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Categorical Design Departure and Symbolic Enhancement: A Study of the Receiver-in-the-Ear Hearing Aid Style

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Abstract

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Introduction

‘Product form design’ is defined as the overall shape, material, texture and color of a product (Krippendorff, 1989; Norman, 2013; Rindova and Petkova, 2007). The type of design that has taken the spotlight of innovation research has been technological designs (Henderson and Clark, 1990). A technological design is defined within the literature as the basic architecture, understood as the way the components of a product are assembled (Baldwin and Clark, 2000). Technological designs have been found to have considerable effects on the dynamics of competition, the organization of product development and technological trajectories, as they can come to constitute ‘dominant designs’ (Anderson and Tushman, 1990; Henderson and Clark, 1990; Clark, 1995; Baldwin and Clark, 2000). Product form designs on the other hand greatly affects how users understand and valorize the products they encounter (Verganti, 2008; Ravasi and Stigliani, 2012). Our knowledge of the relationship between these two aspects of product design is however scant (Verganti, 2008; Eisenman, 2013). To expand our knowledge of this area, this paper will study the relationship

¹ The author would like to thank hearing aid historian, curator of the Eriksholm Collection and service and support manager at the Eriksholm Research Center (Oticon A/S), Claus Nielsen for granting access to the archive and library of the Eriksholm Research Center as well as the memory and kind help of many of the most insightful people in the hearing aid industry.

between innovation in product form design and the establishment of new dominant technological designs within industries.

Early research on innovation in product form design mainly sought to establish the theme as a field of enquiry exploring innovation in design intensive industries and the commercial and strategic role of innovation in product form design (Verganti, 2003; Ravasi and Lojcono, 2005; Cappetta, Cillo and Ponti, 2006). Recent research has shifted focus from understanding the dynamics of innovation in product form design solely, to exploring how it relates to technological change and industry dynamics (Rindova and Petkova, 2007; Talke et al, 2009; Eisenman, 2013; Verganti, 2011; Norman and Verganti, 2014). To designate such innovations, the concept of aesthetic innovation, defined as the utilization of product form designs to enhance the experimental, emotional and symbolic attributes of products (Eisenman, 2013), will be used.

Until now, studies have mainly suggested that the role of product form design in the early stages of technology lifecycles is to create institutional legitimacy of the product by limiting the cognitive distance to previous designs. Hargadon and Douglas' (2001) study of the transition to electrical lightening found how product form design played an important role in creating institutional legitimacy by imitated the former technology of the oil lamp. The findings of this study have been echoed throughout the literature on product form design. The work of Eisenman (2004, 2013) suggests that prior to the establishment of a dominant design product designs will typically seek to explain the functionality of new technology, rather than enhancing their symbolic attributes. After the establishment of a dominant design, as the technology matures, the role of product form design will shift towards extending the categorical departure in order to create renewed excitement or add symbolic value to products. Rindova and Petkova (2007) argues that since novel technologies often will present a considerable cognitive distance from the evaluator schemas that users have of the product category, product form design should aim for categorical resemblance in the early stages of a new technology. If a product utilizing a new technology represents a too far cognitive distance from the former, users will tend to evaluate it as strange or useless.

In contrast to these observations, the study by Talke et al (2009) shows that high design novelty can increase sales early in technology lifecycles were technological improvements are un-transparent or invisible to the user. This finding indicates that early currently, un-studied roles for early stage aesthetic innovation exist. This study will identify how early stage symbolically enhancing aesthetic innovation can positively impact the establishment of dominant designs within an industry. Other

authors have argued for a lack in our knowledge of how early stage aesthetic innovation impacts the further product trajectory within an industry (Verganti, 2008; Eisenman, 2013). Previous innovation research has found that in the early stages of technology lifecycles, industries are characterized by different designs competing for dominance (Henderson and Clark, 1990). In light of this, the overall research question of this paper will be as follows:

How can aesthetic innovation impact the selection of dominant technological designs within industries through enhancement of the symbolic attributes of products?

Theoretical foundation: Product Form Design and Industry Dynamics

In the following, the theoretical variables for the study will be derived from previous theorization. The first theoretical variable concerns design dominance within industries. Several authors have called for research on how product form designs relates to the notion of dominant design. Various concepts have been suggested in this regard: ‘dominant aesthetic manifestation’ (Eisenman, 2013), ‘dominant product language’ (Dell’Era, Marchesi, Verganti, and Zurlo, 2008; Verganti, 2008). Cappetta, Cillo and Ponti found in their study of the clothing fashion industry how, convergent, rather than dominant designs arise (2006). Unlike dominant technological designs that often render alternative designs non-competitive, convergent designs spawn a set of new market niches, rather than becoming established as an industry standard. In spite the importance of these insights, we still lack knowledge of how product form designs enhancing the symbolic attributes of products can impact the establishment of dominant technological designs.

From the literature on dominant technological designs, we know that perceptions of value are central to the selection of the technological designs (Anderson and Tushman, 1990; Schilling, 1998). In addition, product form design are central in influencing users’ perception of value, as it influences which categories, product are evaluated in terms of (Rindova and Petkova, 2007). In light of this, innovations in product form design should be able to support the selection potential of a new technological design, as it can enhance the perception of value of the emerging technological architecture. While the impact of such entities on the establishment of dominant technological designs, is currently unexplored, the term ‘dominant aesthetic manifestation’ (Eisenman, 2013) will be used to denote a commonality of design induced aesthetic and symbolic attributes of products across a product category. More specifically, it will be explored whether and how dominant

aesthetic manifestations are related to the establishment of dominant technological designs within industries. The second variable of the analysis is that of ‘symbolic enhancement through categorical departure’. The symbolic attributes of products have been extensively studied in consumer and marketing research (Arnould and Thompson, 2005), but the impact of such dimensions on technological change and industry dynamics remains largely unexplored within innovation studies (Verganti, 2008; Eisenman, 2013). The enhancement of symbolic product attributes through product form design is currently theorized in terms of product semantics, understood as which categories (eg. high end fashion, urban, industrial or “utilitarian”), the attributes of a product refers to (Hirschman, 1982; Krippendorff, 1989) and thereby categorized the user in a given specific way (‘classy’, ‘young’, ‘high tech’). A design that enhances the symbolic attributes of a product will typically be one that draws a reference to categories of higher symbolic status (Rindova and Petkova, 2007).

The third theoretical variable for the study is that of ‘design discourse’. Previous research has suggested that the value adding potential of product form design is positively mediated by the volume of design discourse (Eisenman, 2013) and that the meaning and value of designs are transmitted through expert discourse (Cappetta, Cillo and Ponti, 2006) and that the translation of new meanings associated with product categories in to actual market value occurs through processes of negotiation among experts and other institutional stakeholders (Khair and Wadhvani, 2010). In light of these insights, identifying the impact of aesthetic innovation on the selection of dominant technological designs has to take into account the level of institutional expert discourse transmitting and translating design meanings into perceived market value of products. Therefore, the product level analysis of product form design evolution should be complemented by a market level analysis of how stakeholders and expert discourse represent and transmit that of product form designs (Khair and Wadhvani, 2010).

