



Paper to be presented at the DRUID Academy Conference 2016 in Bordeaux,
France on January 13-15, 2016

The Co-Evolution between Product Form Design and Product Categories: The Renaissance of the Behind-the-Ear Hearing Aid Style (2003-2010).

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Abstract

This paper will analyze co-evolutionary relationships between product categories and product form designs. Previous research has found how the interaction between product categories and product form design influences users' perception of product value and how changes in product form design can catalyze changes in the meaning and value associated with products. This study will analyze this specific interplay in the establishment of dominant designs within industries. To carry out this analysis, an in-depth, longitudinal case study will be done of the establishment of a new dominant design in the hearing aid industry in the period 2003-2010. Data for the study include interviews, archival material, industry statistics, and hearing care trade journals. The study contributes to theory with the following results: Co-evolutionary dynamics found in the case of technological designs were also observed in relation to product form design. It was found how product form design can catalyze change in the meaning and value associated with product categories. Finally, it was found how dominant designs in industries not merely can be constituted by a given technological design architecture, but also by a particular product form design manifestation.

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The Co-evolution between Product Form Design and the Meaning and Value Ascribed to Product Categories

This study explores the relationship between product form design and the meaning and value associated with product categories in the market place. It is positioned between two emerging themes within management and innovation studies: product category evolution (Rosa et al, 1999; Lounsbury and Rao, 2004; Kaplan and Tripsas, 2008; Navis and Glynn, 2010) and innovation in product form design (Ravasi and Lojacono, 2005; Rindova and Petkova, 2007; Verganti, 2008; Ravasi and Stigliani, 2012; Eisenman, 2013).

Product categories are entities that have been found to play several important roles in guiding market and industry dynamics (Rosa et al, 1999). Product categories are seen as market institutions, influencing the perceived legitimacy and value of products within the category (Glynn and Navis,

2013), category belonging or exclusion and provides guidance for technological trajectories (Kaplan and Tripsas, 2008; Garud and Rappa, 1994).

The most basic function that product categories serve in the organization of markets and industries is providing categorical labeling, such as ‘mini-van’ or ‘smartphone’. Such labeling allows for the subsumption of products under the category as members and thereby comparison between products (Rosa et al, 1999). Product categories can be important factors to consider for managers since they influence the perceived legitimacy of novel market offerings. If novel market offerings reflect a too high cognitive distance from the category it is subsumed under, it can lead to a low level of cognitive legitimacy that may hinder its diffusion (Rindova and Petkova, 2007; Hargadon and Douglas, 2001). On a socio-cognitive level, users have been found to often ascribe value to products through reference to mental categories (Rindova and Petkova, 2007).

Categories are not static entities, but have been shown to respond to changes in technology (Grodal, Gotsopoulos and Suarez, 2015) and competing product categories (Rosa et al, 1999). Product categories change not only in terms of labeling, members and competing categories, but also in terms of the meaning and values ascribed to them (Khair and Wadhvani, 2010). Such processes are not solely the outcome of supply and demand interactions, but can occur through broader networks of actors. In the case of Modern Indian Art, the change in the meaning and value was catalyzed by various actors mobilizing cultural resources in legitimizing the artistic worth of the category. The mobilization of cultural resources has been found to not only be mobilizable in the institutional market discourse, but also in product form design (Rindova, Dalpiaz and Ravasi (2011) and even technology (Bijker and Law, 1992). The meaning of products or product categories can be understood in various ways, such as semantical meanings embedded in product forms (Krippendorff, 1989; Verganti, 2003), symbolic meanings of a product within a given social context (Holbrook and Hirshmann, 1993; Ravasi and Stigliani, 2012) or what the nature and purpose of a product is perceived to be (Hargadon and Douglas, 2001; Verganti and Öberg, 2013). The value ascribed to categories can be understood as discursive manifestations of the perceived value proposition of a category in a market (Khair and Wadhvani, 2010).

Research within design studies and innovation management of product form design has found that product form designs have meaning and value embedded in them through product languages carrying expressions of meaning and value (Krippendorff, 1989). Radical innovation in product form design will typically represent a discontinuity from the meaning and value ascribed to the

respective product category (Verganti, 2008; Norman and Verganti, 2014). In relation to Khaire and Wadhvani's findings (2010) that category change is catalyzed by actors mobilizing cultural resources, it is interesting to see how radical innovation in product form design often has its antecedents in the mobilizing of new cultural resources compared to competitors (Verganti, 2008; Rindova, Dalpiaz and Ravasi, 2011). Other findings within the literature on innovation in product form design indicate that radical design innovation can redefine product categories in terms of value propositions offered and competition between category members (Norman and Verganti, 2014). Product form designs only reflecting an incremental degree of novelty compared to the category, will conform to the meaning and value dominant within the category at the time (Rindova and Petkova, 2007; Verganti, 2008). These insights suggest a cyclical relationship between product form design innovation and product categories in some respects analogue to technological change in industry lifecycles (Anderson and Tushman, 1990; Eisenman, 2013). To deepen our understanding of this relationship further, the work of Grodal, Gotsopoulos and Suarez (2015) on the co-evolution between technological designs and category labeling will provide a fruitful point of departure.

In their study of the relationship between technological design and product category emergence, Grodal, Gotsopoulos and Suarez (2015) suggest two types of co-evolutionary dynamics: echoing and discerning. In short, echo effects shape evolution, such as a trajectory of product designs or a product category and discerning concerns selection, in terms of which designs or categorical formulations that gain institutional and market support. If a given technological design receives increased support, product category labeling will mimic this design. In addition, product category labels corresponding to the design will be more likely to increase in support, and non-corresponding labels will increase their chance of being considered unfitting or irrelevant due to the discerning effect. Since we are dealing with a co-evolutionary relationship, this relationship is bilateral. If a given product category labeling increases in support, technological designs will seek to mimic it and designs corresponding to it will increase in support from the market place, while non-corresponding designs will decrease in market support. The question is whether a similar relationship can be found between product form designs and the meaning and value ascribed to product categories.

