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EFFECTS OF INNOVATION TYPES ON PRODUCT IDENTITIES: DOES RADICAL INNOVATION LEAD TO A MORE INTEGRATED PRODUCT IDENTITY?

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ABSTRACT

In this study, the relation between innovation that lead to innovation types and product identity integrity is investigated through a theoretical frame, which is briefly tested through Turkish television industry. There are many studies in literature that discuss design's role in innovation. The differentiation of product design activities from technological improvements was also discussed before; however more recent studies conducted by Dell'Era and Verganti also discuss the visual language aspect and its contribution to product innovation. Even if many aspects of visual elements and their effect on perceived novelty are discussed, the overall outcomes of design-driven innovation on product identity and brand identity still need to be discussed. There is a prior study conducted by Dell'Era and Verganti (2007) that provide quantitative clues on the subject, but theoretical explanations and their evaluations on fieldworks are still needed. This study aims to provide theoretical explanations to product identity outcomes of certain innovation types. Literature on innovation, organizational creativity, and comparative studies on radical and incremental innovations are studied together with studies on product identity strategies to provide a relation between innovation types and product identity outcomes. The study supports the provided theoretical relations to a degree through a study that is conducted with three Turkish television producers, as cognitive and strategic factors that link radical innovation with integrated product identity can be identified. The results support prior studies that claim companies with radical innovation capabilities have more homogenous product identity. The outcomes can be developed further for developing product identity strategies.
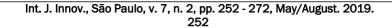
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EFECTOS DE LOS TIPOS DE INNOVACIÓN EN LAS IDENTIDADES DEL PRODUCTO: ¿LA INNOVACIÓN RADICAL LLEVA A UNA IDENTIDAD DE PRODUCTO MÁS INTEGRADA?

RESUMÉN

En este estudio, la relación entre la innovación que conduce a los tipos de innovación y la integridad de la identidad del producto se investiga a través de un marco teórico, que se prueba brevemente en la industria de la televisión turca. Hay muchos estudios en la literatura que discuten el papel del diseño en la innovación. La diferenciación de las actividades de diseño de productos de las mejoras tecnológicas también se discutió antes; sin embargo, estudios más recientes realizados por Dell'Era y Verganti también discuten el aspecto del lenguaje visual y su contribución a la innovación de productos. Incluso si se discuten muchos aspectos de los elementos visuales y su efecto sobre la novedad percibida, los resultados generales de la innovación impulsada por el diseño sobre la identidad del producto y la identidad de la marca aún deben discutirse. Hay un estudio previo realizado por Dell'Era y Verganti (2007) que proporciona indicios cuantitativos sobre el tema, pero aún se necesitan explicaciones teóricas y sus evaluaciones sobre el trabajo de campo. Este estudio tiene como objetivo proporcionar explicaciones teóricas a los resultados de identidad de productos de ciertos tipos de innovación. La literatura sobre innovación, creatividad organizacional y estudios comparativos sobre innovaciones radicales e incrementales se estudian junto con estudios sobre estrategias de identidad de productos para proporcionar una relación entre los tipos de innovación y los resultados de identidad de productos. El estudio respalda las relaciones teóricas proporcionadas hasta cierto punto a través de un estudio que se realiza con tres productores de televisión turcos, ya que se pueden identificar los factores cognitivos y estratégicos que vinculan la innovación radical con la identidad de producto integrada. Los resultados respaldan estudios previos que afirman que las empresas con capacidades de innovación radical tienen una identidad de producto más homogénea. Los resultados pueden desarrollarse aún más para desarrollar estrategias de identidad de productos.

Palabras Clave: Innovación Orientada Al Diseño. Identidad Del Producto. Fijación De Diseño. Estrategias De Innovación. Análisis De Formato De Diseño (DFA).