Research design, data and methods

This study seeks identify and understand dynamics related to product form design not previously studied in the literature. Since such dynamics have only been given minimally empirical attention, an in-depth case study design was ideal to highlight the features of the phenomenon (Eisenhardt, 1989; Flyvbjerg, 2006). Throughout the longitudinal analysis of the case, a set of theoretically

derived variables was traced to identify how product form design, technological designs and design discourse interact along industry lifecycles. Historical/longitudinal case studies have previously been shown to be fruitful in analyzing the social dimensions of technological change, in terms of how actors in the selection environment relate to, and understand, a new technological innovation (Pinch and Bijker, 1987; Bijker and Law, 1992; Hargadon and Douglas, 2001).

The literature has until now broadly assumed that previous categories are beneficial for novel products to be associated with. In some instances previous technological categories may suffer from being associated with negative meanings such as being inefficient, stigmatized, obsolete or unappealing. In such instances, it will likely be beneficial for the adoption of new technological category not to become associated with. Since the literature is currently limited to product categories free from being associated with negative meanings, a context was chosen of a product category that 1) has suffered from being associated with negative product meanings and 2) where the symbolic meanings associated with the product category is a central driver of innovation efforts and play a central role in the market selection of a new technological innovation.

The hearing aid industry was chosen as the empirical context for the study. The hearing aid industry is an ideal context for the study since the meaning associated with product categories has a significant effect on market dynamics, such as market penetration and competition between product styles (Kochkin, 1994a, 1994b, 1996, 1999, 2007, 2009, 2011). Hearing aids have for long suffered from a perception as a very unattractive device to need as well as use, due to views in society related to aging and the stigmatization of hearing impaired (Nielsen, 2008; Mills, 2011). Avoiding negative categorizations of the user such as “old” or “handicapped” has since the birth of the electrical hearing aid by the end of the 19th century, been a stable driver for the evolution of the hearing aid. Unlike the parallel technology of eyeglasses which acceptability arguable is completely taken for granted in the case of most adults, in spite of a significant improvement in miniaturization and increased level of user satisfaction, the hearing aid still faces an alarming low penetration rate of 1 out of 5 hearing impaired person actually acquiring a hearing aid (Kochkin, 2009).

More specifically, the study analyzes the emergence of a new dominant technological design within the hearing aid industry in the period 2003-2010, the receiver-in-the-ear style. The new style reflected a high level of categorical incongruity at the time of its launch and was perceived as being of a high level of novelty. Contrary to the general assumption in the design literature, its impact on the market and industry was catalyzed by product form design seeking a high level of departure

from previous hearing aid designs. Instead the product form designs escalating the diffusion of the technological innovation sought resemblance towards the category of consumer electronics, and thereby positively enhanced the symbolic attributes of the hearing aid category. It is not the claim of this paper that product form design was the only, nor primary, factor in the success of the new devices. For the purpose of this study, it is sufficient that categorical departure impacted the selection of the technological design significantly in the early stages of its diffusion.

Data collection

Data for the study included various types of archival material, trade journal publications, media publications, company press releases, interviews and secondary literature, typically survey based studies, on the dynamics within the hearing aid market (see table below for data overview).

Trade journal publications were collected through the Eriksholm Research Center library. Initially publications in the extended interval (1990-2015) were read through for an initial exploratory aiming at an overview of the material and the broader industry context of the events starting in 2003. Secondly, the material specific to the interval (2003-2010) was analyzed systematically in relation to the theoretical variables derived from the existing literature. In this phase, all content relevant for the study were scanned using a hand scanner device. Thirdly, all scanned material was reanalyzed in order to ensure the robustness of the findings of the second stage of the analysis.

Informants for interview were selected due to either having an extensive knowledge of the later evolution of the hearing aid industry, being involved with the development or marketing of the new style of devices or for having extensive knowledge of the life conditions of hearing impaired people. Interviews were semi-structured, following pre-defined questions, but often the informants entered new areas that often proved relevant as well. News media sources, company annual reports and press releases were collected specifically to fill out gaps in the narrative that the trade journal data could not provide information for as well as triangulation of interviews to mitigate retrospective bias.

To validate findings, triangulation between data types and data sources were used, as well as discussions of findings with hearing aid historian and curator of the Eriksholm collection throughout the plus one year that the data collection lasted.

Data type	Sources	Information content	Amount
Trade journals (1992-2010)	<i>Hearing instruments</i> 1992-1996(HI), <i>The Hearing Journal</i> , 1992-2010 (HJ), <i>Hearing review</i> 1994-2010 (HR)	Market share data and industry information for case narrative. Overview of product launches and images of devices for design evolution analysis. Advertising for validation of analysis of categorical positioning. Textual/discursive data on product claims for category level analysis,	440 magazines in total.
Interviews	Informants included representatives from manufacturers and people with a vast amount of clinical and/or counseling experience.	Information for industry narrative. Insight into the meaning and value associated with the hearing aid category as well as sub-categories.	12 in total (typically 1-1,5 hours long each)
Textual data sources for contextualization and triangulation of trade journal and interview sources.	General business media, Manufacturer annual reports and press releases, , hearing aid related blogs and webpages, UK and DK patient magazines for hearing aid impaired people	Popular press on hearing aids, firm level information, information about specific products.	Approximately 300 pages of single spaced text.

Operationalization of variables

The three overall theoretical variables for this study is 1) Design dominance (in terms of product form design and technological design) 2) Aesthetic innovation in terms of symbolic enhancement through categorical design departure and 3) design discourse. Due the aim of this study to understand the relationship between product form design and technological design dominance, both product form designs as well as technological designs were included. Technological design was operationalized in terms of product architecture, understood as the way the technological components of a product is structured (Baldwin and Clark, 2000). The currently unexplored notion of dominant aesthetic manifestation was central in the tracing of this variable. Product form design was operationalized in terms of product semantics, understood as the concepts or categories that the form language of a product refers to (Krippendorff, 1989; Verganti, 2003; 2008). For a product

form design to qualify as a ‘dominant aesthetic manifestation’, it should shape the further selection and variation within the product trajectory, both in terms of product form design and technological designs. Categorical design departure was operationalized in terms of the degree to which the form language of a product resembled the prototypical form features of its home category (Rindova and Petkova, 2007). Symbolic enhancement was operationalized in term whether the form language of a product reflected a higher degree of resonance with the identity related needs of users (Hirschman, 1982; Holt, 2004; Holt and Cameron, 2010). The hearing aid is stigmatized due to a symbolic status associated with old age, handicap, bodily degeneration and even low intelligence (interview data, Patient magazine data and Kochkin, 1994a, 1994b, 2007). In light of this, symbolically enhancement of a hearing aid can be operationalized in terms of degree of departure from the prototypical form features of hearing aid in favor of categories such as jewelry or portable audio equipment. Design discourse will be operationalized in terms of the meanings and value ascribed to products in claims by institutional market actors referring to products or product categories (Navis and Glynn, 2010; Khaire and Wadhvani, 2010). In terms of which the design related value propositions was being assigned to the product or product category (Cappetta, Cillo and Ponti, 2006).

The Data Analysis Process

Trade journal publications and interviews were analyzed and written into a narrative of the industry context of the emergence of the new product category, the mini-BTE and how it shifted the majority of market share from the ITE (in-the-ear) to the BTE category. While the set of interviews mainly consisted of informants from the manufacturer Oticon A/S, biases were mitigated through interviews with informants from a competing manufacturer that also was a central actor in the studied events (GN ReSound). Furthermore, several times throughout the process of analysis, the trade journals helped adjusting some of the information given by interviews to be representative for the industry in general.