To explore this relationship between product form design and product categories, this paper will seek out to answer the following research questions:

In which ways can product form design catalyze change in the meaning and value associated with product categories?

and

In which respects can the meaning and value associated with product category co-evolve with product form designs of the products within that category?

To guide the enquiry into these questions, three research propositions will be derived from the existing literature.

The meaning and value ascribed to a product category play a significant part in framing consumers' perception of the value of products subsumed under the category (Khairi and Wadhvani, 2010). The degree to which a category member participates in the meaning and value of its respective category is however not a fixed relationship. For example, product form design is a determining factor for the degree to which a particular product will participate in the meaning and value currently ascribes to its given category (Rindova and Petkova, 2007). Product form designs create a categorical positioning, where designers can manipulate the cognitive distance between product and category and thereby influence which sets of meaning and value users will evaluate the product in terms of.

Along industry lifecycles, one of the most central events shaping the further evolution of a technology is the selection of a dominant design (Anderson and Tushman, 1990). Dominant designs are selected in terms of users' perception of value of the given design (Schilling, 1998). Since this value perception is influenced by the category that users evaluate a given product in terms of, categorical positioning through product form design can be expected to be a significant factor in the establishment of dominant designs (Hargadon and Douglas, 2001). When a dominant design is established with the support of categorical positioning through product form design, the dominant designs can be expected to not only reflect a dominant manifestation in technological design, but also a specific manifestation of categorical positioning through product form design. Other authors have suggested the further explorations of such phenomena under the terms 'dominant aesthetic manifestation' (Eisenman, 2013) or 'dominant product language' (Verganti, 2008). If a radical innovation in product form design becomes dominant, this should create echo and discerning effect on the meanings and values associated with the product category.

Proposition 1: If a discontinuity in product form design rises to dominance within an industry, the meaning and value associated with the product category will evolve in conformity with the meaning and value embedded in the product form design.

The literature on dominant design has found how consumer needs, expectations and consumption routines are shaped by the manifestation of the dominant design in the market (Anderson and Tushman, 1990; Schilling, 1998). The wake of incremental innovation following a discontinuity will typically follow demand pull dynamics rather than technology push logics (Dosi, 1982). If a radical innovation in product form design, influence the meaning and value users expect from a product within a given product category, the further line of incremental design innovations will conform to this new manifestation of the product category due to discerning effects (see also Verganti, 2008 and Norman and Verganti, 2014 for similar observations). As far as the analogue between technology and product form design is valid, the discerning effect will lead to the establishment of a product form design trajectory that will shape further product development within the category. If a dominant manifestation of product form design has impacted the meanings and values of the product category, the following product form designs along its trajectory will depart considerably from the previous trajectory of product form designs.

Proposition 2: Dominant manifestations of product form design will shape a design trajectory providing directions for further product form design evolution within the given product category

The two propositions formulated concern the phases of industry lifecycles after the establishment of a dominant design. The relationship between product form design and the meaning and value associated with product categories in the establishment of dominant designs should however also be analyzed. The two co-evolutionary bilateral feedback effects suggested by Grodal, Gotsopoulos and Suarez (2015) each emphasize enhancing effect though conformity between design and category. That the central logic here is conformity since a design is discerned if it echoes the most supported category label, and a category label is discerned if it echoes the most supported technological design. In terms of the co-evolution between product form design and the meaning and value associated with product categories, other dynamics can be expected in the establishment of dominant designs. Various research findings suggest that the categorical positioning through product form design in some cases can enhance its potential for selection through departure rather than conformity (Rindova and Petkova, 2007).

If the meaning and value associated with a product category are negative, it will result in low demand for products within that category (Khaire and Wadhvani, 2010). In a case where the meaning and value associated with a product category are negative, they can be expected to create a negative discerning effect where conforming designs lessen their chance of selection. In such instances, rather than echoing, it may become beneficial for a firm to dissociate their product with the respective category through a product form design creating categorical non-resemblance. This could occur through the creation of a categorical positioning that intentionally departs from its respective home category and instead mimics other higher value categories (Rindova and Petkova, 2007). Designs that attempt to mimic other, more distant, categories of higher value, will likely have their antecedent in the mobilization of cultural resources from ‘registers’ distant from those typically drawn upon within its industry (Rindova, Dalpiaz and Ravasi (2011).

Research in consumption studies have found how the meaning and value associated with market offerings can impact demand differently dependent upon broader socio-cultural changes in society (Hirschman, 1982; Holt, 2004; Sandikci and Ger, 2010). A set of symbolic meaning and value propositions that before have been in high demand, might lose their attractiveness due to changes in society and their social context of consumption. If a radical innovation in product form design conforms better to the meaning and value potentially sought for in its given context of consumption than the category in general, it will increase its chances of becoming the dominant manifestation of product form design. To sum up, in some instances, echoing the meaning and value of the current manifestation of the product category can decrease its selection potential of a product form design. In such instances the echoing will become displaced from the product category to meaning and value in other cultural registers able to enjoy discerning effects from the given state of the context of consumption. Therefore, the dominant manifestation of product form design within an industry will likely be one that has a higher level of conformity with its given context of consumption than its respective product category.

Proposition 3: If the meanings and values embedded in a product form design resonate with its given context of consumption to a greater degree than its respective category, it will support its potential for becoming the dominant manifestation of product form design within its category.

