PC industry. To streamline the presentation, a first section focuses on visual analyses and presents the methodological approach and findings of these analyses. A second section focuses on discursive analyses and presents the methodological approach and findings of these analyses. [Table 1](#) summarizes the data sources and analytical methods.

*Visual analyses of aesthetic innovation.* I content analyzed pictures of PCs, as these show visual changes to PCs' aesthetic attributes, to examine the extent of aesthetic innovation in the PC industry. Specifically, I traced the design of PCs along two modes, color and shape. As explained above, these modes are easily and innately identifiable (Ulrich, 2007) and are the basis for the attributions that users make about the products and the ways they express both the producing firms' attributes and users' identity-related attributes (Belk, 1988; Bloch, 1995). I examined pictures used in the 1992–2003 period because Microsoft introduced the improved version of Windows, Windows 3.1, in 1992. This version is the basis for the Wintel standard. (Data were not available for 1991 and no longer available beyond 2003.) I sourced pictures from *PC World* magazine, a widely read magazine that features articles on the industry, emerging and related technologies, product reviews, and advertisements. I selected this magazine as a source of pictures because it offers a consistent presentation of the PCs introduced throughout the period. Moreover, this magazine covers the industry's Wintel machines for the most part and is not targeted toward any particular niche market or toward a market that is pre-disposed to aesthetic innovations.

**Table 1.** Summary of Data Sources and Analytical Approach.

Data	Historical data about PC industry	Pictures of PCs	Pictures of PCs divided by firm type (known brands Vs. white boxes) and by sources of the pictures (from ads or from review articles)	Product Reviews	Interviews with Industry executives
Source	Academic articles and books, analyst reports, Thomas Register	PC World magazine	PC World magazine	ABI Inform databases	ABI Inform database, Lexis/Nexis database
Quantity	Reviewing the history of the industry	1,138 PCs from 128 firms	809 Pictures from ads, 85 from firms; 329 pictures from review articles, 91 from firms. 6 brands identified (Dell, Compaq, Gateway, IBM, HP, and Sony)	1,478 reviews, (89 publications, 918,770 words, 334 firms, and 1,315 products)	49 interviews, (22 firms, 61,103 words)
Motivation for collecting	Historically contextualizing the increase in aesthetic innovation	Identifying the prevalence of aesthetic innovation as indicated by the use of colors and round shapes in the design of PCs	Assessing whether the increase in aesthetic innovation found in previous analysis was specific to known brands or to advertisements that may have a bias for aesthetic innovation	Verbal mode reflects how products are framed and which of their attributes are considered valuable. Content analysis demonstrates both attention to aesthetic innovation and the extent to which it is institutionalized.	Comparing the aesthetic language produced by journalists to aesthetic language produced by firms
Method of analysis	Synthesis of the data	Tracing the proportion of machines that were round or colorful each year	Analyzing the proportion of colorful and round machines according to firm type and picture source in the periods identified as demand growth (1992–1998) and demand decline (1999–2003)	Developing a unique coding dictionary to assess the extent of language pertaining to product aesthetics in the periods identified as demand growth (1992–1998) and demand decline (1999–2003)	Using the GI coding dictionary to assess the extent of language pertaining to product aesthetics in the period identified as demand growth (1999–2003)

For each year, I coded all pictures of computers appearing in the December issue. I coded only one issue per year because the change in actual models and the advertising context which situates them do not change monthly or even quarterly. I coded 1,138 computers from 128 firms. (I also coded the April and August issues for 4 of the 12 years and found no visual or statistically significant differences in the pictures of these months relative to the pictures in the December issue of the same year.)

In coding the colors of computers, I found that most machines were beige or black, with black replacing beige over the study period. However, of theoretical interest were colorful computers. Following the colorfulness of the iMac, I traced the prevalence of colorful computers such as silver, blue, or a combination of two or more colors. Additionally, I coded PCs as round when their designs had curves and roundness and they had a sleeker, more streamlined appearance, rather than angular shapes and corners. Overall, designs evolve along particular axes (Robinson, 1958, 1975) and roundness represents a possible physical axis along which the shapes of PCs progress. More specifically, a “box” to “ball” axis captures a trend from the angular and boxy base-shape of the PC toward the most representative example of an aesthetic innovation in this industry, the Apple iMac, which was round and ball-like. Further, streamlined, round shapes emphasize clean, continuous product lines that are associated with design efforts (Creusen & Schoormans, 2005; Noble & Kumar, 2010). Fig. 2 shows the proportion of colorful and round computers throughout the data collection period.

*Findings.* The data show a marked increase in the proportion of colorful machines from 1998 onward, with a sharp rise following 1999 and a gradual increase in the proportion of round machines from 1995 with a marked jump from 1999 onward. These shifts coincide with both the maturation of the product market and the saturation of the consumer market, as presented in Fig. 1, and with the introduction of the Apple iMac in June 1998. Thus, this analysis links the context of a mature, highly standardized technological product market with a clear example of a strategically successful aesthetic innovation to a marked increase in the proportion of colorful and round PCs, indicating the increasing importance of aesthetic innovation as a dimension of competition in the industry. Specifically, by 2003 about 50% of PCs were colorful (with most others being black and very few remaining beige machines) and about 63% of PCs were round rather than angular.