INTRODUCTION

In early literature, product innovation was mostly referred as an activity that stems from theoretical conceptions that lead to scientific research, which become technologies that can be marketed through commercial activities (Trott, 2005; Stefik & Stefik, 2004). It was suggested that innovation could occur as either technology-push or market-pull (Afuah, 2003). The previous definitions do not stress design as a source for innovation; however recently product innovation is researched in both technology and meaning dimensions (Verganti, 2009). It is suggested that meaning dimension forms new product languages that alter the users' perception of the products (Verganti, 2008). Therefore it can be inferred that the innovation characteristics of a company may have an effect on product identities.

There is information in the literature about the ways innovation characteristics can affect product languages. Dell Era and Verganti (2007) suggest that organizations with radical innovation capabilities have more homogenous product

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languages. However, since their results support the opposite of their original assumption, the findings are open for further studies.

This study is conducted in an effort to study and analyze the reasons behind the relation between radical innovation capabilities and integrated product identities. The factors that form the theoretical relations were studied in two groups. The first group of the factors is referred as strategic factors, which are basically discussed through studies about brand and product identity preferences of designers and organizations. The second group is evaluated as cognitive factors, which analyze the nature of radical and incremental innovation environments of technological and design oriented innovations, and define the reasons that lead them to homogenous and heterogeneous product identity integration. After defining the theoretical explanations, a qualitative case study is made to understand if the relations provided could be observed.

Reviewing the literature on innovation types and strategies

As mentioned earlier, innovations can be evaluated in two directions; design and technology. Verganti (2009) demonstrated how these two orientations may be examined together through his work.

In his work, the "meaning" axis represents the radical changes that can be observed in a products' meaning. Radical changes in the meaning of the products can be made through design-driven innovation, while design-driven incremental innovations can be done through human-centered design. Human-centered design is formerly defined by Norman as adapting technological products to users' daily life (Norman, 1993). This view may be investigated together with the idea about products' evaluation proposed by Norman and Verganti (2014). In their study, writers suggest that products tend to evolve to a certain optimum; any attempt to improve a certain product is to bring it to a best state possible within its defined context. However, when radical changes occur in products, attempts to bring the new product to another optimum start again, within another

context. Writers make an analogy to hill-climbing and they state that "Incremental innovation tries to reach the highest point on the current hill. Radical innovation seeks the highest hill." (Norman & Verganti, 2014). Another claim made in this study is that, human-centered design efforts almost never end up with radical innovation; which may be supported by other studies that state design researchers' and users' view on products may be affected and limited by their prior experiences (Steen, 2011).

The technology axis of the model refers to radical and incremental technological innovations, which can also be described as technology push and market pull innovations; technology push innovations tend to have an R&D orientation, and radical technology changes the market conditions (Rothwell, 1994; Di Stefano et.al., 2012; Forés and Camisón, 2016). Also, market pull innovations are claimed to take market into account as the source for directing R&D activities (Trott, 2005). Norman and Verganti (2014) provide another perspective to technology driven innovations regarding industrial design discipline, and suggest that technology driven radical innovations may change the substructure of the product, however they do not change the product's meaning; a good example being the transition to LCD TVs from CRT TVs.

Strategies related with technology driven radical and incremental innovation

The differences between companies that focus on incremental and radical technological innovations may be either strategic or structural. In literature, it is stated that there is a correlation between companies size, market orientation and incremental innovation capability; it is also suggested that for producing successful radical innovations, companies need to have innovation champions and a vast number of technology experts along with higher technological capabilities (Song & Thieme, 2009; McDermott & O'Connor, 2002; Brettel et. al., 2011; Di Benedetto et. al., 2008; Ettlie et.al., 1984; Amabile et. al., 2016). Un (2010) compared companies that prefer project oriented employing to firms that prefer to employ researchers more individually, to suggest that

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researchers who have more individual working capability tend to produce more radical innovations than those who are hired to work within a certain project. Regarding organizational creativity, Woodman et. al. (1993) suggest that limitations on task strategies can decrease creativity, while autonomy can have a positive effect. Studies also suggest that although industrial collaborations up to a degree may support both incremental and radical innovations, an overly complex information network is found to be ineffective for radical innovation, together with a need for better information management (Oerlemans et. al, 2013; Ritala& Hurmelinna-Laukkanen, 2013, Di Benedetto et. al., 2008). They also suggest that an information network should be more diverse for incremental innovation (Oerlemans, 2013).