The analysis was considered finished at the point of saturation, when no inclusion of additional data informed the analysis any further. The analysis mainly focused on the American market, since the public health insurance regimes in European countries, generally have had a preference for behind-the-ear devices due to lower repair frequency, easier fitting processes and the need for less

differentiated product portfolios (Interview data and HR, August, 2007). Focusing on the American market enhanced the validity of the study as the user preference would play a larger role in the selection environment than in several European contexts.

The study explored how categorical departure through product form design can enhance the perception of value, and thereby likelihood of market selection, of new technological designs. Therefore, a product level analysis of close to all product form designs within the product category was carried out. In order to be able to identify whether and how the diffusion of the technological design receiver-in-the-ear was connected to an increased use of novel product form designs in the industry, the technological design of each product was noted as well as the categorical positioning of each product form design.

Categorical departure was determined through the comparison of an image of the device with selected images of previous product form designs. Two of the designs used for comparison were chosen for being either prototypical and the other two were chosen for representing some of the less prototypical seen within the category within a decade. By not only including the most prototypical designs, but also the recently most novel, the analysis was better able to identify whether the focal product form design actually represented a product form design discontinuity within the industry. The first type was the typical BTE device with minimal focus on novelty in product form designs, often seen in colors imitating the skin or hair for a camouflage effect. The second were less typical BTE designs expressing meanings such as “high-tech-ness”, novelty and breakthrough technology. These were included as they were seen in years leading up to the introduction of the mini-BTE in 2003. Four devices were selected. Two with no departure from the typical BTE product form design: Widex Quatro, Oticon Personic, and two with a medium departure from the typical BTE design². These form designs emphasizing the high tech nature of the device: Oticon DigiFocus and Phonak Claro.

² It should be noted that these devices may have been considered novel at the time of their launch, but at the time the studied events took place, these were the types of BTE devices that the mini-BTEs sought distance from.



Widex Quatro, 1988³



Oticon, Personic, 1992



Oticon Digifocus, 1996



Phonak Claro, 2000⁴

Apart from distance from the hearing aid category, potential categorical positioning was another important variable for the analysis, as this has been shown to impact the value perception of products (Rindova and Petkova, 2007). For this part of the analysis it was determined whether the given design attempted to create associations to another category. To further inform and validate these findings, product launch announcements and advertising were used as an indicator of the

³ Image acquired from: <http://hearinglosshelp.com/blog/when-was-the-first-electric-hearing-aid-made-and-other-hearing-aid-firsts/>

⁴ Image acquired from: http://www.phonak.com/com/b2c/en/products/fm/what_is_fm/the_history_of_fm.html

manufacturer's intent for the design. Through this, it was possible to control for whether a similar categorical positioning could be found there. Non-correspondence between the two was however allowed, in cases where the categorical positioning of the design in itself stood very clear and explicit. The analysis included only to a certain degree the actual color of the device in the image, instead the availability of colors were of interest. This was due to the fact that advertisements of hearing aids typically involve colors that rarely are purchased (interview data), why the focus in the comparison should be careful to ascribe too much weight to bold or novel colors in the designs.

Categorical positioning was analyzed in terms of 1) which categories did the design refer to through resembling prototypical form features? and 2) to which degree was this reference manifest in the product form design? The matter of degree was analyzed in terms of high, medium, low and none. All devices had some sort of resemblance to the category 'hearing aid', meaning that all devices were noted the categorical positioning 'hearing aid' in either low, medium or high (indicated for by for example medium → hearing aid). Not all devices however, had any notable categorical resemblance to other categories, these were only noted in relation to the hearing aid category. Throughout the studied interval, a gradually increasing amount of devices had a categorical resemblance to the category 'consumer electronics' and a few to the category 'jewelry'. Values high, medium, low were assigned not on an absolute scale but relative to the sample of designs in relation to the traditional BTEs selected for comparison. While other studies have successfully utilized quasi-experimental settings for evaluated design novelty (Talke et al, 2009), this study purposely avoided this, due to the general unfamiliarity of people with the history of hearing aid design and since non-historically informed, present time evaluation likely would render the evaluations prone to present bias. In order to mitigate biases and validate the findings of the researcher, claims of the design analysis was triangulated with other data sources such as descriptions in product launch announcements, advertisements and interviews. An overview of findings was sent to hearing aid historian and curator of the Eriksholm collection for further validation.

Institutional discourse is an important transmitter of the symbolic and aesthetic attributes of designs (Cappetta, Cillo and Ponti, 2006; Eisenman, 2013). In light of this, product level design analysis was supplemented by a product category level discourse analysis of how the meaning and value of the new category of products were represented. Discourse analysis is the analysis of discursive formations, where the focus on statements is displaced from what statements refer to, to the

statements themselves (Phillips and Hardy, 2002). Discourse analysis has been found to be a reliable method for identifying how institutional stakeholders ascribe meaning and value to products and product categories (Khaire and Wadhvani, 2010). Relevant parts of trade journal publications and miscellaneous media publications were analyzed in terms of how the style of devices was characterized and argued as being valuable or relevant by market and industry actors. For this part of the analysis, trade journal articles and design award announcements in trade journals were used. Typically the articles mainly concern the selection, fitting or testing of devices. Often, however, they begin and end with some more general statements about the focal type of device. Due to the scope and aim of these publications and the work of the editors of the publication, the issues and themes reflected in these articles can be expected not only to reflect the concerns of the author, but also the field of hearing care professionals and manufacturers more generally. The sample of material for the design discourse analysis included a considerable longer interval than the focal period starting 2003, but commenced the analysis in the early 90's to get an aggregated perspective on dynamics in the design discourse related to cosmetics in the hearing aid industry.

The Renaissance of the Behind-the-Ear-Device

In the following, a year-by-year historical narrative will be presented of how the new technological design, the receiver-in-the-ear, rose to dominance within the hearing aid industry. The narrative will cover central aspects of market changes, product level evolution and design discourse. The analysis will show how the establishment of dominant aesthetic manifestations can support the selection of a novel technological design. The process will be conceptually represented in the following phases: Category Emergence, Category Stabilization, Aesthetic Manifestation Emergence and Dominant Aesthetic Manifestation. The central mechanism identified in the study commences with novel designs creating a new niche category within the market that gains the status of aesthetically and symbolically superior to the established categories. Within this niche category, the new technological design was able to gain strong market support for its early stage diffusion later leading to its establishment of a new dominant technological design.

The years before the mini-BTE had seen some increase in BTE market share, due to a trend in microphone placement, but still however, in 2002 the distribution of market share was 77.1% /

22.8% in favor of ITE devices⁵. BTE regained over 50% US market share in 2007 and RITE/RIC as an independent category from the BTE category broke the 50% market share barrier in 2012 (a very high proportion in a market with such heterogeneous needs as the hearing aid industry due to different types of hearing loss, shape of ear canals and dexterity related to handling the device). In 2013 BTE's took up 74% of the hearing aid market. While the Hearing Industries Association did not start collecting data specific to the RIC/RITE style before 2009, according to the estimates of *Hearing Review*, more than the double of this amount was constituted by RIC/RITE devices (See illustration below).