The nature of the data and its analyses do not allow for any causal argumentation about the relative impact of industry conditions and the introduction of the iMac. However, qualitative analyses of the data, based on identifying colorful or round PCs in the pre-iMac period (1992–1998), show

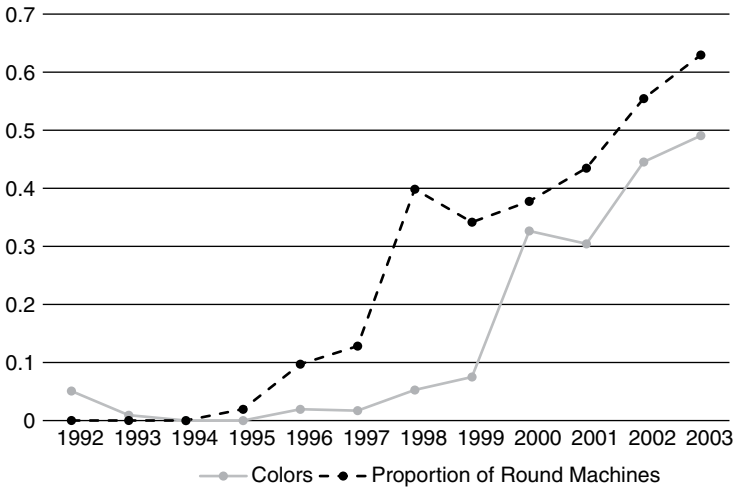


Fig. 2. Proportion of Colorful & Round PCs in Pictures from *PC World Magazine*.

that some firms introduced machines prior to the iMac. For example, Sony introduced a PC in purple and grey in 1996 and purple PCs in 1997 and 1998 and NEC introduced a purple machine in 1997. Compaq introduced round laptops in 1995 and round desktops in 1996. Yet, the more prevalent use of color took hold only after the introduction of the iMac. The use of roundness in Compaq's machines was not as distinct as its use in the iMac, a machine that offered a radically different casing for the PC. This qualitative analysis suggests that the iMac influenced the institutionalization of aesthetic innovation. Specifically, while earlier attempts to offer PCs that were not beige, black, or angular existed, their patterns of introduction appear sporadic and random in the pre-iMac period.

*Aesthetic innovation as differentiation or institutionalization.* In the next set of analyses, I characterized the firms in a variety of ways to ascertain whether aesthetic innovation is a choice of some firms (which would suggest aesthetic innovation is merely a differentiation strategy) or of the majority of firms (which would suggest the institutionalization of aesthetic innovation as a dimension of competition). Based on S&P industry reports (Graham-Hackett, 1999, 2001, 2003), I separated the group of market leaders from the smaller or niche-oriented firms and performed the analysis of the pictures of computers made by Dell, Compaq, Gateway, IBM, HP, and Sony separately. These firms held an increasingly large proportion of the market over the

study period.<sup>1</sup> (These firms are henceforth termed “branded” and contrasted the “unbranded” group). Additionally, I separated pictures according to their source: review articles or ads. Firms may use different criteria in selecting the types of pictures they use in ads (i.e., more expressive and attention-grabbing photos directly linked to aesthetic innovation, if such exist) and those they offer to reviewers (i.e., more neutral and without any visual attempt to manipulate an objective review).

I relied on the results presented above and used them as well as the historical analysis to demarcate the industry into two periods: the period of industry growth (1992–1998) and that of declining growth and the years following the iMac introduction (1999–2003). I compared the prevalence of colorful and round PCs between the two periods in the pictures of branded and unbranded firms. Using *t*-tests, I compared the means of these variables for pictures sourced from the review articles or the ads. I also analyzed desktops separately to determine whether laptops, which may be more amenable to aesthetic innovation because they are more “personal” artifacts, might bias results by overemphasizing aesthetic innovation.

*Findings.* Results of these analyses suggest that both branded market leaders and unbranded firms engaged in aesthetic innovation in the 1999–2003 period, a period of declining growth and one that followed the introduction of the Apple iMac. As seen in Figs. 3 and 4, the color of computers changed to include more varied color combinations, and the shape of computers changed to include more streamlined computers with rounder designs. I present detailed results of these analyses in Appendix A.

Taken together, these findings suggest that aesthetic innovation is an institutionalized dimension of competition in the industry, rather than an approach to branding and differentiation pursued by specific firms. Furthermore, findings clearly demarcate the institutionalization of aesthetic innovation in the 1999–2003 period. As such, findings correlate aesthetic innovation with both the overall competitive environment and the 1998 introduction of the Apple iMac.

In this context, it is important to note that at the time of the iMac introduction, Apple had a marginal slice of the market (2.5%) due to its non-standard operating system. Arguably, it was a firm not in the comparative set of other branded market leaders that adhered to the Wintel standard (Graham-Hackett, 1999, 2001, 2003). This marginality reduces the likelihood that the success of the iMac was enough to drive processes of mimetic isomorphism based on the legitimacy of its strategy. In other words, it is likely that the competitive environment was ripe for incorporating aesthetic innovation as a dimension of competition, and it is more likely that Apple facilitated



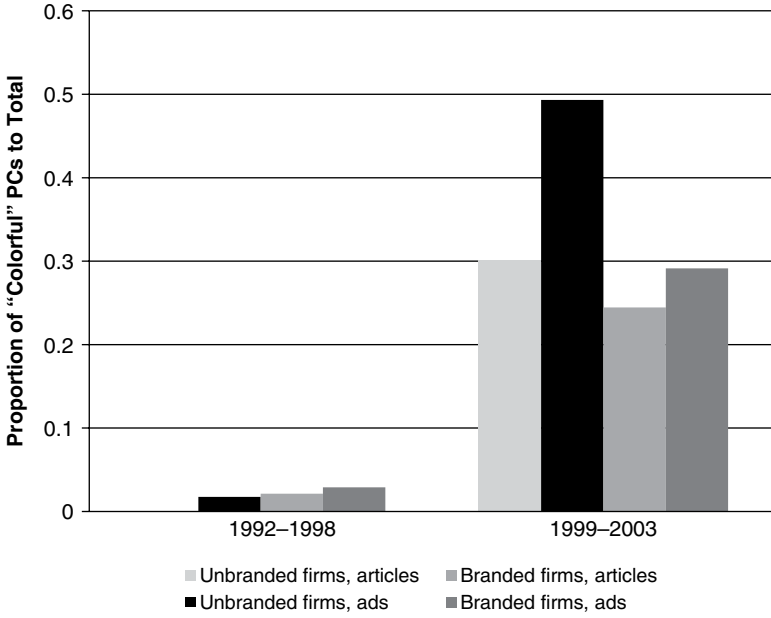


Fig. 3. Proportion of Colorful PCs in Pictures from *PC World Magazine* by Firm Type.