Methods and Data

Since the interplay between product form designs and the meaning and value associated with product categories has only received minimal empirical attention, an in-depth, contextual case study will be the most fruitful approach to expand our knowledge of the subject. The ideal context for this case study will be one where the meaning and values associated with the product category has a significant effect on demand and thereby industry dynamics in terms of the establishment of dominant designs and the further trajectory it can be expected to shape.

The hearing aid industry satisfies the above mentioned criteria and was therefore chosen as the empirical context for the enquiry for this research project. The industry has a long record of experimenting with a very broad array of product form. Such forms have implications for how devices are to be worn on the body, as well as their overall mechanical composition and typically have a corresponding product category. These include hearing aids behind the ear (BTE) and in-the-ear (ITE). ITE has various sub-categories depending on the placing of the device in the ear canal: in-the-canal (ITC), completely-in-the-canal (CIC) and more recently invisible in the canal (IIC). Finally a last design category is that of receiver in the ear/canal (RITE/RIC). Due to its current dominance are categorized as an independent category while it for its first initial six years was categorized as a BTE device.

Initially an explorative analysis was conducted to identify which meaning and value the hearing aid product category in general has been ascribed throughout the history of the technology. Since hearing aid industry throughout its lifetime has faced a considerable low penetration rate due to a range of significant adoption barriers, analyzing these adoption barriers was the analytical entrance point to understand the meaning and value ascribed to hearing aids. For this part of the analysis, interviews with informants with exceptional insight into hearing impairment and the life world experience of hearing aid users and the database of the Better Hearing Institute of the Marke Trak studies. The Marke Trak studies are large scale survey based trackings of developments in the hearing aid market. The studies were published for the first time in 1989 and until recently under the authorship of Sergei Kochkin. The focus of this initial explorative phase was on developing a broad, thematic account of the meaning and value associated with hearing aid use, while still remaining sensitive to changes throughout the period studied.

Secondly an analysis was carried out of the emergence and evolution of the new category of hearing aid devices termed mini-BTE's (behind the ear), among other category labels. 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 to the BTE category. While interviews were dominated by sources from the manufacturer Oticon A/S biases were mitigated through interviews with informants from other central manufacturers with extensive experience in the industry (Widex and GN ReSound). Furthermore, several times throughout the trade journals helped adjust some of the information given by interviews to be representative from industry wide context. The main themes that was sought out in the data was the technological evolution of the products within the category, product form innovations occurring within the category and the beliefs about the market and user that guided the development and marketing of the new breed of devices. The data collection and analysis for this part of the analysis was considered finished at the point of saturation, when no inclusion of additional data seemed to neither inform nor support the claims in the analysis any further. The analysis mainly focused on the American market, since the public health insurance regimes in European countries, generally have tended to have a preference for behind-the-ear devices due to prize, lower repair frequency, easier fitting processes and the need for less differentiated product portfolios.

Thirdly, an analysis was done on how the evolution of product form design in the industry in the years 1990 to 2010 had impacted the meaning and values associated with the two main product categories on the market: In-the-ear devices and behind-the-ear devices. From 2009 on, the style of hearing aids where the receiver is placed within the ear and the rest behind the ear, gained its own distinct category in the statistics of the Hearing Industries Associations (HIA). Before that, it tended to be seen as a sub-category to the behind the ear device, reflected in the commonly used label mini-BTE. For this part of the analysis, articles and product launch statements in trade journals were used. To understand how the BTE category changed in terms of meaning and value ascribed to it, a comparative category was needed. Since the new style of devices, initially was taken to represent the BTE category, the comparative case should represent the ITE category. The CIC (completely- in-the-canal), a sub-category to the ITE, was selected as it was the most recent, major advancement within the ITE category and was seen as a response to a similar set of challenges in the market place as the later new breed of BTE's. First of all, for both devices, addressing the stigma of hearing aid use through improved cosmetics was a central aspect. The CIC was introduced in 1992, but established as an independent category in 1994 and the mini-BTE in 2003. To understand how the two innovations differently impacted the meaning and values ascribed to the hearing aid category, and the two competing product categories, the product claims made referring

to the new devices, by hearing aid dispensers was used. In the trade journals, it was analyzed how the style of devices was characterized and argued as being valuable or not by dispensers and industry professionals. Typically such articles concern the selection, fitting or testing of devices. 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 more generally. For the CIC part of the analysis the years 1992 to 1997 was chosen and for the mini-BTE 2003-2010. These intervals were selected to span from the introduction of the new designs and to its point of market maturation, indicated by the introduction of low end products embedding the new designs. Choosing sources from hearing aid dispensers rather than hearing aid users, was motivated by findings of previous research that the value of product design often is transmitted through institutional, expert discourse (Cappetta, Cillo and Ponti, 2006) and that design discourse increases the potential role for value creation through product form design within industries (Eisenman, 2013).

Finally, in order to evaluate whether the new category and trajectory of product form designs had had an impact on the market penetration rate and user demographics, the Marke Trak studies were revisited. For this part, relevant Marke Trak publications were reviewed in terms of how the introduction of the mini-BTE category had mitigated some of the central adoption barriers related to hearing aid use.