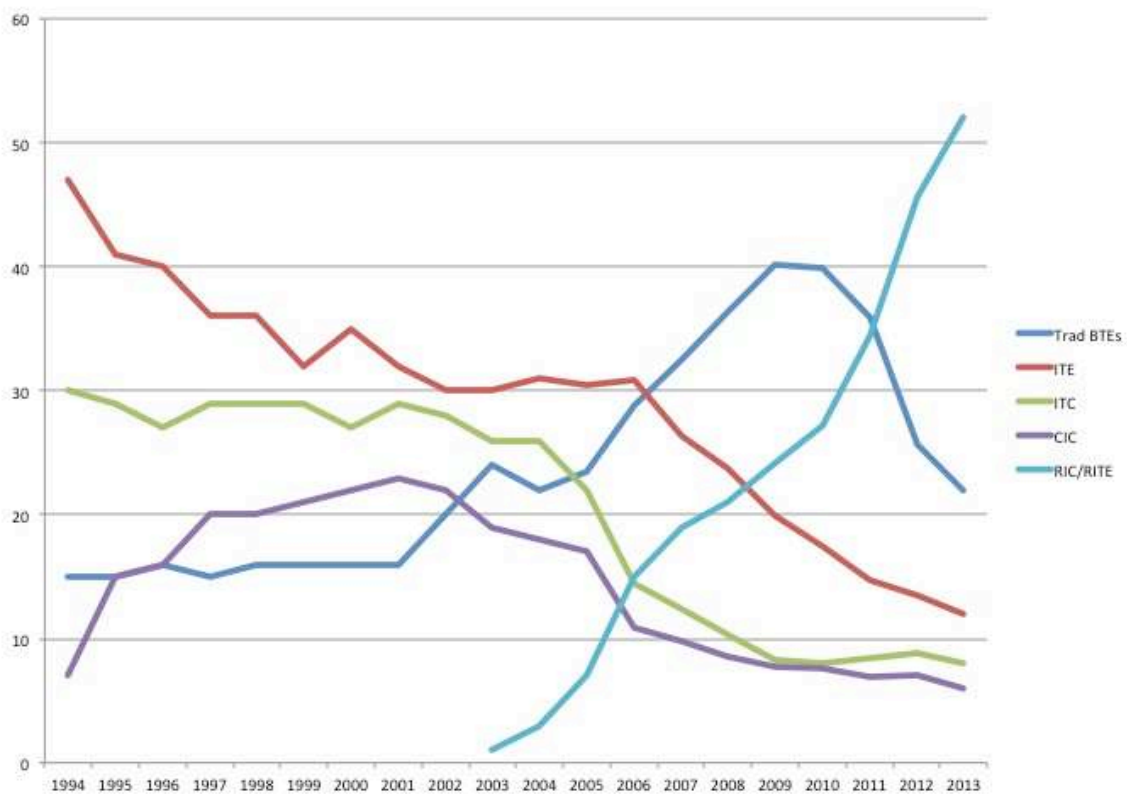


Illustration 1: Distribution of market share among device styles. *The graph was brought in Hearing review, 2014, June. The RIC/RITE market share before 2009 are not based on HIA statistics, but are HR estimates. The exact RITE market share before 2009 is not available, as the best available indicator at the time, namely battery size, is only able to trace mini-BTE market share and not solely RITE market share.*

⁵ The market share estimates are based on statistics from the Hearing Industries Association (HIA) and brought in *The Hearing Journal* and *Hearing Review*

With the introduction of the first hearing aids utilizing digital signal processing in 1996, the early 2000-2003 was in a state of maturity, as reflected by the fact that low end devices were being launched utilizing digital signal processing. The preceding years saw a few incremental innovations for example in terms of automatization and enhancing speech recognition. In **2003**, the industry however witnessed the introduction of two devices that later would lead to the shaping of a considerable trajectory in the industry. One was the BTE device ReSoundAIR by hearing aid manufacturer GN ReSound. Another was a particular device launched by newcomer Seebotek, named PAC. In terms of technology, ReSoundAIR was a modular innovation. The thin tube, a nearly invisible tube transporting sound from the device to the ear, as well as the open fitting ear plug, each represented the first successful attempts at commercializing these adjustments to the traditional BTE architecture. In addition, ReSoundAIR used what was termed an open fitting, where the ear plug does not close off the ear nor requires customization to the ear shape of the specific user. Today, ReSoundAIR remains the bestselling product launched by GN ReSound (Interview data). The device however, became tremendously successful and led to 12% of organic growth before 2005 (Danish business media). In response to winning their fifth design award for ReSoundAIR, CEO Jesper Mailind stated that: *“These [other products also winning the award ed.], are world-class lifestyle products, and it shows that with the ReSoundAIR we've managed to change the perception of hearing instruments from being a heavyweight aid for the hearing impaired to being a lifestyle product”* (HJ, 2004).

In terms of product form design, ReSoundAIR did not explicitly attempt a high level of categorical positioning towards any other product category, it did however represent a, at the time, considerable level of departure from the prototypical form features of a BTE device. While the design, did present a categorical departure, it did not explicitly seek to provide an alternative cosmetic value proposition to the invisibility of canal devices. It did however provide an important stepping stone in attempting to position the hearing aid as a non-medical piece of consumer electronics. On a level of design discourse, the symbolic attributes of the device was heavily emphasized however. The Danish mainstream newspaper *Politiken* wrote about the newly launched device [translated by the author]:

“Is he being sent coded messages through the glass clear wire? Or is he equipped with latest in headsets, mobile phones or MP3 players? Neither ...the super cool device... is the company's [GN ReSound ed.] latest alternative to the existing – and less appealing of all solutions- the big skin



colored plug. ... The extremely popular use of mobile headset equipment has in other words resulted in a positive spillover on the use of hearing aids”⁶.

The symbolic enhancement of the product by form features not resembling that of a prototypical hearing aid was referred to when Delta was described as a highly attractive lifestyle product. These aspects of the product form design of ReSoundAIR were not however mentioned in early advertising or product launch announcement, meaning that they initially were not seen as key selling points. The categorical departure of ReSoundAIR initially was a considerable source of organizational resistance and skepticism towards the device (interview data). Not until December 2004, did the CEO of GN ReSound state in Hearing care trade press that ReSoundAIR intended to change society’s perception of hearing aid use (HJ, 2004, December). Initially it was typically merely the comfort, acoustic attributes of small size that were emphasized in hearing care trade journals about ReSoundAIR. As the designer of the device mentioned when interviewed, it was not attempts to design something radically different, but only to depart from the traditional form language of the hearing aid. Soon after however, the device had created its own hearing aid product category considerably driven by its resemblance to other product categories than that of the hearing aid.

Seebotek’s device PAC can be credited for the initial development of a receiver-in-the-ear technological design that later played an important part in the rise to dominance of the mini-BTE category. In contrast to ReSoundAIR, Seebotek utilized a closed fitting, placing the receiver deep in the ear canal, rather than the open fitting that later rose to market dominance. While placing the receiver in the ear, naturally led to a new shape of the device as well as a smaller body, the design of PAC reflected no categorical departure from the prototypical features of a hearing aid.

With the launch of Seebotek PAC and ReSoundAIR, a new sub-product category to the BTE was created. This category was at this stage only minimally associated with the receiver-in-the-ear style. Instead however, but mainly with providing a competitor to the ITE category in terms of “cosmetics”.