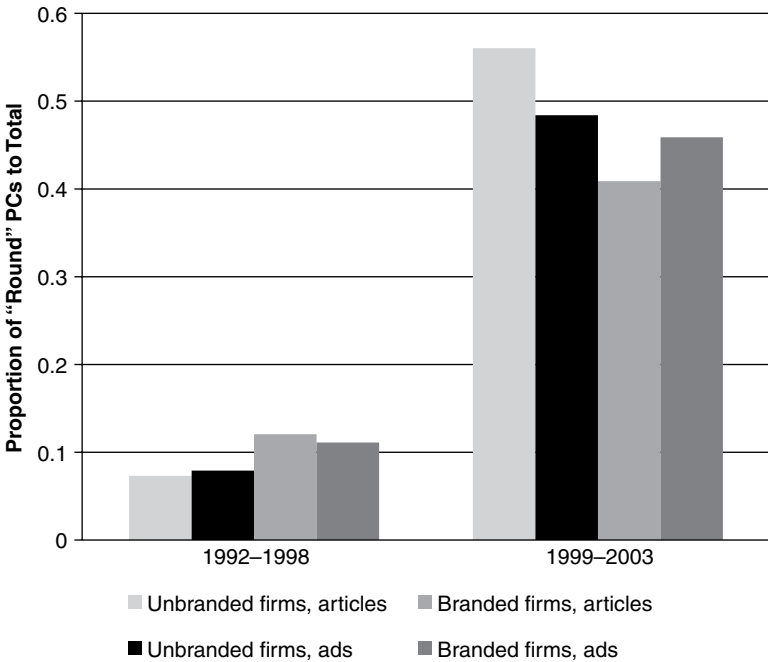


Fig. 4. Proportion of Round PCs in Pictures from *PC World Magazine* by Firm Type.

the process and offered a “proof-of-concept,” than that it introduced a novel strategy which most firms quickly imitated.

*Discursive analyses of aesthetic innovation.* To further understand aesthetic innovation in the PC industry, I collected and analyzed descriptions of PCs written by journalists. The following section introduces the methodological approach in some detail, due to its novelty, and then introduces the findings.

Overall, the verbal mode, based on written descriptions of PCs, is relevant to understanding aesthetic innovation because, as argued above, aesthetic innovations enable users to link product attributes to aspects of their identities. Users establish these links by reading descriptions that position products as signifiers in a semiotic system (Barthes, 1983). In this way, the interaction between the affordances of the visual and verbal modes illuminates the new social and emotional meanings that PCs acquired in the context of competition in a mature market and the institutionalized understandings about competitive dimensions of merit.

As an example, users typically connote the sleek design of Apple’s products to a “cool” identity because journalists describe them in the following way:

When I first saw pictures of the iMac months ago at Apple’s Web site, I almost tried to send in my credit card numbers that very day. *Mac users are cool and clubby*, and that weird, gumdrop-shaped piece of “Bondi blue” plastic seemed like the neatest thing in the world ... In style ... it toasts the competition. The iMac is definitely one hip-looking piece of hardware ... *You’ll never feel cooler.* (1998 review of the Apple iMac in the *Washington Post*). (Italics added)

I collected product reviews because I reasoned that they would reflect firms’ increased attention to aesthetic innovation. First, to the extent that firms affect their products’ aesthetic attributes, reviewers are likely to notice these effects. Second, to the extent that PCs become symbols which users consume to express their identities, reviewers are likely to engage in interpretative descriptions. Thus, the presence of non-technological adjectives, such as “cool,” is indicative of an interpretive description that introduces meanings which do not emanate directly from the machine’s material components. The following analyses trace the use of aesthetic language in industry texts – language describing aesthetic product attributes and the sensory and emotional responses they evoke.

I collected the entire population of full text reviews from all three ABI Inform databases (*Global, Trade and Industry, and Dateline*), the *ProQuest Newspapers* database, and the *Research Library* database (henceforth: the ABI database) for the 1992–2003 period. The data set includes 1,478 reviews (89 publications, 918,770 words, 334 firms, and 1,315 products). The search used “PCs” as the subject term and “product reviews” as the document type.

I used two categorization dictionaries to code the extent of aesthetic language in the product reviews. Categorization dictionaries are lists of words that correspond to thematic categories. By counting the number of words that are common to both the analyzed text and the thematic “dictionary list.” it is possible to conclude the extent to which the text represents the particular theme (Krippendorff, 2004).

*Product Reviews dictionary.* Specifically, I created a dictionary based on the text of the product reviews, following an iterative, multistage process (Abrahamson & Eisenman, 2008; Porac, Wade, & Pollock, 1999). First, using the Simstat/Wordstat content analysis software package, I extracted the list of all the words used in the 1,478 product reviews. From this list, I coded all words with a frequency of 2% or higher, a total of 1,623 words. Coding involved assigning words into thematic categories, such as words that pertain to the senses.