Koberg et. al. (2003) found correlation between the age and size of a company and incremental innovation; also being experimental and having a more dynamic industrial structure favors radical innovation. Another aspect that favors radical innovation is having incubation units, as they allow large scale organizations to focus on projects that are not directly appealing to their core customers; targeting a core customer group is mentioned to favor incremental innovation (McDermott & O'Connor, 2002; Ford et.al, 2009, Sheng & Chien, 2016).

Strategies related with design driven radical and incremental innovation

The conditions that favor design driven radical innovation is mostly defined by recent studies in literature; there are also some studies that compare companies possessing design driven radical innovation capacity with the ones that have design driven incremental innovation capability.

Verganti and Öberg (2013) claim that unlike technology driven innovation, design driven innovation should be done through interpreting and envisioning. For effective interpreting and envisioning, sources should be selected according to their hermeneutics capabilities; properly selected experts could be more helpful than crowdsourcing (Verganti, 2011). However, it should be noted that inclusion of users in radical innovation researches is not completely omitted

in literature. It is suggested that lead users can provide insights about products that are to be used in upcoming years (Franke et. al. 2006), and their needs do not exactly fit to the needs of majority of the users (Urban and Von Hippel, 1988). This view can also be seen in Verganti's (2009) studies which hint that lead users can be a source of information for radical innovations. Employing researchers that are not directly related to relevant industry is suggested to favor radical design driven innovation (Dell'Era & Verganti, 2010). Also, one of the main characteristics of companies that can make effective design driven radical innovation is claimed to be focusing on socio-cultural changes, rather than current market trends (Verganti, 2009).

Dell'Era and Verganti (2010) compared companies which practice different types of design driven innovation to discover that companies with radical design driven innovation capability have (1) a larger percentage of their products to be designed by outsourced designers, (2) more outsourced designers to collaborate in projects, (3) a higher percentage for working with foreign designers when compared to other firms, (4) more diverse backgrounds in their designer portfolios, (5) a tendency to work with designers from subsectors. It is stated in studies in organizational creativity that skills in several domains may be necessary to build novel ideas (Amabile et. al. 2016).

Multidisciplinary teams formed by people of diversified backgrounds with different qualitative abilities are mentioned to be facilitators of creativity (Woodman et. al. 1993; Basadur, 2004). Dell'Era and Verganti (2009) also support that companies tend to inspect areas such as fashion and art to transfer product language and meaning aspects.

Companies with an incremental design driven innovation capability are mostly claimed to have an opposing character to firms that have radical design driven innovation abilities. Incremental innovation capabilities are studied though being market oriented and human centered on both technology and design directions (Norman & Verganti, 2014).

Applying user segmentations, making focus groups and doing surveys support market awareness; focus groups may also include

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interviews (Garrett, 2010; Kunert, 2009; Wilson, 2014; Wilson, 2013). Task analysis, user tests, contextual inquiry studies may be listed among methods that support user centered design (Norman, 1986; Garrett, 2010; Leonard et.al, 2006).

Besides the research techniques mentioned, the characteristics of design research team may also provide hints about the capabilities of an organization. Referring to studies in the literature, it can be said that companies that have incremental design driven innovation capabilities tend to work mostly with their in-house designers; and they do not get regular support from outsourced experts (Dell'Era & Verganti, 2010; Dell'Era et. al, 2008). Perks et. al. (2005) also suggest that external designers appear frequently in radical product developments, however incremental developments are mostly conducted by internal designers. But, they also state that radical development does include internal designers, and radical innovators seem to employ combined teams of external and internal designers. This may be due to companies' need for language consistency; Dell'Era et. al. (2008) define the role of "socio-cultural researchers" as design managers who keep proposals of designers within company directions, stressing the need for a coherence between external designers. Ravasi and Lojacono (2005) also stress the need of coherence among various ideas coming from external sources.