⁶ “Bruce of Beethoven går lige ind” (2003), Politikken, 16.10




The design trajectory of the mini-BTE: Category Emergence					
Manufacturer and product title	Year of launch	Product form design	Categorical positioning (degree of resemblance → designated category)	Technological design in terms of ear fitting speaker placement (thin tube BTE or RITE)	Examples of claims in product launch announcements and advertising related to cosmetics
GN ReSound, ReSoundAIR	2003		low → Hearing aid medium → consumer electronics	Open fit, thin tube BTE	
Seebotek, PAC	2003		high → Hearing aid	Deep fit closed fitting, RITE	

In **2004** the company Vivatone launched a hybrid device in 2004, also named Vivatone. This device utilized a receiver-in-the-ear-architecture combined with an ear plug speaker leaving the canal even more open than in the case of ReSoundAIR. Together with ReSoundAIR and Seebotek PAC, these three devices were the technological stepping stones for the renaissance behind the ear device has and still are witnessing. The categorical positioning of Vivatone was similar to Seebotek PAC, reflecting minimal categorical departure from the traditional BTE form features. The device were shaped slightly different than the typical BTE device, since the placing of the receiver outside the body of the device naturally lead to another shape and size, apart from that, it aligned resembled more the prototypical skin-imitating BTE device than some of the various high tech BTE devices in the sample for comparison, such as Phonak's smooth chrome device Claro. While Seebotek and Vivatone provided the technological stepping stones, ReSoundAIR presented an aesthetic discontinuity that later would provide inspiration for what later became the dominant aesthetic manifestation of the mini-BTE category.

While 2003 and 2004 were the technological foundation for the mini-BTE category was laid, **2005** was the year where the category mini-BTE gained stability in the market and industry. The discourse related to the products that reflected this stability, rarely however, was concerned with the placing

of the receiver in the ear by Seebotek PAC and Vivatone. Rather it was the open-fitting plug and thin tube modification of the traditional BTE that initially enjoyed the praise, attention and industry wide imitation. For example, in an article titled “*why open fittings are the next big thing*” (2005, HJ, May), it was the open-fitting, rather than novel, external speaker placement in the ear, the private dispenser chose to hail as a promising route to greater acceptability of hearing aid use. By the end of 2005 all major manufacturers had launched an open-fitting thin tube BTE, in some cases as a modular change to existing product (Oticon merely introduced the Oticon corda, a thin tube adjustment that could be attached to the products in their existing portfolio). This indicates that the receiver-in-the-ear had yet to achieve the status of the category with the most symbolic and aesthetic benefits, less likely to stigmatize the user.

While dispensers until now mainly appeared to appreciate the new devices due to sound quality and comfort, the discourse gradually changed towards the mini-BTE category to also holding a promise for changing the negative symbolic meanings associated with the hearing aid product category. It was however still merely due to providing an alternative to the in-the-ear and canal devices in terms of discreetness. One of the first observed trade journal articles written by dispensers emphasizing the cosmetic superiority of open fitting BTE’s, argued that “*Today, by combining this simple technique with hearing aids that are cosmetically and technologically superior, we can produce even better results*” (Open-ear fitting offer that old familiar sound, HJ, 2005, July). These tendencies were reflected in the distribution of market share, where BTE devices slowly start to cannibalize on the ITE market. As reflected in the fact that the 2005, BTE up from 26% in 2004 up to 33% and CIC down 2% (HIA statistics through HJ), approximately 12% of these were mini-BTE, measured in terms of battery type (HJ, 2006, April). The fact that the BTE category grew and canal devices lowered reflects that the new devices competed on cosmetics and not only sound quality nor comfort.

The design trajectory of the mini-BTE: Category Stabilization					
Manufacturer and product title	Year of launch	Product form design	Categorical positioning (degree of resemblance → designated category)	Technological design in terms of ear fitting speaker placement (thin tube BTE or RITE)	Examples of claims in product launch announcements and advertising related to cosmetics (if any at time of launch)
Vivatone, Vivatone	2004		High → Hearing aid	Open fit, RITE	
Starkey, Xtra	2005		medium → Hearing aid, Low → consumer electronics	Open fit, thin tube BTE	
Phonak, Valeo	2005		High → Hearing aid, Low → Consumer electronics	Open fit, thin tube BTE	
Bernafon, SwissEAR	2005		High → hearing aid, Low → Consumer electronics	Open fit, thin tube BTE	
Unitron, Moda	2005		Medium → Hearing aid, Low → jewelry Low → consumer electronics	Open fit, thin tube BTE	<i>“Stylish just got sophisticated”</i>
Widex, Senso Vita Elan	2005		High → hearing aid, Low → consumer electronics	Open fit, thin tube BTE	
Starkey, Davinci	2005		High → hearing aid, Low → consumer electronics	Open fit, thin tube BTE	<i>“more than just good looks”</i>
Micro-Tech, Seneca	2005		High → Hearing aid	Open fit, thin tube BTE	
Tendencies in the interval:		Most hearing aids launched in the interval has a high level of resemblance to the hearing aid category Categorical resemblance to the consumer electronics category can be found, but only at a low level.		RITE product launches: 1 (approximately 11 in total) products	

In the second stage of ‘Category Stabilization’, a new technological innovation was introduced, in this case, the architectural innovation of the receiver-receiver-in-the-ear style. While no of the

product launched in this phase reflected a high level of categorical departure, ReSoundAIR reflected a radical level of novelty in its present market context. It did however, play an important catalyst for the creation of the new category of devices “*not looking like hearing aids*”.

By the end of **2006**, the editor of *Hearing Journal* announcement stated that the year in retrospect had been the “*Year of the BTE*”. 2006 saw the launch of two devices that would represented a considerable discontinuity in hearing aid product form design. The hearing aid manufacturer Oticon A/S launched the hearing aid Delta that utilized a receiver-in-the-ear (RITE) architecture. Apart from that, in terms of product form design, it represented a considerable level of discontinuity with likely the most insisting manifestation ever witnessed by the industry of designing a hearing aid device not looking like a hearing aid. With a particular triangular shape and easily exchangeable shells on the faceplate, available in a broad array of colors and styles, Delta was the self-proclaimed hearing aid for people that hated hearing aids. In response to receiving the 2007 design and engineering award from the American Association of Consumer Electronics CEO Niels Jacobsen spoke to The Hearing Journal “*This award proves that we have moved the concept of hearing aids into competition with some of the most desired electronic equipment in the world*” (HJ, 2007). Later president Peer Lauritsen stated that more than 70% percent of Delta buyers were first time users and describes how Delta is seen by users as “*hip and not like a hearing aid*”. Driven by the sales of Delta corporate growth of Oticon in 2006 amounted to 12,4 % in their 2007 annual report the company furthermore stated that “*Responses to Oticon Delta by hearing care professionals and end-users have been extremely favourable*” (William Demant annual report, March, 2007). Interview informants involved in the commercialization of Delta reported that the feedback they typically got from dispensers were that customers in surprise appreciated that the device “*did not look like a hearing aid*”. Hearing aid users were furthermore reported to enthusiastically show off their hearing aids on golf courses, at dinner parties and at other social events (interview data). Interviewed employees at Oticon both mentioned anecdotally that the launch of ReSoundAIR and Delta was the first time each of the manufacturers had witnessed dispensers reporting that customers entered a clinic asking for a particular device, rather than merely asking for something as deep in the ear canal as possible (interview data).