To better understand words that had the potential of multiple meanings (425 words), I examined each word in the context of the sentence and paragraph in which it appeared. Then, I refined the category definitions. I repeated this process in the second and the third iterations. The analysis based on the contextual reading did not generate additional categories, and as such enhanced the reliability of the categorization scheme. Table 2 shows the definitions and examples of words in each category.

The iterative dictionary-building process generated five theoretically relevant sub-categories that capture aesthetic language (153 words). These sub-categories are not meant to be mutually exclusive; rather, the division into sub-categories is a function of the dictionary generation process, which began with a long list of words and categorized them. Therefore, several sub-categories comprise the facets of aesthetic language. The analysis uses aesthetic words in all sub-categories combined as its measure. More specifically, aesthetic language has words that pertain to products’ aesthetic or symbolic appeal (*aesthetics* sub-category), or to the cognitive or sensory responses the products can trigger (*sensory and emotional* sub-category). Also, aesthetic language pertains to physical elements of products’ industrial designs, shapes, and ergonomic elements (the *industrial design, shapes, and ergonomics* sub-categories).

To triangulate findings, I used two additional sets of words: another set of thematic words, labeled *Technological Components and Functions*, has words that describe PCs’ basic hardware components and their technical capabilities in terms of product functionality. Sub-categories here include *system components, hardware, and technical capability* with words naming system’s basic components and mechanisms or specific hardware components, and words

describing what the technology can do, respectively. As it examines attention to technological innovation, this category creates a point of comparison for interest in ideas defined as representing aesthetic innovation. I also generated a list of random words, not particular to either aesthetics or technology, from the product reviews' lexicon, as an additional dictionary category. Arguably, the behavior of these two categories should differ from that of the aesthetic language category.

*General Inquirer dictionary.* To further triangulate findings, I also used the *General Inquirer* (GI) dictionary, a group of several well-validated content dictionaries: The Harvard IV Psychosocial Dictionary (Stone, Dunphy, Smith, & Ogilvie, 1966; Zull, Weber, & Mohler, 1989), Osgood's semantic differential dimensions (Osgood, Suci, & Tannenbaum, 1957), and Laswell's categorization dictionary (Namenwirth & Weber, 1987). The GI dictionary has been used to analyze different types of texts (e.g., Abrahamson & Fairchild, 1999) and is highly reliable. To select the GI categories that could be used as measures of aesthetic language, I reviewed the GI category definitions and selected categories with words that represent visual design, sensory responses, and emotions (see Table 2 for definitions and examples).

*Analytic method.* I used computer aided text analysis, a method asserting that words which occur more frequently in a certain text can be interpreted as more central to the text. Another key assertion is that changes in the frequencies of words over time indicate changes in the level of attention devoted to a particular issue (Krippendorff, 2004). In this theoretical context, aesthetic language suggests the extent to which aesthetic attributes are relevant to products' evaluations.

I used the content analysis software to generate the list of words used in the reviews for each year in the 1992–2003 window and counted the number of words from each dictionary category that were present in this list. I followed Abrahamson and Fairchild's (1999) use of residual word counts to factor out the causal effect of very large variations in the total number of words on changes in the frequency counts of the thematic categories. Specifically, I regressed the number of words in a thematic category for a given year on the total number of words in all the articles that year:

$$Y [\text{total number of words in category } c, t] = \beta^* \times [\text{total number of words in all categories, } t] + \varepsilon$$

This functional form forecasts the number of words expected for each category on the basis of the total number of words in a particular year. However, I used this form to generate the residuals – the differences between the actual observations and the forecasted observations (i.e., regression errors). The interpretation of the residuals assesses their signs (Abrahamson & Fairchild, 1999;

**Table 2.** Dictionary Categories.

Measure	Category Name	Definition	Examples
Product Reviews Dictionary Categories: Aesthetic language	Aesthetics	Words that relate to the physical and / or symbolic appeal of the product. (29 words)	<i>Beautiful, colorful, stylish...</i>
	Sensory and Emotional	Words that pertain to the cognitive and sensory response the product evokes. (20 words)	<i>Pleasure, clever, vibrant...</i>
	Industrial Design	Words that express design in the context of materials and textures; words that emphasize the visible aspects of the design rather than the technological aspects. (37 words)	<i>Heavy, material, sturdy...</i>
	Shapes	Words related to the physical shape of the PC. (31 words)	<i>Bulky, curve, slim...</i>
	Ergonomics	Words that pertain to how the industrial design of the product affects users' interactions with the products. (36 words)	<i>Adjust, comfortable, tilt...</i>
Product Reviews Dictionary Categories Technology language	System Components	Words that refer to a PC's basic system components and mechanisms. (37 words)	<i>Desktop, laptop, digital, DOS...</i>
	Hardware	Words that refer to specific hardware components. (85 words)	<i>Hard drive, mouse, motherboard...</i>
	Technical Capability	Words that pertain to what the technology can do, including many verbs and words describing the achievements of the technology. (61 words)	<i>Operate, process, boot...</i>
General Inquirer Dictionary Categories: Aesthetic language	Arousal	Words indicating excitation. (166 words)	<i>Awe, emotion, mellow...</i>
	Pleasure	Words indicating the enjoyment of a feeling. (168 words)	<i>Admiration, amuse, bliss...</i>
	Quality	Words indicating qualities that can be detected by the human senses. (344 words)	<i>Glamour, sleek, fashionable...</i>
	Color	Colors. (21 words)	<i>Black, blue, beige...</i>
	Skill: Aesthetic	Words mostly of the arts. (35 words)	<i>Beautiful, graceful, lovely...</i>

Stavins, 1995). Positive residuals indicate that: (actual word count in a category) – (predicted word count in a category) > 0, or that the actual count is greater than expected, and that by extension, the category is particularly strong that year. By the same logic, negative residuals indicate that: (actual word count in a category) – (predicted word count in a category) < 0, or that the actual count is smaller than expected, and that by extension, the category is particularly weak that year. To estimate the prevalence of aesthetic language, I compared the mean residual score in the increasing growth, pre-iMac period (1992–1998) with the mean residual score in the declining growth, post-iMac period (1999–2003). The comparison is descriptive, rather than inferential, because I had the entire population of articles, rather than a sample.