The strategies listed for both innovation aspects can be helpful to identify any possible theoretical links to product identity integration.

Product identity and its relation with innovation structures

The visual representation of products is discussed under several titles. Dell'Era and Verganti (2007) discussed this phenomenon under the terms "sign and languages". Karjalainen (2007) refers to the same issue by pointing out to the design cues resulting from brand identity. Here, starting from the identity concept within a firm, an explanation for the chosen "product identity" term will be given.

It can be assumed that identity formation within an organization starts from corporate level.

Balmer and Greyser (2003) state that, within a corporation, the question "Who we are?" discusses organizational behaviors and organizational identity, while "What we are?" question aims to examine corporate identity. Vella and Melewar (2008) state that, the identity of corporations should be evaluated differently from the identity of people. Wee (2015) supports this idea by claiming that the identities of people are congenital, while the identities of organizations are created. Corporate identity is claimed to be a combination of communication, design, culture, behavior, structure and strategy at the corporate level (Vella and Melewar, 2008).

Brand identity is stated to be a concept that is, in some cases, close to the corporate identity. However, a company can own several brands; therefore one brand can be owned by two corporations with two different corporate identities (Balmer & Greyser, 2003). A corporate identity is more related to the shareholders of a company, while brand identity targets communication with customers (Watson & Kitchen, 2008; Wee, 2015).

Cagan and Vogel (2002) name product identity as one of the factors that support brand identity, naming the three attributes of product identity as personality, point in time and sense of place. Balmer (2008) defines product identity as the source of brand identity when he separates corporate brands from product brands. It is stated that in some cases product identities can excel corporate identities; however mostly product identity is defined as a supporter of brand identity that nourishes an integrity sense (Warell, 2001; Karjalainen 2004; Dowdy, 2003).

Another concept that is related to product languages is product character, which mainly is the reflection of the product language on the potential users (Karjalainen, 2004). Here, product identity is referred as the companies' intention on how to reflect brand identity, while product character will be referred as audience's perception.

It can be claimed that product identity can be transfused to audiences via visual codes; products can communicate with users through geometry, measurements, textures, materials, graphics and details (Crilly et. al., 2004). There are various references that include symbols, signs and visual

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cues, such has "implicit" and explicit"; first can be defined as the codes that help people to differentiate two person's faces, while the second refers to more open visual codes (Karjalainen, 2004; Karjalainen & Snelders, 2010; Karjalainen, 2007). "Genuine" codes refer to visual cues that can communicate with users without prior knowledge; while "stringed" codes need prior exposure to produce a meaning cumulatively (Karjalainen, 2003). Finally, there are "complete" and "partial" cues; former communicates to general audience while "partial" cues only appeals to special consumer groups (Karjalainen & Snelders, 2010).

Strategic factors that relate product identity integration with innovation characteristics

It can be assumed that companies that tend to prefer applying radical innovations in general, may lean towards a more integrated product identity. It is frequently stressed that it is harder for radical innovators to have their products adopted by users; and it is also mentioned that an integrated product identity favors product adoption (Warell, 2001; Norman & Verganti, 2014).

In their study, Person et. al. (2007) provided designers with hypothetical scenarios to analyze their choices in various situations. They suggested that, at the beginning of the product life-cycle and when the product line is narrower, designers preferred more integrated product identities. This statement is compatible with Karjalainen (2004) study that declares Nokia preferred a more integrated product identity at the beginning, followed by a more diverse product language at the maturity stage. However, it is also stated that even with the diversified product range, there were visual cues that connected Nokia products (Karjalainen, 2004), as it is ideal to offer a perceptible product identity even within diversified products (Warell, 2001; Karjalainen, 2003, Person et. al. 2008).