Analysis

The Renaissance of the Behind-the-Ear-Device

The renaissance of the BTE device can be accredited to two main technological innovations: the introduction of receiver in the ear/canal architecture (RITE/RIC), the introduction of open-fitting, thin tubes for BTE devices. A more minor driver had some impact as well, namely an increased use of directional microphone technology, easier exploited in a BTE than ITE device. The years before the mini-BTE had seen some increase in BTE market share, but still, in 2002 the distribution of market share was 77.1%/22.8 in favor of ITE devices¹. Few years later this led to a new dominant design in the hearing aid industry challenging the before dominant design of In-the-ear devices

¹ The market share estimates are based on statistics from the Hearing Industries Association (HIA) and brought systematically in *The Hearing Journal*, *Hearing Review* and *Hearing Instruments*

(ITE). 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. 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)

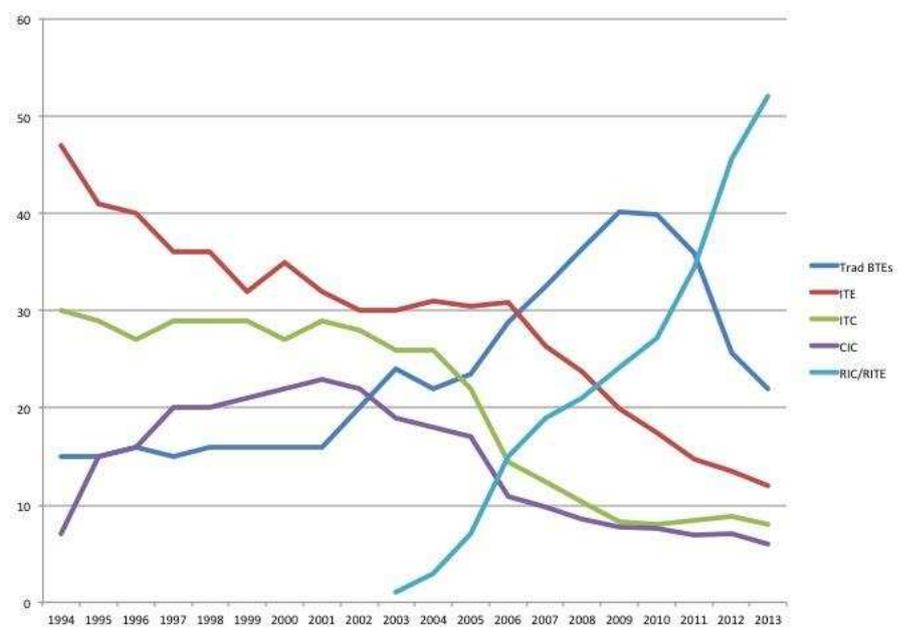


Illustration 1: Distribution of market share among device styles. The graph was brought in Hearing review, 2014. The RIC/RITE market share before 2009 are not based on HIA statistics, but are HR estimates.

Previously the ITE was the default style for cosmetically conscious users. The BTE device however was mainly seen as a requirement for heavy hearing losses requiring a considerable amount of amplification or for hearing aid users not caring much about revealing their disability to their surroundings. When the completely-in-the-canal device (CIC) was launched in 1992, not however established as an independent category till 1994, it was heralded as an end to the stigma associated with hearing aid use. This tendency to have the ITE device as the default option for younger, active and cosmetically minded users continued until 2003. By then, the ITE and its various sub categories were challenged for their market dominance by the new breed of BTE-devices, the mini-BTE.

With the first hearing aids utilizing digital signal processing in 1996, the early 2000 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 Danish hearing aid manufacturer GN ReSound. Another was a particular device launched by a newcomer named Seebotek, named PAC. In terms of Technology ReSoundAIR was a modular innovation. The thin tube as well as the open fitting ear plug were each the first successful attempts at commercializing these adjustments to the classical BTE architecture. ReSoundAIR represented the first commercially successfully application of the thin tube, a nearly invisible tube transporting sound from the device to the ear. In addition, it used what was termed an open fitting, where the ear plug does not close off the ear nor requires it customization to the ear shape specific to the user. ReSoundAIR remains the bestselling product launched by GN ReSound. In response to winning their fifth design award for ReSoundAIR, CEO Jesper Mailind stated that: “These are world-class lifestyle products [other products winning the award ed.], 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).

Seebotek's device PAC can be credited for the initial development of a receiver in the ear, behind the ear device. In contrast to ReSoundAIR, Seebotek utilized a closed fitting, placing the receiver deep within the ear, rather than the open fitting dominating the current market today. The company Vivatone launched a hybrid device in 2004, also named Vivatone, utilizing a receiver in the ear architecture combined with the open fitting ear plug from ReSoundAIR. These three devices were the technologically stepping stones for the renaissance the behind the ear device has and still are witnessing. ReSoundAIR, Sebotek PAC and Vivatone each were shaped differently than the typical BTE device, since the placing of the receiver outside the body of the device allowed for it to take new shapes. Neither of the devices however, expressed any radical discontinuity in design languages used. They did however have some impact on the market gradually escalating the shift in market share among styles sooner to be named the “BTE renaissance” among industry commentators. The period from 2003 to early 2006 provided the technological stepping stones and nascent design ambitions that later fueled the discontinuity in the hearing aid market and industry constituting an institutional frame in terms of the meaning and value associated with the hearing aid

category and sub categories as well as the design frames manifest in the industry. The period 2006-2008 saw a remarkable intensifying role of product form design aiming at categorical repositioning away from the tradition BTE hearing aid.

In 2006 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. A few months before, the smaller manufacturer Hansaton launched its “Soundmanager” device. This 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. 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 the receiving of 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).

The mini-BTE emerged as a new dominant design, capturing large portions of the market share before held by the ITE device. Most of the products that played an important part in forming the BTE boom in the years following 2003 also represented significant departures from traditional BTE product form designs. This begs the question of which role these product form designs played in the shifting status of the BTE category to suddenly becoming the dispenser’s default option for the more resistant, cosmetically minded customers. In light of this, we can safely infer that these events led to a considerably change in terms of the meaning and value ascribed to the BTE category compared to the ITE category. In the following, this change will be the focus of more systematic analysis.