*Findings: Journalists’ use of aesthetic language.* Results show that journalists emphasized and interpreted aesthetic product attributes to a greater extent in the second period (see Fig. 5). Using the Product Reviews dictionary, the frequency of the aesthetic words in the text of product

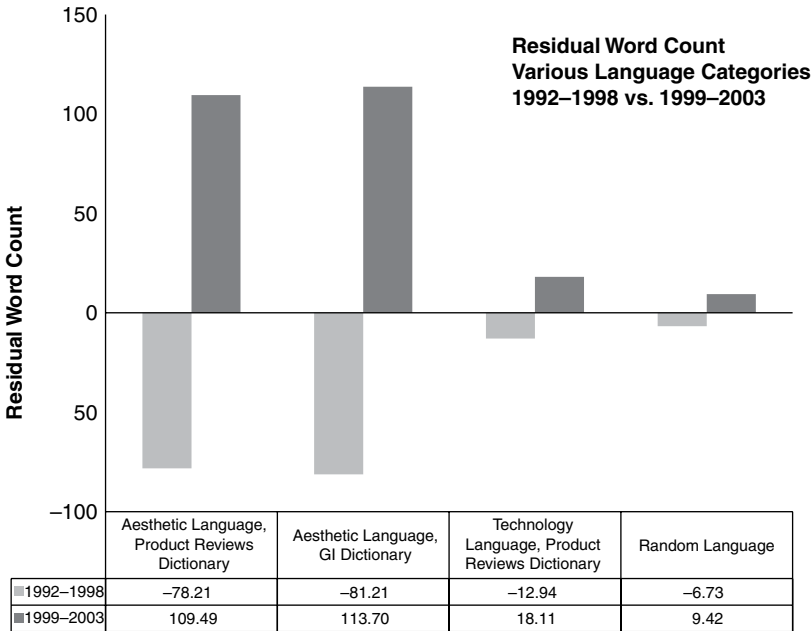


Fig. 5. Language Analyses, Product Reviews.

reviews, controlling the total number of words in a given year – the residual count – was negative ( $-78.21$ ) in the increasing growth, pre-iMac period (1992–1998). This frequency increased to a positive count ( $109.49$ ) in the second, declining growth, post-iMac period (1999–2003). Results are indicative of the differences in the relative interest aesthetic language received. For example, in the second period, there were 109 more aesthetic words than expected. These residual counts are very large (for comparison, see [Abrahamson & Fairchild, 1999](#)). Thus, results suggest that as firms engaged in aesthetic innovation, journalists allocated space to describe these aesthetic innovations.

The results were replicated using the GI dictionary: the residual word count for the aesthetic language measure was negative ( $-81.21$ ) for the first period and positive ( $113.70$ ) for the second period. This replication increases the reliability and construct validity of the Product Reviews dictionary measure.

Moreover, the *Technological Components and Functions* category and the randomly selected words displayed overall different behavior relative to the aesthetic language categories. In addition, the residual counts were much smaller (see [Fig. 5](#)). These small residual word counts suggest there was relatively little difference in the patterns of the thematic categories that were not theoretically motivated, further establishing the discriminant validity of the Product Reviews dictionary. I describe additional robustness analyses in Appendix B.

*Findings: Firms' use of aesthetic language.* The above results are derived from analyzing reviews of PCs written by journalists. To get a sense of aesthetic language in texts generated by firms, I collected interviews with industry executives to assess the overall aesthetic tenor in the industry. Specifically, I collected interviews from both Lexis/Nexis and the ABI database for the 1999–2003 period. The Lexis/Nexis search collected all interviews tagged as “PCs” and “management” in the *General News, Magazines and Journals, Business, and Finance and Industry* database categories. The ABI search tagged “PCs” and “interview” in article type. I read interviews to remove duplicates and verify relevance, leading to 49 interviews (22 firms and 61,103 words). I traced the extent of aesthetic language in the interviews over the 1999–2003 period using the GI dictionary. Again, comparison is descriptive, rather than inferential, because I had the entire population of interviews, rather than a sample.

[Fig. 6](#) graphs the proportion of aesthetic words relative to the total number of words. Results show that the presence of aesthetic language in industry interviews increases consistently throughout the declining growth, post-iMac, period (1999–2003), from 1.4% to 1.9%. Arguably, this finding demonstrates the increase in attention to aesthetic innovation throughout the PC industry and that it is not limited to the choices of a specific firm, but reflects the institutionalization of aesthetic innovation in the PC industry.