Differentiating product identity from competitors is another aspect of visual language strategies (Monö, 1997). Person et. al. (2008) hint Dyson example to express radical innovators need to differentiate their products from competitors to stress the novel aspects of the product. In industries where innovation is mostly done by

product languages, such as furniture, companies may work together on new visual cues in order to enhance user adoption (Verganti, 2009). Therefore it can be said that being a radical innovator increases the possibility of producing novel visual cues, which are in some cases brought to the market together by some other radical innovators.

When radical and incremental innovators are compared through their product identity integration tendencies, it may be claimed that radical innovators will have more integrated identities. Incremental innovators enter market when it starts to mature; and their main competitive strategy becomes product diversification for different markets. On the other hand, radical innovators operate mostly on growth stage, and they may have a tendency to differentiate their product language from others when they introduce new technologies. On product meaning level, radical innovation is made by bringing new visual cues, which are sometimes produced in cooperation with other companies in the industry.

In literature, copy-cat behavior is also mentioned, where companies deliberately copy another company's product appearance in order to mislead and induce customers (Person et. al., 2008).

Cognitive factors that relate product identity integration with innovation characteristics

Within cognitive factors, the aspects that lead a company towards homogenous or heterogeneous product identity will be discussed. Here, the main theoretical link will be design fixation. Some of the studies on design fixation will be explained briefly, in an effort to stress the relation between innovation characteristics and product identity integrity.

Design fixation mainly refers to designers' tendency to solve a design problem within the context of a prior solution that is exposed to them (Jansson & Smith, 1991).

Following the experimental study done by Jansson and Smith (1991), there were other studies that explore the stimuli that cause fixation, and factors that lead to defixation (Crilly, 2015). Among these studies, Purcell and Gero (1996) state that fixation can be related with

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problem area experience. In their study they observed that industrial designers did not get fixated in an engineering problem, while mechanical engineers did. They also argued if this finding was related to how industrial designers were educated, however their result about expertise was backed up by others, and there some studies that show industrial designers may also get fixated on product forms (Crilly, 2015; Cheng et. al., 2014).

There are other studies which also support the idea that domain expertise increases the occurrence of design fixation (Viswanathan and Linsey, 2012; Linsey et. al., 2010), while some of these focus on the use of within-domain or between-domain examples by domain experts (Ozkan and Dogan, 2013; Christensen and Schunn, 2007).

Field expertise leads to more common use of within-domain examples (Björklund, 2013), which diminishes the probability of employing novel solutions to design problems (Dahl and Moreau, 2002).

Since within domain analogies are formerly presented solutions to a design solution, they trigger probability of problem fixation through semantic analogies (Moreno et. al., 2014).

Studies suggest that designers are highly affected by examples that are shown to them; many of them tend to fixate on visual examples rather than verbal explanations, even if visual examples are inaccurate (LeFevre and Dixon, 1986; Smith et. al., 1993; Chrysikou and Weisberg, 2005; Christiaans and Van Andel, 1993).

Some studies on how to diminish fixation effect suggest that "forgetting" the problem by staying away for a while, which may help to decrease the fixation tendency (Smith et. al., 2011). Linsey et. al. (2010) suggests that using analogies for problem solving may reduce the fixation. Smith et. al. (2011) also suggest that using evolved analogies helps defixation; designers may look at totally different problem areas to bring a solution which will be novel for the actual problem.

When the literature on design fixation is evaluated together with the recent innovation studies, it may be suggested that companies with radical innovation capabilities could have a more integrated product identity.

Since radical innovators of product meanings tend to work with designers from different backgrounds, the possibility of getting fixated on product forms and visual codes would be reduced. Industrial designers seem to have a tendency to get fixated on product forms (Cheng et. al, 2014), since visual cues on the products are mainly their expertise. Therefore, including designers from other fields to solve a problem, as most radical innovators of meaning do (Dell'Era & Verganti, 2010), may help to reduce fixation tendency.

The habit of concentrating on future scenarios rather than current market needs could create a forgetting effect; since current solutions would not be designers' primary focus, the designers of organizations with radical design driven innovation capabilities would be less prone to getting fixated on various visual cues that are existent in the market.