To further explore the three research propositions of this paper, the following indicators will be used to analyze the relation between design change and category level change:

- 1.** Category level change in meanings and values should lead to the establishment of a product form design trajectory due to discerning effects. This should be observable in a consistent pattern of the use of design expressions in the further product trajectory. It

should furthermore be observable in the product claims made by manufacturers when presenting the value proposition of their novel devices for hearing aid dispensers.

2. If product form design change has impacted the meanings and values ascribed to the product category, it should be echoed in market level value ascriptions to the category, and products within it. To analyze whether such change is observable, trade journal articles will be analyzed in terms of how perceive the end user value proposition for the new category of devices. This analysis will be done comparatively with the introduction of the CIC device in 1992-1996 that previously were seen as the default option for attracting users resistant to adopting a hearing aid due to appearance and stigma-related factors.
3. If discontinuous change in product form design has impacted the meaning and values associated with its respective product category, it should create a discerning effect for the diffusion of products conforming to that particular design. In the case of hearing aids, since the internal and external stigma related to hearing aid use are central adoption barriers and since the industry faces a considerable low penetration rate, a discerning effect should be observable in terms of market penetration rate and user demographics before and after the change occurred.

1) Design Trajectory

The years following Seebotek PAC and ReSoundAIR an industry wide use of novel BTE designs could be observed. A frequent common denominator was attempts to shape and style the hearing aid in a manner differentiating the device significantly from traditional hearing aid shapes. In the following table it is seen how various manufacturers each had to have an aesthetic, receiver-in-the-ear “design device” in their portfolio. In the following is depicted the evolution of the mini-BTE in its early years (2003-2008)

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Manufacturer and product title	Year of launch	Image of design	Design novelty (cognitive distance from traditional BTE)	Technological design: Ear plug fitting/product architecture in terms of receiver placement
GN Resound "ResoundAIR"	2003		Medium	Open fit, thin tube BTE (traditional architecture)
Seebotek "PAC"	2003		Low	Deep fit closed fitting, RIC/RITE
Vivatone "Vivatone"	2004		Low	Open fit, RITE
Bernafon "SwissEar"	2004		Medium	Open fit, thin tube BTE (traditional architecture)
Starkey "Xtra"	2005		Medium	Open fit, thin tube BTE (traditional architecture)
Oticon "Delta"	2006		High	Open fit, RITE
Hansaton "Soundmanager"	2006		High	Open fit, RITE

Micro-Tech “Seneca”	2006		Low	Open fit, thin tube BTE (traditional architecture)
Phonak “Audeo”	2007		High	Open fit, RITE
Bernafon “Brite”	2007		High	Open Fit, RITE
Widex “Passion”	2008		High	Open fit, RITE
Siemens “Vibe”	2008		High	Open fit, RITE, body in the crest of the ear with highly visible faceplate.
Starkey “Zon”	2008		High	Open Fit, RITE
GN Resound “Dot”	2008		High	Open Fit, RITE

Illustration 2: The design trajectory of the mini-BTE

Before the introduction of the mini-BTE, the dominant aesthetic manifestation in the industry was that of invisibility. Some BTE’s before that reflected incremental attempts at making the BTE more aesthetic. Examples of this are the design of Danavox (now GN ReSound) Danasound in 1996 that attempted to depart from the “prosthesis” like look of the typical skin colored BTE or chrome BTE’s expressing being “high tech” and related to computer technology. The latter of these

occurred with some frequency around the introduction of digital signal processing to communicate that the user now “had a computer residing within the ear”. Apart from that, as the comparative market discourse analysis later will reveal, the ITE were the default option for dispensers in terms of cosmetics and the dominant logic in the industry held that the deeper in the canal a hearing aid could be placed, the better it would be at combating the stigma associated with hearing aid use. It was not until the GN ReSound’s ReSoundAIR and even more so, Oticon’s Delta that any radical attempts at changing the design language of the hearing aid, away from being a piece of medical technology to an attractive and hip piece of consumer electronics were being attempted.

With the birth of the “mini-BTE” category as industry press often termed it, the most radical attempts at designing hearing aids departing from traditional BTE designs occurred. In terms of the use of product languages, two considerable shifts occurred: Attempts were made to design hearing aids not resembling the typical design language of a hearing aid and while some digital hearing aids and some pocket aids previously had aimed at taking a technophobic stance in their design, the new generation of mini-BTE’s proudly embraced their technological nature creating symbolic resemblance to hip and fashionable pieces of consumer electronics rather than medical devices. It was explicit the intension of the GN ReSound and Oticon to create something that could change the perception of what a hearing aid was, by designing it in a way radically stretching the form language from traditional shapes. Interviewed product managers at GN ReSound and 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. The feedback that manufacturers typically got from dispensers, however, were that customers entered the clinic immediately asking for a device hidden in the canal, but when the dispensers asked them to quickly try a mini-BTE before, clients often remarked in surprise that “it did not look like a hearing aid”. Hearing aid users were reported to enthusiastically show off their hearing aids on golf courses, at dinner parties and at other social events.

This leads us to the next part of the analysis. If the product form discontinuity of the dominant aesthetic manifestation of the mini-BTE design trajectory had a category level impact on the hearing aid market, it should be observable in terms of the claims made by relevant actors referring to the product category (Rosa et al, 1999; Navis and Glynn, 2010; Khaire and Wadhvani, 2010).