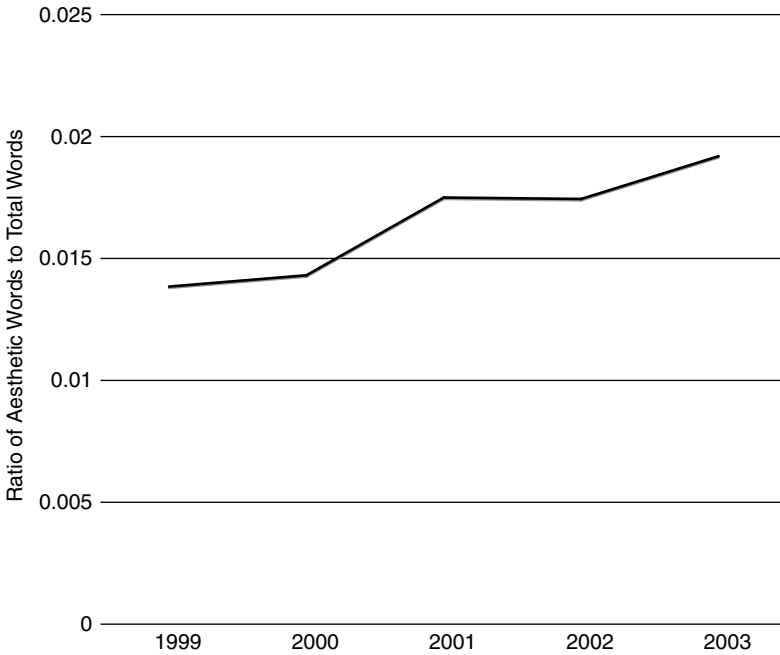


Fig. 6. Prevalence of Aesthetic Language in Industry Interviews (GI Dictionary).

To summarize, findings work together to demonstrate that a competitive environment characterized by standardization and commoditization, market saturation, and high reliability of the technology was amenable to incorporating aesthetic innovation as a dimension of competition. The institutionalization of aesthetic innovation manifested in two ways: firms, both differentiated branded firms and unbranded ones, engaged in aesthetic innovation by making PCs that were colorful and rounder, and journalists attended to aesthetic innovation in their product evaluations, while firms increased their discursive attention to aesthetic innovation. Further, findings show that a prominent strategic success in applying aesthetic innovation, the introduction of the iMac, preceded the prevalence of aesthetic innovation in the industry.



*Apple's Role in Institutionalizing Aesthetic Innovation in the PC Industry*

Again, the study design does not assess the causal impact of the iMac. Nonetheless, in the context of the discursive analyses, it is important to highlight Apple's discursive impact. Possibly due to its historic prominence in the PC industry and the charisma of its founder, Apple garnered a disproportionate amount of media attention. Overall, Apple had lost market share over time and did not adhere to the Wintel industry standard, issues that would suggest the media would position the firm as marginal and negligible. Yet, the data contain a high number of product reviews pertaining to Apple. Specifically, Apple has 142 reviews in the data, while Dell, with four times the market share (Graham-Hackett, 1999), has 151 reviews. Also, Apple issued a relatively high number of press releases related to product launches (99 releases with 61,541 words) relative to Dell, the industry leader (168 releases with 92,643 words over the same period). It is likely that this disproportionate discursive representation amplified Apple's strategies and increased their impact.

Overall, firms that receive a lot of coverage becomes more influential and more likely to be imitated. Journalists confer legitimacy, shape markets, and frame attention by selecting which information to emphasize (Aldrich & Fiol, 1984; Micheli & Gemser, 2016; Pollock & Rindova, 2003; Rindova, Pollock, & Hayward, 2006). So, coverage positions firms' choices as an institutional norm and implicitly encourages other firms to behave similarly (DiMaggio & Powell, 1983). Therefore, while Apple was not the first firm to introduce colorful or round PCs, Apple's timing and execution garnered the success and attention that may have been required to institutionalize aesthetic innovation in the PC industry. Importantly, as suggested in Appendix B, the increase in aesthetic language reflects a change in the body of reviews as a whole, rather than an increase associated with Apple.

Additionally, research suggested that in competitive settings in which most firms meet the markets' requirements along some attributes, the market is likely to shift to a new set of competitive attributes. This transition is likely to occur in response to a successful strategy of one or a few firms (Christensen, 1997). This argument pertains to the results derived here. The institutionalization of aesthetic innovation in the PC industry was embedded in the competitive context of a market in which products were commodities of similar and adequate quality and reliability. This market was receptive to a strategy that would emphasize the signaling ability of products (Candi & Saemundsson, 2011; Eisenman, 2013). Moreover, this market was receptive to a firm, in this case Apple, taking the lead in terms of introducing this new attribute.

Apple was suited for introducing this competitive dimension due to both its inherent capabilities in terms of product design and its ability to garner media attention. Nonetheless, it is important to remember that, as detailed above, Apple was not the first or only firm to offer colorful or round machines, and that its competitive position is unlikely to have made its choices regarding aesthetic innovation the basis of an emergent competitive dimension in a different competitive setting.

## DISCUSSION

As a whole, the study presents a systematic multimodal methodology that elucidates the ways in which both the design and descriptions of PCs worked to reposition their social meanings and the overall understandings about the relevant competitive dimensions in the PC industry. This paper studies the manifestations of aesthetic innovation as an institutionalized, industry-level dimension of competition in a setting in which the symbolic dimension of products became increasingly important. It couches the competitive role of the PC as an artifact that is both technological and socially meaningful in the context of management knowledge about the evolution of technological competition. Specifically, using a variety of visual and verbal modes, the study examines firms' increased attention to aesthetic innovation over the 1992–2003 period and attends to Apple's role in affecting this attention. Findings show that the institutionalization of aesthetic innovation in the PC industry emerged in the context of a competitive environment that was likely to benefit from attending to aesthetic product attributes: color and shape became more important when growth slowed. Potentially, in this setting, the introduction of the iMac and its market success were more likely to be understood as an important, rather than esoteric, strategic choice. This understanding, by firms as well as evaluators, likely led firms to increase their attention to aesthetic attributes such as color and shape, in effect, legitimating this strategy. Here, findings examine the language used to describe PCs and to evaluate competition in the industry and show an increased use of aesthetic language in a period coinciding with a decline in growth and the years following the introduction of the iMac.