Attempts were made to design hearing aids not resembling the typical design of a BTE hearing aid. The new generation of mini-BTE’s attempted to create a categorical positioning of symbolic resemblance to hip and fashionable pieces of consumer electronics rather than medical devices. It

was explicitly the intension of the GN ReSound and Oticon to create something that could change the perception of the hearing aid category (interview data with responsible designers/product developers), by designing it in a way radically “stretching” the product form design away from the traditional BTE shape. Same year, entrant manufacturer Hansaton launched its “Soundmanager” device. The Soundmanager was a rectangular shaped device also attempting to break with the dominant perception of a BTE device as “the brown banana behind the ear”, a common description of a stereotypical, traditional BTE device. A business manager from Hansaton reported in the *The Hearing Journal*: “*in designing the Soundmanager, Hansaton has set out to remove the “orthopedic” stigma generally associated with hearing aids and create what consumers will regard as an appealing ear accessory” “Soundmanager’s unique design aimed to appeal to younger consumers”*, (HJ, March, 2006).



During January dispenser reported in surveys that 40% of their BTE sales now were mini-BTE’s (HJ, 2006, January). Surveys found that users of mini-BTE’s typically were 60 years old (9 years below average), users reported in surveys that reasons for choosing a mini-BTE were “invisibility” and that the device “*looks less like a hearing aid*” (HR, October, 2008; HJ, November 2006). One industry commentator commented on the positioning the hearing aid closer to various non-medical devices that “*we are now starting to see products that can appeal to a progressively younger and larger audience*” (HR, November, 2006). This reflects that the hearing care community were starting to be grasped by enthusiasm for the categorically departing designs. In news and business media however, product claims referring to the new devices echoed the symbolic attributes attempted enhanced by the designs. These tendencies were also reflected in the broader designs discourse in public media. Same year, in the article “*The Hearing Aid as a Fashion Statement*”, the *New York Times* wrote about Delta⁷:


“THIS hearing aid looks more like an earring. Its tiny triangular body comes in exuberant colors like sunset orange, racing green or cabernet red; a slender wisp of wire uncoils gracefully from the body to an earpod no bigger than a teardrop. But it is indeed a hearing appliance, made by the Danish company Oticon. ... Customers are drawn by both the smallness of the device — it’s hard to see unless wearers lift their hair and push down the tops of their ears — and its smart appearance, said John Voss, who has fitted patients with it at

⁷ “The Hearing Aid as Fashion Statement”, *New York Times*
<http://www.nytimes.com/2006/09/24/business/yourmoney/24novel.html?ref=business&r=0>, September, 2006

Hearing Associates' offices in Duluth and Grand Rapids, Minn. "People want the smallness so no one will see it, but once they get it, they are happy to show it off."

The hearing aid industry had never enjoyed a similar popular hype and type of design discourse, and while hearing aids previously had been winning design awards, more and more design award announcements showed up in trade journals, awarded to among others Bernafon's Brite, Phonak's Audeo and Starkey's Zon. For example, while the Red Dot Design award was awarded to only 2 hearing aids in the interval 2000 to 2005, this remarkably increased to 8 hearing aids in the interval 2005 to 2009. This was not solely manifested in hype however, 2006 finished with 10,6 % increase in total hearing aid sales, a considerable amount in the ever so static market. In addition to this, BTE sales doubled in the fourth quarter compared to the third and second and thereby constituting 46% of total sales to the misfortune of in-the-ear devices.

The design trajectory of the mini-BTE: Aesthetic Manifestation Emergence					
Manufacturer and product title	Year of launch	Product form design	Categorical positioning (degree of resemblance → designated category)	Technological design in terms of ear fitting speaker placement (thin tube BTE or RITE)	Examples of claims in product launch announcements and advertising related to cosmetics
Phonak, microSavia	2006	High → Hearing aid, Low → consumer electronics		Open fit, thin tube BTE	
Oticon, Delta	2006		Low → Hearing aid High → Consumer electronics Medium → jewelry	Open fit, RITE	<i>"Delta's triangular design features sleek lines, hot colors, and a brushed metallic surface"</i> <i>"ear "accessary""</i> <i>"...a design that says "hi-tech", not hearing impaired."</i>
Hansaton, Soundmanager	2006		Low → Hearing aid High → Consumer electronics	Open fit, RITE	<i>"(Soundmanager) is the first system to meet precisely the requirements now placed on modern communication products"</i>




Beltone, MIA	2006	High → Hearing aid		Open fit, thin tube BTE	
Sonic Innovations, Ion	2006		Low → Hearing aid Medium → Consumer electronics	Open fit, thin tube BTE	
Vivatone, Entre	2006	High → Hearing aid		Open fit, RITE	
Phonak, Verve	2006	High → Hearing aid, Low → consumer electronics		Open fit, thin tube BTE	<i>“elegant and stylish appearance”</i>
Tendencies in the interval:		<p>Most hearing aids in the sample still reflect a high level of categorical resemblance to the prototypical behind the ear hearing aid</p> <p>For the first time, designs with a high level of resemblance to the consumer electronics category is introduced.</p>		RITE product launches: 3 (approximately 10 mini BTE product launches in total)	




The just described events in this interval will be termed ‘Aesthetic Manifestation Emergence’, where a new aesthetic manifestation is introduced within a product category that later will become the dominant use of categorical design positioning within it. In the case of the receiver-in-the-ear hearing device, this occurred in 2006 with Oticon’s device Delta and Hansaton’s Soundmanager. These both reflected product form designs seeking a categorical resemblance towards categories with consumer electronics rather than the traditional hearing aid category. In the years following, this new aesthetic manifestation within the mini-BTE category, spawned a series of imitators where nearly all major manufacturers included a highly categorically departing receiver-in-the-ear device in their product portfolios.

The second quarter of **2007** represented the largest volume of hearing aids ever sold, driven by an increase in BTE sales (HIA statistics brought in HJ, 2007, August). By 2007, the mini-BTE category sat firmly on the position as the cosmetic category in the market. Sergei Kochkin, author of the Marke Trak studies, newly appointed director of the influential Better Hearing Institute concluded a discussion of findings on motivations for non-adoption that *“The war on stigma should*

continue to be waged, but at a much more extensive level than in the past. Stigma can be alleviated by less conspicuous products such as open-fit BTE's" (HJ.April, 2007). Interestingly the same characterization had been made by the same researcher and commentator about the CIC in the mid 90's, reflecting that the mini-BTE had gained a similar status as the cosmetic choice within the industry (Kochkin, 1994a).