2) Echoing between product form design and category level meaning and value ascriptions

When dispensers where to argue for the value of the CIC, cosmetics where often qualified with a reference to the cosmetic benefits of the device as “obvious”, reflecting that at the time, hiding a ITE device as deep in the canal as possible was the obvious way to make it more attractive to cosmetically minded users. The introduction of the mini-BTE can be argued to have led to a new product form design trajectory within the industry, supporting the claim that the aesthetic mini-BTE created a dominant manifestation of product form design within the industry. In the years before 2003, had a manufacturer launched a new device with a new faceplate color or slightly smaller circuit size, it constituted a significant industry news message. The mini-BTE and especially with Oticon’s Delta, institutional change occurred leading to a “designitization” of the hearing aid device not seen before in an even close extend. This was reflected in the product claims made in the manufacturer news sections in hearing care trade journals. Even in the years where the CIC reflected a considerable novelty in product form design, only few references to cosmetics or appearance could be found and only few product claims concerned new product designs (a few mentioned the option of getting different colored face plates to blend in with the shadow of the ear canal). After 2003 and especially 2006, this changed dramatically. Product claims and user representations (product claims about the target user market for the device) changed considerably. References to the user characteristics previously characterizing trade journal publications about the emerging market segment of baby boomers were mirrored in the user representations seen in product claims. In addition product claims in product announcements or design award announcements explicitly stating that the device looked radically different from the traditional device were nearly always present. This reflected the fact that categorical repositioning was directly attempted to conform to the product meaning and value sought for in the changing context of consumption.

The following overview of the findings of the product claim analysis should not be taken as an exhaustive collection of quotes, but more as a typology of product claims that occurred frequently in the material. Other types of product claims related to the addressing of stigma were found, but if only a single of these were found, they were not included in the analysis, unless they could be subsumed under other types of claims. “Cosmetics” were taken as the point of departure for the textual analysis as it represents the dimension of hearing aid selection that concerns addressing the stigma and appearance related adoption barriers in hearing professional discourse.

Comparative, category level analysis CIC/Mini-BTE product discourse

	<p>CIC: Collected in the period 1992-1996 in The Hearing Journal, Hearing Instruments, Hearing Review</p>	<p>Mini-BTE: Collected in the period 2003-2008 in The Hearing Journal and Hearing Review</p>	<p>New product claims in terms of categorical positioning in the mini-BTE analysis (CIC product launch announcements contained below 5 references to “invisibility” and “inconspicuous” in total, in spite of three rather than two trade journals provided data for the study).</p>
<p>Cosmetics</p>	<p>“What are the advantages of CICs? Besides the obvious cosmetic advantage, there are at least four others.”</p> <p>“CIC’s are not merely a cosmetic change in technology”</p> <p>“The CIC advantage. The CIC have been shown to attract younger individuals with milder hearing impairments. Although the initial interest in this device is due to its cosmetic appeal, a variety of other acoustic advantages have been discovered with this particular style”</p> <p>“Best Cosmetics. Hands down the CIC is the best device for addressing cosmetic concerns.”</p> <p>“Why all the excitement over CICs now? We dispense CICs now because we can. Progress in signal processing circuitry and the miniaturization of components have made it possible to achieve high fidelity and small size. And the fact remains that stigma is still one of the primary reasons why people do not purchase hearing aids “.</p> <p>“This hearing aid style is</p>	<p>“OC fitting devices are small enough to be minimally visible and physically unobtrusive for most patients”</p> <p>“ but the cosmetics associated with BTEs- including sporty slim-tube designs and receiver-in-the-ear (RITE) options: Specifically intended to appeal to a younger clients while having an obvious appeal to the current demography of hearing instrument users”</p> <p>“The re-introduction or the open-mold fitting has created great acceptance for the use of amplification with the hearing impaired”</p> <p>Generationally, baby boomers have already demonstrated that they are not likely to be as stigmatized by hearing aids as their predecessors, as evidenced by the myriad of Bluetooth headsets that resemble large BTE devices in current use ... The introduction of "micro" BTE devices that look and feel "edgy" compared with traditional "institutional" hearing aids could be a prelude to hearing aids</p>	<p>“ReSoundAIR wins fifth design award. ... Previous winners of the prestigious Japanese Design award [Good Design Award ed.] have included iPod and a Sophisticated cell phone from Sony Ericsson.” ReSoundAIR 2004 (Design award announcement)</p> <p>“(Soundmanager) is the first system to meet precisely the requirements now placed on modern communication products. The elegant design is small, invisible, comfortable and easy to handle (Hansaton, Soundmanager, 2006)</p> <p>Delta's triangular design features sleek lines, hot colors, and a brushed metallic surface (Oticon, Delta, 2006)</p> <p>Designed to seamlessly combine enhanced clarity of speech in noise with a sleek cosmetically attractive design (Oticon, Delta, 2006)</p> <p>“Innovative design” ... revolutionary product design” (Bernafon Brite, 2007).</p> <p>“Although cosmetics have always been a strong driver</p>

	<p>thought to provide significant more satisfaction because of its visibility (or lack of visibility)”</p> <p>“Nobody wants to get old. But because hearing impairment is so strongly associated with being old, wearing hearing aids becomes the scarlet letter of aging. ... The hearing industry should take lessons from the vision profession. Today, advertising vision care is aimed at the young. Glasses are fashionable. Obtaining vision care is simple. Research tells us that we must change. The practitioners tell us we must change. Patients tell us we must change. The stagnation in growth of hearing aid sales tells us we must change.”</p> <p>“Dispensers and manufacturers alike have equated this negative attention factor with hearing aid visibility and consequently have advertised hearing aids in ever smaller sizes. Unfortunately, as this is at the risk of sacrificing performance Furthermore, this step reinforces the belief that hearing aids have to be hidden hearing loss is something to be ashamed of.”</p>	<p>evolving into "personal communication systems."</p> <p>“Since one aspect of hearing aid stigma is being associated with aging and infirmity, devices that are discreet or resemble other communication devices can help in attracting new users”</p> <p>“These new products, which offer unprecedented sound quality and cosmetics, are great drivers in the continued acceptance and satisfaction with hearing aids.”</p> <p>“These came as a breath of fresh air, looking sleek and modern and more-or-less disappearing on the ear. In addition to their cosmetic appeal, open fit hearing aids are generally physically comfortable to wear, eliminate occlusion related complaints, and reduce the occurrence of feedback.”</p>	<p>for successful solutions, it is not enough for hearing instruments today just to be small; they must also have an appealing design. (Siemens Vibe, 2008)</p> <p>“ "red dot" award-winning Brite line not just as innovative hearing instruments that offer state-of-the-art technology, but one that offers fashion as well as functionality. (Bernafon Brite, 2007)</p> <p>“Bernafon was inspired by the shape and tactile characteristics of soft organic forms, and intended to design a hearing aid that complements the individual. Bernafon created a device that features and iconic shape drawn from nature, resulting in a distinctive yet discreet design” Bernafon Brite, HJ, 2007, 60, 11 (design award announcement)</p> <p>“Developed for the huge untapped market for first time users, Audéo is designed to offer the stylish look that this population demands. ... Cool design” ... (Audéo, HJ, 2007, 60, 6)</p>
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Illustration 3: Comparative overview of typical product claims.