### *Theoretical Implications*

The study responds to the call for using a multimodal lens to expand our understanding of organization theory and of the visual turn more specifically

(e.g., Bell, Warren, & Schroeder, 2014; Meyer et al., 2013; Ravasi & Stigliani, 2012; Zilber, 2018). Visual information, such as aesthetic design, has significant communicative potential for conveying complex ideas effectively and immediately. By focusing on the institutionalization of visual changes to PC design, the study adds to research in several areas.

First, by focusing on the agency of Apple, the study adds to a line of work examining the institutional conditions shaping the relationship between organizational practices and the visibility of artifacts (e.g., Höllerer et al., 2013; Lefsrud, Graves, & Philips, 2018; Oberg, Drori, & Delmestri, 2018). The study traces a setting in which a particular actor influenced other actors in the field, namely competitors and journalists, and links this influence to the competitive setting that enabled it. Specifically, the study links the distinct visual attributes of Apple's iMac and its market success to changes in a dimension of competition within a technological industry.

More generally, the findings demonstrate the usefulness of the multimodal approach to understand key institutional processes, such as mimetic isomorphism and loose coupling (DiMaggio & Powell, 1983). Research has used discursive analysis to demonstrate processes of mimetic isomorphism (e.g., Abrahamson & Fairchild, 1999), but the analyses here integrate discursive patterns with visual ones when they show how industry actors affected the design and the descriptions of PCs. Moreover, the analyses, in that they distinguish among the behaviors of branded and unbranded firms, demonstrate that these behaviors manifest at the industry level, rather than at the level of an individual firm. Relatedly, these patterns speak to issues of loose coupling. While branded firms are likely firms that invest in the development of their designs, unbranded firms are likely imitators. Put differently, for unbranded firms, attention to design is likely loosely coupled with key processes within the firm, but nonetheless, these firms participate in the practices of visual design that have become institutionalized.

Second, the focus on visibility in product markets suggests that technology producers, in this case PC manufacturers, are, in effect, manufacturing cultural goods. The aesthetic attributes that firms develop are intended to trigger evaluations based on emotional and sensory responses and the associations these responses evoke. In other words, firms develop technologies and understand that these technologies are marketed and consumed in a setting that values the communicative potential of aesthetic attributes as symbols that users link to their identities. Here, the focus on visibility allows the study to bridge a common schism in most organizational research – that between technological and cultural production. While research typically evaluates competition and progress in technological industries by examining firms' efforts to

improve underlying functional product attributes and production efficiencies, this study integrates ideas about production of culture and sociology of consumption into extant frameworks about competition.

More specifically, the focus on the aesthetic design of PCs highlights the significance of PCs as artifacts that are signifiers in a semiotic system with two orders of meaning (e.g., Verganti, 2009). While first-order meanings are typically tied to an artifact's functionality, such as understanding a PC as an information processing device, second-order meanings are typically tied to shared interpretations of the visual attributes of the artifact, such as understanding the PC as a symbol suggesting its owner is "cool." In this way, PCs are not merely functional artifacts but also symbolic ones.

Third, the study highlights the important role of the media in the context of institutionalizing aesthetic innovation. The media both reflect firm behavior and influence it (Gamson & Modigliani, 1989; Kennedy, 2008). Specifically, by reading what journalists write, firms sharpen their understandings of what the market values (Rosa, Porac, Runser-Spanjol, & Saxon, 1999) and which firms are in their comparative set (Kennedy, 2005). Thus, the increased attention by journalists likely ignited a positive cycle in which writing about aesthetic innovation increased the legitimacy of this strategy, possibly leading more firms to engage in aesthetic innovation, and subsequently offering more content related to aesthetic innovation for journalists to review.

Fourth, by exploring aesthetic innovation as an industry-level transformation rather than a firm-level choice, the study links our knowledge of visibility to our understanding of the evolution of competition. The study traces changes to the design of PCs in the context of a standardized technological market in which innovation was primarily incremental. Thus, it lends empirical heft to studies theorizing aesthetic innovation as a form of incremental innovation more likely prevalent in mature technological markets (e.g., Candi & Saemundsson, 2011; Christensen, 1995; Eisenman, 2013; Rindova & Petkova, 2007; Walsh, 1996).

#### *Limitations and Future Research*

The interest here in tracing an institutionalized use of aesthetic innovation implicitly assumes that this type of innovation is strategically beneficial. Future work could explicitly assess whether PC firms were able to increase their margins or slow down the decline in growth after engaging in aesthetic innovation. Evidence shows that growth of PC sales increased after 2003 (7.7% in 2004 and 11% in 2005 (Yang & Williams, 2009)). Tying aesthetic

innovation to growth would enhance extant work showing that aesthetic innovations positively affect sales (e.g., Bornemann, Scholer, & Homberg, 2014; Gemser & Leenders, 2001; Hertenstein et al., 2005; Yamamoto & Lambert, 1994).

Furthermore, future work would need to ascertain the generalizability of these ideas to other technological settings. Interestingly, anecdotal evidence from the car industry suggests that General Motors realized that investing in aesthetics and introducing new models with minor technological changes but noticeable aesthetic ones was an important competitive choice. Over the course of relatively few years, the firm's competitors appreciated the strategy and joined in its pursuit, leading to a market in which aesthetic innovation is an institutionalized competitive dimension (Sloan, 1964).

## CONCLUSIONS

In sum, the study suggests that the aesthetic design of products is not only a dimension for differentiating them, but also a lens for understanding their production in the context of a broader socio-cultural environment. Moreover, this study is among the first to develop an institutionalized understanding of aesthetic innovation demonstrating the behavior of multiple firms and extending it toward technological contexts and beyond firm-level aesthetic capabilities. It does so by presenting a rigorous multimodal analysis that combines visual and verbal modes, and by so doing, advances our abilities to understand the relationship between visual communication, processes of institutionalization, and the social construction of meanings.