Being less vulnerable for design fixation may increase the possibility for a company to produce novel product forms. It is discussed that novel product identity cues can be transferred to other product categories (Karjalainen, 2007).

Therefore it may be suggested that after creating a genuine product identity, an organization can transfer its design cues to various new product lines. It may be claimed that organizations with radical design driven innovation capabilities can create and transfer distinctive identity codes, since they do not usually get affected by design fixation.

To sum up, it can be suggested that companies with radical innovation capabilities usually do not get focused to market, and work with designers from different backgrounds. These practices may diminish the design fixation effect to nourish the possibility of creating novel design cues, which may be passed to other products later to form a homogenous product identity.

On the other hand organizations with incremental innovation capabilities tend to focus on market and work with more monodisciplinary teams of industrial designers; therefore, they can be affected by design fixation. This tendency may increase a possibility of bringing various semantic cues from different competitors to their products, ending up with a heterogeneous product identity.

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Research

To test the theoretical factors listed here, studies with three consumer electronics companies were conducted as case studies.

A prior study done by Dell'Era and Verganti (2007) provided quantitative data on the relationship between radical innovation capabilities and homogenous product identity. In this work, the explanations for the logic behind this correlation are tested in a simple way to see if they are worth further investigation.

Research method

For the three cases, there are two separate studies. First, the general innovation characteristics and strategic preferences of the companies are studied. Then, product identity integrities are explored.

Analyzing innovation capabilities

There are several methods to study organizations' innovation capabilities, such as defining innovation indicators, evaluating expenditures on R&D, innovation scoreboards (Freeman & Soete, 2009; Kleinknecht et. al., 2002; Hollanders & van Cruysen, 2008). However, most of these methods do not investigate design as an innovation capability, nor do they concentrate on radical and incremental innovation capabilities. It is also stated that there is a lack of consideration for design in innovation studies in general (Hobday, 2011).

Therefore, the strategic indicators listed previously are sought in each company to get an overall idea about their innovation tendencies. Afterwards, the theoretical reasoning for product identity integrity and innovation characteristics listed below are investigated for each company.

Table 1: The codes for product identity integration and innovation capability relation

	Homogenous Product Identity – Radical Innovation Capabilities	Heterogeneous Product Identity – Incremental Innovation Capabilities
Strategic Factors	• Operating at the beginning of product life-cycle • Narrow product range	• Operating closer to the maturity stage of product life-cycle • Broad product range
Cognitive Factors	• Staying away from current solutions/forgetting • Use of analogies	• Evaluation of current solutions/ market orientation • Fixation risk arising from expertise

Semi structured interviews were done with three companies, to be transcribed and thematically coded to define strategic choices (Glesne, 2015; Flick, 2009). Since one senior employee from technology R&D and design departments of each company could be interviewed just once, semi-structured interviews were helpful to avoid a secondary research by providing necessary flexibility (Gray, 2004; Louise Barriball & While, 1994).

The interviews were made with one researcher visiting senior employees in their workplaces. Interview durations were within 30 minutes to 1 hour. Questions were mainly aimed to encourage them to describe their innovation strategies. None of the codes were asked openly in order not to lead participants' answers.

Analyzing product identity integrity

To analyze product identity integrity Design Format Analysis (DFA) method was used.

There are several methods suggested to analyze product semantic inputs in the literature, such as semantic differential (Alcántara et. al., 2005; Hsu et. al, 2000; Ampuero & Vila, 2006). Dell'Era and Verganti (2007) also identified a group of semantic codes through a vast number of products to analyze quantitatively afterwards.

In this study, it was aimed to do a more in-depth research including all types of visual cues, since the number of product sample was relatively small and LED TV's are hard to differentiate through more simple codes such as

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color, texture, material etc. Therefore DFA method was applied.