3) Changes in user demographics

Through a review of relevant publication in the Marke Trak database of the Better Hearing Institute it was sought out whether any significant changes had been found in user demographics and penetration rate from the introduction of the mini-BTE. The negative meaning and value, in the form of the stigma often associated with hearing aid instruments, has been documented to be a considerable adoption barrier ((Kochkin, 1993, 1994b, 2007). This barrier is resulting in a considerable low penetration rate of approximately 20% of the typical market size estimate (Kochkin, 1993; 1999). While several dispensers reported that their user base was getting younger with the introduction of the mini-BTE, the Marke Trak studies showed no significant difference in terms of the age of users (Kochkin, 2009, 2011). A significant difference was however found in terms of income, civil status, severity of the hearing loss and relationship to the work force (Kochkin, 2011). Compared to users of other hearing aid styles, the mini-BTE did show signs of a clear segment, resembling what was projected for the CIC device in the latter half of the 90's (Kochkin, 1994a, 1994b). Users tended to live more active lives and sought help for less severe hearing losses. Furthermore, new users of hearing aids in the time period tended to be more likely to choose a mini-BTE than other styles (Kochkin, 2011). Through this it can be inferred that the mini-BTE could shift the market share from ITE to the BTE category by becoming the preferred style of devices for users most resistant to hearing aid adoption. A Significant increase in penetration rate would indicate considerable change on the overall category level of 'hearing aid'. While these seemingly were not the case, the changes the Marke Trak studies reported in user demographics and that first time users typically preferred mini-BTE's, indicate that the status of the BTE device had shifted. Rather than being the option for less cosmetically minded users, to being the default option for users preferring to avoid carrying a hearing aid symbolizing old age, weakness and degeneration. Finally, it points at the fact often mentioned in the previously analyzed product claim, namely that the social context of consumption for hearing aids had changed. Even older segments were now demanding hearing aids that carried other meanings and value than traditional hearing aid styles did.

Alternative explanations/falsification of findings: An analysis was carried out to control for whether the main empirical claim of this paper, namely that radical change in product form design catalyzed institutional change in the market and industry in the form of a new design trajectory. This brief analysis tried to falsify this claim by arguing that the success of the new breed of BTE

devices were not due to categorical repositioning through product form design, but primarily through other factors. None of these counter claims were found plausible.

Did the mini-BTE gain the dominant market share due to price concerns? Mini-BTE's were considerable more expansive than traditional styles. Due to the receiver being placed in the humid environment of the ear canal, repair frequency was higher than on traditional BTE's. Furthermore, if price was a primary cause, change should primarily be observed at the point of product maturation were low end mini-BTE products were introduced. This was however not the case.

Did the mini-BTE gain the dominant market share solely due to acoustic performance: Was the success of the mini-BTE primarily a matter of acoustical/audiological performance, for example by eliminating occlusion and feedback? Seebotek Pac and Vivatone solved the occlusion challenge and minimized feedback as well. They did however present a radical product form discontinuity and the success were not like Resound Air or Delta nor did they have the same impact in forming a design trajectory. The institutional change following the introduction of the mini-BTE typically imitated the designs of ResoundAIR and Delta rather than Seebotek PAC or Vivatone.

Was the shift gradual rather than a discontinuous event, meaning that the mini-BTE could not have catalyzed it? In between the introduction of the CIC and the mini-BTE, in 1996 a major discontinuity in technology did occur, the transition to digital signal processing. This did not however seem to have any considerable effect on the distribution of market share among styles of devices. The transition to digital, did lead to new forms of product claims, for example emphasizing the high tech nature of the device. In addition of the first two fully digital devices launched, Widex senso and ITE and Oticon DigiFocus and BTE, Widex were the significantly most successful of the two, nearly tripling their turnover in a few years after the launch of the device. This indicates that the shift back to the BTE as dominant was not just a gradual continuation of market trends commencing several years before the introduction of the mini-BTE.

Discussion of propositions: Bilateral Echoing/Discerning Effects and Categorical Positioning as a Determining Factor in Dominant Design Selection

The first two propositions concerned bilateral echoing and discerning effects between product form designs and the meaning and value ascribed to product categories. Both of these were observed in

the study. Product specific product claims and category level product claims in market discourse echoed the meanings and values sought embedded in product form designs by manufacturers in the early phases of the mini-BTE. The mini-BTE's launched in 2007-2008 considerably echoed the claims, why a cyclical, bilateral echo effect can be inferred.