## NOTE

1. Although Sony did not have a large share of the market, the firm has a distinct brand and a sizable number of pictures in the data. Other known brands (e.g., Acer, Toshiba) did not have enough pictures to justify inclusion in the branded group. Further, to test this separation, I also analyzed each of the larger firms (Dell, Compaq, and Gateway) separately, but did not find different result patterns.

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## APPENDIX A: AESTHETIC INNOVATION AS DIFFERENTIATION OR INSTITUTIONALIZATION

The analyses that follow examined pictures according to their source (review articles or advertisements) and distinguished between the design of machines from firms that have a clear brand and relatively sizable market share (Dell, Compaq, Gateway, IBM, HP, and Sony) and other firms (termed non-branded). The analyses compared the pictures in terms of the color and shape of the PCs.

*Comments:* The effect sizes of the Cohen's  $d$  values indicate that these differences are large. Further, for the analysis of the pictures sourced from the review articles, and for the roundness variable in the pictures sourced from the advertisements, the differences in the differences between the periods for both groups of firms are not qualitatively or statistically significant (ANOVA results not shown). The differences in differences are statistically significant for the color variable in the pictures sourced from the ads [ $F = 4.38$ ,  $df = 1, 20$ ,  $p < 0.05$ ]. Thus, the changes for the unbranded firms between the first and second periods are stronger than the changes for the branded firms. However, the time difference effect is highly robust for both groups of firms and the interaction effect is small. So, the overall interpretation that branded and unbranded firms engaged in more aesthetic innovation in the 1998–2003 demand decline, post-iMac period, holds.

*Robustness check:* These visual analyses were also performed separately for pictures of desktops (442 pictures of desktops in the ads, 214 of branded firms, and 228 of unbranded; 247 pictures of desktops in the review articles, 94 branded, and 153 unbranded). Results in the direction of change hold for these sub-samples, and all but the change in the proportion of the color category for pictures of unbranded firms sourced from the ads are statistically significant. In other words, the increase in the prominence of aesthetic innovation is not associated only with laptop computers, machines that are more likely to speak to users' identities due to their size and portability. Possibly, the data for the pictures of unbranded machines in the ads may have been biased by a strong prominence of colorfulness in the laptops. However, this result does not affect the overall interpretation of results.

**Table A1.** Proportion of Colorful and Round PCs by Picture Source, Firm Type, and Time Period.

Picture Source	Review Article (N = 329) (91 Distinct Firms)				Advertisement (N = 809) (85 Distinct Firms) <sup>a</sup> *			
	1992–1998	1999–2003	1992–1998	1999–2003	1992–1998	1999–2003	1992–1998	1999–2003
Period								
Firm type	Unbranded firms (N = 191)				Unbranded firms (N = 402)			
Proportion of colorful PCs	0	0.3	0.02	0.24	0.17	0.49	0.02	0.29
Statistics	$t = -2.9$ , $df = 4$ , $p < 0.05$ , Cohen's $d = 2.9$				$t = -4.79$ , $df = 4$ , $p < 0.01$ , Cohen's $d = 3.8$			
	$t = -2.58$ , $df = 4$ , $p = 0.06$ , Cohen's $d = 2.58$				$t = -3.8$ , $df = 4$ , $p < 0.01$ , Cohen's $d = 3.8$			
Proportion of round PCs	0.07	0.56	0.12	0.4	0.07	0.48	0.11	0.45
Statistics	$t = -3.65$ , $df = 6$ , $p < 0.01$ , Cohen's $d = 2.98$				$t = -4.76$ , $df = 9$ , $p < 0.01$ , Cohen's $d = 3.173$			
	$t = -3.67$ , $df = 10$ , $p < 0.01$ , Cohen's $d = 2.32$				$t = -3.91$ , $df = 10$ , $p < 0.01$ , Cohen's $d = 2.47$			

<sup>a</sup>Several firms appeared in both groups of pictures, total number of distinct firms in the data set is 128.

## **APPENDIX B: ROBUSTNESS CHECKS: JOURNALISTS' USE OF AESTHETIC LANGUAGE**

I performed additional analyses to assess the robustness of the findings describing the discursive dynamics of product reviews (not graphed or detailed due to space limitations). First, I analyzed reviews after removing Apple-related reviews using both the Product Reviews and GI dictionaries, and the pattern of results holds. Thus, changes in language patterns are not based only on journalists' reactions to the product choices of Apple, a firm clearly engaged in aesthetic innovation. (Results also hold when reviews of Dell, Compaq, Gateway, and other large, branded firms are removed.) Therefore, findings suggest that the patterns of discursive change in the data represent journalists' reactions to product choices of many firms.

Next, the pattern of results for the reviews that discussed only desktops holds when both the Product Reviews and GI dictionaries are used. Results of this analysis suggest that the basic pattern of results is not driven by journalists' reactions to smaller, portable machines more likely to link to users' identities. Additionally, findings hold for a subset of trade publications targeting IT professionals, using both the Product Reviews and GI dictionaries, and consequently, the basic pattern of results is not driven by language addressing the lay-user subset of the market.

Lastly, I ran each of the analyses with an alternate periodization: 1992–1996 and 1997–2003. Arguably, results should differ, as they indeed do. Overall, the change in the direction of the residuals, from negative to positive, was different for all the analyses using the aesthetic language measures obtained from both the Product Reviews and GI dictionaries. This finding suggests that the periodization scheme does capture an underlying industry shift.