By the end 2006, of the 19 manufacturers with open-ear products on the market only 4 utilized a receiver-in-the-ear technology (A Guide to Open-Ear Products, Ibid.), by the end of 2007, close to all manufacturers had a receiver-in-the-ear device in their portfolio. These new launches however, did not bear resemblance to initial receiver-in-the-ear devices Seebotek PAC or Vivatone, but the categorical departure initiated by ReSoundAIR and the very explicit categorical positioning towards consumer electronics and especially portable audio equipment. By the end of 2008, close to all major manufacturers had launched a categorically departing receiver-in-the-ear device. These designs sought participation in more distant categories than 'hearing aid' or 'medical devices' and advertising and product launch announcements continually emphasized how the devices would not stigmatize the user as handicapped or old, but as active, cool and self-confident. In addition to being firmly established as being of high cosmetic value in terms of discreetness, the aesthetic aspects of the new designs became more emphasized within industry design discourse. As an industry commentator noted in HJ, 2008, November "*This new breed of products is also showing up in an amazing range of shapes and colors, as that old industry dream of stylish hearing aids is finally coming true*", indicating that design discourse in the dispensing community reflected enthusiasm for the categorical departing product form designs. These occurrences suggest that the new niche category the mini-BTE, created by ReSoundAIR and PAC in 2003, now had witnessed a dominant aesthetic manifestation, that manufacturers conformed to when introducing the receiver-in-the-ear architecture within their product portfolios. That this aesthetic manifestation had achieved a industry dominance was furthermore seen in how companies adopted the design options of existing product portfolios. For example, Vivatone Entre that was launched in 2006, the year where the aesthetic manifestation was merely emerging, had been initially launched solely in skin colors, but became updated to also include various metallic colors, reflecting a slight categorical positioning towards the consumer electronics category had reached great acceptance in the market (HJ, nov, 2007)

The design trajectory of the mini-BTE:2007-2008					
Manufacturer and product title	Year of launch	Product form design	Categorical positioning (degree of resemblance → designated category)	Technological design in terms of ear fitting speaker placement (thin tube BTE or RITE)	Examples of claims in product launch announcements and advertising related to cosmetics
Siemens, Centra Active	2007		High → Hearing aid	Open fit, RITE	
Unitron Moxi	2007	Medium → Hearing aid, Medium → consumer electronics		Open fit, RITE	“Sleek and stylish”,
GN ReSound, Azure	2007	Medium → hearing aid, Low → Consumer electronics		Open fit, RITE	
Phonak, “Audeo”	2007		Low → Hearing aid High → Consumer electronics	Open fit, RITE	“Developed for the huge untapped market for first time users, Audeo is designed to offer the stylish look that this population demands. ... Cool design”
Oticon, Epoq	2007	High → Hearing aid, Medium → consumer electronics		Open fit, RITE with wireless streamer.	“a true high-tech communication device”
Bernafon, “Brite”	2007		Low → Hearing aid High → Consumer electronics Low → jewelry	Open Fit, RITE	“revolutionary product design” “ “red dot” award-winning Brite line is not just an innovative hearing instruments that offer state-of-the-art technology, but one that offers fashion as well as functionality.” “iconic shape drawn from nature”
Widex, “Passion”	2008		Low → Hearing aid Medium → consumer electronics	Open fit, RITE	“If ever there was a discreet and great-sounding hearing instrument custom-designed for the active and vital baby boomer generation, this is it!”

Siemens, "Vibe"	2008		Low → Hearing aid Medium → consumer electronics High → jewelry	Open fit, RITE, body in the crest of the ear with highly visible faceplate.	<i>"Although cosmetics have always been a strong driver for successful solutions, it is not enough for hearing instruments today just to be small; they must also have an appealing design."</i> <i>"Aimed at baby boomers for whom "bold is in"</i>
Starkey, "Zon"	2008		Low → Hearing aid High → consumer electronics	Open fit, RITE	<i>"... comes in a stylish yet discreet receiver-in-the-canal (RIC) style."</i> <i>"Beautifully designed exterior"</i>
GN ReSound, "Dot"	2008		Medium → Hearing aid Medium → consumer electronics	Open fit, RITE	<i>"Unrivaled gain, beautifully designed and incredible comfortable"</i>
Rexton, Gem	2008	Medium → Hearing aid, Medium → consumer electronics		Open fit, ITE	
Tendencies in the interval:		Very few devices in the interval had a high level of resemblance to the hearing aid category. The general level of categorical resemblance to the consumer electronics category had increased considerably from previous years.		RITE product launches: 11 (approximately 13-14) products in total	Frequent use aesthetic terminology beyond merely discreetness

Summing up findings

How can symbolically enhancing aesthetic innovation support the selection of a new dominant technological design within an industry? In this study it was found how categorical departure triggered a central mechanism that was found to be central in the rise to dominance of the receiver-in-the-ear architecture. Early categorically departing product form designs created a new product category in the hearing aid market. This new category, the mini-BTE quickly became a challenge to the in-the-ear devices as the category best able of addressing the stigma of hearing aid use. This was reflected in design discourse as well as the distribution of market share among hearing aid styles, where BTE sales cannibalized on ITE sales (the previous default option for addressing the stigma of hearing aid use).

The aesthetic innovations in 2006, became the dominant aesthetic manifestation of the receiver-in-the ear style when all remaining major manufacturers in 2007-2008 launched a receiver-in-the-ear device in their product portfolio. The categorical positioning of Delta and Soundmanager spawned imitators across the industry leading to a new dominant aesthetic manifestation and industry wide diffusion of the receiver-in-the-ear architecture in the years 2007-2008. The years 2007-2008 saw a rapid diffusion of the receiver-in-the-ear architecture within the mini-BTE category, often introduced by manufacturers in products reflecting strong symbolic and aesthetic enhancement through a low degree of resemblance to the hearing aid category and medium or high degree resemblance to the category consumer electronics or jewelry. The initial technological front runners however, with low level of categorical departure, Seebotek and Vivatone, had however minimal impact on the further product form design trajectory in terms of spawning imitation, in spite of presenting a technological architecture with similar acoustical benefits.

After 2008, the diffusion of the receiver-in-the-ear architecture escalated at a somewhat continuous pace. The aesthetically innovative mini-BTE's did not fully substitute traditional BTE's, but apart from creating the market niches of design devices, it heightened the general level of categorical positioning away from the hearing aid category and towards the consumer electronics category. Already in 2007-2008 this was seen in the case, that while a higher rate of devices showed a low-or-medium degree of resemblance to prototypical BTE features, in favor of a typical low to medium degree of resemblance to the consumer electronics category. While Delta and Soundmanager in 2006 created these niches seen in 2007-2008, with Bernafon Brite, Siemens Vibe, Phonak Zon, Phonak Audeo and Widex passion, the highly successful product form designs did not only impact the further product variation in terms of creating market niches but was also manifest at a slightly lower intensity in the remaining mini-BTE category that reflected a generally heightened level of departing from the hearing aid category in favor of the consumer electronics category. Even the traditional BTE category, as seen in the instance of devices such as Unitron Yuu, 2007, Oticon Neera in 2013 and Widex' Fashion Power in 2015, and all reflecting medium resemblance to the BTE category and low to medium participation in the consumer electronics category. Following the dominance of the new aesthetic manifestation within the industry, the receiver-in-the-ear architecture became established as its own independent category by the Hearing Industries Association in 2009, unlike before where it had shared the mini-BTE category with open-fitting, thin tube BTE's. In addition, it was standard for a product family to include a receiver-in-the-ear style, meaning that the architecture had diffused beyond the niche category of the mini-BTE to

being “a very dominant style within the industry today” (interview data with lifelong top manager in GN ReSound).

It requires mentioning that several considerable innovation within the in-the-ear category occurred in the interval, without achieving a noteworthy impact on the market and industry. One of these were the device “be by ReSound” in 2008, overall the architecture was similar to a receiver-in-the ear device. The main difference was that the speaker was placed deep in the ear canal and the body of the device discreetly in the ear without fitting closely, and thereby allowing for the benefits of an open fitting. Another significant in-the-ear design innovation was the absolutely invisible canal device Lyric by InSound Medical in 2009 (acquired by Phonak in 2010). This miniature device would be placed deep in the canal where it would reside for a month or more, before it required to be taken out for a shift of batteries. While these two innovations represented considerable advancements in terms of the former cosmetic imperative of creating a hearing aid as invisible as possible, these devices did not present any significant barrier to the gradual market expansion of the receiver-in-the-ear device, nor where they imitated at a rate even close to that of ReSoundAIR and Delta.