Drawing on a distant cultural register of 'consumer electronics' rather than the local registers of 'hearing aid instruments' or 'medical instruments', the mini-BTE represented a categorical repositioning away from the stereotypical BTE hearing aid towards more attractive consumer electronics categories. Since product claims observed in the market discourse echoed this repositioning, if this echoing supported their potential for being selected in the market place, a discerning effect can be inferred (Grodal, Gotsopoulos and Suarez, 2015).

The fact that the later mini-BTE trajectory (2007-2008) echoed the meaning and value ascribed to the overall category seemed to influence the market selection of them positively. Due to the fact that the market share for BTE devices increased rapidly in the period, a discerning effect was likely to have occurred. This effect supported the market selection of devices representing a categorical positioning away from 'hearing aid' or 'medical device' to 'consumer electronics'. In the review of relevant Marke Trak publications, changes in the user base were reported that provide further support for the presence of the discerning effect. The reported changes in the user base suggested that the categorical positioning of the mini-BTE design trajectory successfully had mitigated some of the negative meaning and value associated with hearing aid use.

The third research proposition concerned the specific interplay between categorical positioning through product form design and changes in the social context of consumption, in shaping users' perception of product value. In many markets, users' perception of product value is a central determining factor for the selection of a dominant design (Schilling, 1998). This proposition was explored in terms of the establishment of the dominant product form manifestation of the mini-BTE. While the Marke Trak studies reported of no significant changes in the market penetration rate through attracting more, younger users, other changes in user demographics were reported. These indicated lifestyle changes in the elderly segments of hearing aid users. The aesthetic mini-BTE provided a set of superior product meaning and value for the new baby boomer generation of hearing aid users. As seen in the design trajectory analysis, the selection of the consumer electronics infused mini-BTE was likely supported by that fact that it fitted better to the changes in the social context of hearing aid consumption than the category of 'hearing aid' traditionally has done.

The fact that the product form design of early mini-BTE's such as Delta had a significant impact on the further design trajectory, through departing from traditional BTE designs, reflects an interesting form of discerning effect. If we take discerning effects to be mechanisms that enhance market selection, between a category level and a product design level, a more distant discerning effect can be argued to have taken place. By 'distant discerning effect' is implied an instance where the selection of a design is supported by the fact it is departing rather than conforming to its respective home category in favor of a more distant category (Rindova and Petkova, 2007). In this case the consumer electronics infused mini-BTE design and the traditional BTE category. Several positive product claims in the market discourse emphasized this resemblance to consumer electronics and the "revolutionary" design of the devices, supporting its selection, due to its categorical non-conformance. In light of this, the categorical positioning of the early consumer electronics-infused mini-BTE's can be expected to have enjoyed a distant discerning effect through avoiding echoing the traditional BTE category. Since early the designs of mini-BTE's did not echo their own category nor another local category, this indicates that a discerning effect from a more distant product category, such as 'portable audio player' enhanced the selection of the mini-BTE product form design that shaped its further trajectory. This is instance of a distant discerning effect is however very unlikely to have been a co-evolutionary one. Rather, it can be expected to be a unilateral one, since any significant effect from the mini-BTE to the evolution or selection of consumer oriented portable audio equipment is unlikely.

Discussion of Contribution

This study sheds important light the mobilization of cultural resources in catalyzing change in the meaning and value associated with product categories (Khaire and Wadhvani, 2010), co-evolutionary relationships between product categories and product design (Grodal, Gotsopoulos and Suarez, 2015) and the role of product form design in the selection of dominant designs within industries (Verganti, 2008; Eisenman, 2013).

The co-evolutionary dynamics between product categories and product designs suggested by Grodal, Gotsopoulos and Suarez (2015) were found to be present in the case of product form designs and the meaning and value associated with product categories. It was found that a discerning effect catalyzed the rapid increase in market share of the mini-BTE category. Rather than

only concerning category labeling and technological designs, these effects were also found in the case of product form design and meaning and value associated with product categories.

In their study, Khaire and Wadhvani (2010) found how market actors can mobilize cultural resources in catalyzing radical change in the meaning and value associated with the product category. This study adds to our knowledge of such category level changes. It was found how not only disputes among institutional actors, but also product innovations can catalyze such changes. The interplay between product form designs and category level changes in meaning and value was found to be one of echoing and discerning. A design embedding a novel categorical positioning through can catalyze change in the meaning and value associated with a product category if it successfully can trigger echo and discerning effects. In the case of the mini-BTE, a distant discerning effect, triggered through the mobilization of new cultural resources, was significant in establishing the new dominant product form design manifestation. This manifestation then became echoed in the further evolution of the meaning and value associated with the product category forming category level and design level evolution in its trajectory. In addition, the mobilization of cultural resources in innovation and product development has now been shown to be closely connected to category level market change (Rindova, Dalpiaz and Ravasi, 2011).

Until now, it has not been studied how the mobilization of cultural resources by market actors can radically changing the meaning and value associated with a product category in relation through categorical positioning (Rindova and Petkova, 2007; Rindova, Dalpiaz and Ravasi, 2011). This study found how new product form designs reflecting a novel use of cultural registers (consumer electronics) supported their selection as the new dominant design in the hearing aid industry. This mobilization allowed for a categorical repositioning that provided a better fit with the changing social context of consumption. By tapping into changes in what it meant to be aging and new lifestyles and expectations towards aging , the new consumer electronics infused mini-BTE were supported in being selected as a dominant aesthetic manifestation (Eisenman, 2013) or dominant design language (Verganti, 2008). In studying how a discontinuous product form design innovation could rise to market dominance, a new type of discerning effect was discovered. Synthesizing Rindova and Petkova's idea of categorical positioning (2007) and Grodal, Gotsopoulos and Suarez (2015) notion of the discerning effect, it was found how distant discerning effects can support the selection of novel designs that holds the potential for catalyzing category level change in meaning and value associations.

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