Antecedents

Several social, cultural and technological factors were necessary or important for the new category to become manifest and recognized as opportunities for firms to exploit (Verganti, 2008). In the case of the mini-BTE, a central demand side antecedent was that a changing values, lifestyles and expectations of the merging generation of elderly baby boomers, especially their relationship to technology that for some years had made the industry aware of the potential. For quite some years, hearing care trade press would feature articles about how to address this emerging segment (trade journal data), and for the developers of Delta, addressing the values of this segment was a central imperative (interview data with development team). Another central antecedent was the status of portable audio equipment in society as something attractive, appealing and cool to wear visibly. Several product launch descriptions, advertisements and interview informants explicitly referred to categories, such as ‘gadgets’, ‘lifestyle product’, ‘headset’ and ‘MP3 player’. Even more importantly, when popular media and other design discourse were to express the symbolic enhancement of the new devices, they often did it with reference to such attractive portable audio

equipment products, indicating that the market place status of these categories should be included as an explanatory factor of why these events had not occurred earlier in the history of the industry. Finally another important technological antecedent was the introduction of digital signal processing in 1996, and especially the improvement of active feedback suppression that had made the open fittings possible (interview data).

Discussion

The Role of Aesthetic Innovation in Early Stage Technology Lifecycles

Until now the literature on product form design has predominantly assumed that the product form design of novel technological innovations ideally should seek categorical resemblance to previous designs within the category (Hargadon and Douglas, 2001; Rindova and Petkova, 2007; Eisenman, 2013). This study suggests that symbolic enhancing through categorical departure under some circumstances can play an important role in the early stage of the establishment of technological designs as dominant. In the case of a product which home category represents a high symbolic status, the product form design should aim for categorical resemblance through conformity to the prototypical features of the category. In the case of a product which home category suffers from low symbolic status, the product should depart from the prototypical features of its home category in favor of referencing another, higher status category through resembling prototypical features of products within the higher status category.

Exceptions to established belief favoring categorical conformity early in technology lifecycles, emerges when there in markets reside an unexploited opportunity to enhance the perception of value through symbolically enhancing the product category. The dynamics found in this study should be explored further in terms of the role played by symbolic enhancement in the early phases of industry lifecycles characterized by competition between a various technological designs (Anderson and Tushman, 1990; Schilling, 1998; Grodal, Gotsopoulos and Suarez, 2015).

Through which processes can symbolic and aesthetic innovation impact the selection of dominant designs within industries (Dell'Era et al, 2008; Verganti, 2008; Eisenman, 2013)? Throughout the case study a four phase model was suggested to adequately account for the empirical patterns observed. The model found that categorically departing designs can create new niche categories by

becoming disassociated with the broader categorization schemes within an industry. Through symbolically enhancing aesthetic innovation, such niche category can be associated with higher market value than competing categories. In the case of receiver-in-the-ear style, the niche category become associated in the market with a new “cosmetics”-related value proposition and that supported the early stage diffusion of the new technological architecture that later rose to dominance. In the case of the receiver-in-the-ear architecture, the aesthetic and symbolic attributes of this new category later become a dominant aesthetic manifestation within the industry. These finding supplement the notion of ‘convergent designs’ by Cappetta, Cillo and Ponti (2006). While the convergent product form designs were found in the sense that a niche market for highly symbolically enhanced hearing aid devices were created, it also heightened the general level of categorical departure from the hearing aid category as such in favor of conformity to the consumer electronics category. Another central point of differentiation between convergent designs and dominant aesthetic manifestations is in terms of product level competition. While convergent designs was found not to render former styles non-competitive outside certain market niches, the dominant aesthetic manifestation of the mini-BTE led to a considerable loss of market share for the previously dominant style of in-the-ear category.

Symbolic Spillover Absorption

The nature of antecedents of innovation in product form design has received some attention in the literature (Verganti, 2008; Eisenman, 2013). How other product categories can shape aesthetic innovation in product form design has currently however not been investigated within innovation and management research. This study finds that in cases where an unexploited opportunity reside in the market to draw resemblance to another category of higher symbolic value, such can be utilized by firms for aesthetic innovation. Future research could study such dynamics further under the term “symbolic spillover absorption”, understood as a determining factor for whether or not categorical positioning towards a higher status product category is possible. A symbolic spillover could be understood as an instance where the meaning and market value of products in one category impact the variation and selection in terms of aesthetic innovations within another category or several. Evolutionary studies could explore how changes in the meaning and value of one product category can lead to spillovers that affect the meaning and value of others and how firms can absorb these spillovers and utilize them in product form designs. For example, in the hearing aid industry it

could be studied how the variation and selection of the mini-BTE devices were affected by changing meaning and market value of consumer electronics product categories such as portable audio players. Work on the co-evolution between technology and product form design (Eisenman, 2013), could furthermore explore how technological discontinuities opens up new potentials for firms for symbolic spillover absorption.

Finally, the findings of this research could inform other fields, such as the literature on socio-technical change. Within this literature, the work of Geels has suggested that technological transitions imply changes in the symbolic meanings related to the technology (Geels, 2002, 2004). This study presents insights of these particular symbolic dynamics of technological change, in the form of how not only new technologies not only lead to the establishment of a dominant technological design, but also dominant product form design that influences the perceived symbolic attributes of the products.

Limitations

The case presented here was not a technological transition, as if the study had been of the transition to analogue to digital signal processing, but rather of the establishment of a new dominant technological design. Therefore it does not provide a complete contrasting study to the study of Hargadon and Douglas of the transition to electric lightening (2001). The findings of this study should however be of a high level of validity as what is central as the perception of value of a technology that is perceived as highly novel and departs from existing categories. The receiver-in-the-ear style was perceived as very novel at its time of introduction and a plausible source of categorical incongruity as it blurred the firmly established categorical boundary between in-the-ear devices and behind-the-ear devices.

While the distribution of market share between specific products, such as Delta or Vivatone, were not available to the study, the lack of such output measures were compensated for by including patterns of imitation as well the timing and content of intuitional discourse on reflecting the value perception of the new devices.

In terms of external validity, the hearing aid industry can be argued to represent an exceptional case. The hearing aid product category is however not unique in terms of being associated with negative

symbolic attributes, why similar dynamics likely is observable in other high-technological, high symbolic industries where unexploited symbolic opportunities arise during the early stages of industry emergence.

Managerial implications

The findings of this study will be able to inform innovation and marketing managers with regard to how to use product form design in the early market stages of technological innovations. This study shows how symbolic and aesthetic innovation can be utilized by firms to acquire market share during industry emergence. In the seminal work of Christensen (1997) it is presented a central challenge for established firms to respond to new technological innovations offered by entrant firms. This study suggests that in such industry scenarios, established firm should seek to address the challenge of potentially disruptive technologies through offering a superior value proposition driven by symbolic product attributes. This was the strategy successfully employed by the major manufacturer Oticon against the entrant firms initially launching the receiver-in-the-ear architecture, Seebotek and Vivatone.

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