DFA is basically a method for defining core visual cues for a company's product identity; however it is stated that it can be also used for evaluating identity integrity (Warell, 2001). The main aim of DFA is to define visual cues and evaluate their existence in a range of products. The cues can be strongly existent (filled circle- 2 evaluation points), less-existent (empty circle – 1 evaluation point) or non-existent (blank- 0 evaluation point).

To evaluate integrity better, the visual codes were also evaluated within themselves regarding their strength of existence. The top score a visual code could get were divided into three sections to analyze how easily a company's product could be identified. For example, if there are 8 products to be evaluated, top score a visual code could gather would be 16 – 2 points from each product. So, if a visual code cored between 0-5 it would be regarded as a weak visual code. The codes with scores within 5-10 would be regarded as moderate codes, and the ones with scores within 10-16 would be considered as strong codes. Having more strong codes would benefit identification of a company's products.

Definition of codes resulting from visual cues were not limited, regarding that they can be objectively understood and evaluated by other people. Therefore codes such as "trendy" and "old school" were avoided; however codes such as "archetype feel", "eclectic combination of geometries" were used.

The analyses were conducted by three researchers; two of which were PhD Candidates, who are also project course instructor assistants, and one was associate professor in industrial design. People with industrial design project course experience were chosen, as their ability to verbalize visual codes in different products could be above average. Analyses durations ranged between 2-3 hours.

Overall descriptions for cases

Three television producers from Turkey were included in this study. Television was chosen as the research focus, as it has both technology and meaning dimension. Due to confidentiality reasons, names of the companies and visuals of their products will not be declared.

Turkish consumer electronics companies are mostly incremental innovators (Er, 1997; Bulu et. al, 2006; Çakır, 2004; Tanyılmaz, 2002; Taymaz & Yılmaz, 2008; Ulusoy, 2003; Atman, 2013). For this study, the specific strategies that could be related for incremental innovation capabilities were sought in the interviews. Results showed that, all three companies were mostly incremental innovation oriented. The identified list for strategies can be seen in the table below.

Table 2: Innovation capabilities of the companies

	CAPABILITIES	COMPANY A	COMPANY B	COMPANY C
Technology Driven Radical Innovation	Having innovation champions	+		
	Having large number of experts			
	Independent environment for researchers			
	Effective information management	+		
	Having incubation units			+
	Focusing on core researches			
Technology Driven Incremental Innovation	Pre-defined targets for projects	+	+	+
	A large information network	+	+	+
	Targeting a core customer group	+	+	+
	Focus on market condition and users	+	+	+
	Market-oriented research techniques	+		+
Design Driven Radical Innovation	Outsourced designers	**P**		
	Foreign designers	+		
	Designers from diverse sectors	**P**		
	Designers from subsectors			
	Multidisciplinary teams	**P**		

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	Researchers from other sectors			
	Focusing on changes in lifestyles	**P**		
	Attending exhibitions (fashion shows, art events etc.)			
	Designers with diverse backgrounds	**P**		
Design Driven Incremental Innovation	Market oriented segmentations	+		+
	Market oriented research techniques	+	+	+
	User oriented research techniques			
	Research teams with in house employees	+	+	+
	Lack of regular support from outsourced designers	+	+	+
	Market oriented project briefs	+	+	+

The "+" signs show the existence of a code, while "P" letter represents the potential of a strategy, which means the strategy is not in action yet, but the executive has the intention to build it.

Company A

Among the three companies, Company A was the only company with a design-driven radical innovation code, and the executive declared that he had the intention to imply more design-driven radical innovation facilitators.

The analysis for innovation characteristics and brand identity integrity is presented below, followed by a DFA analysis for company's products.

Innovation characteristics and brand identity integrity relation cues for company A

The identified codes are listed below.

Table 3: The codes of Company A for product identity integration and innovation capability relation

	Homogenous Product Identity – Radical Innovation Capabilities	Heterogeneous Product Identity – Incremental Innovation Capabilities
Strategic Factors	• Operating at the beginning of product life-cycle (Potential) • Narrow product range	• Operating closer to the maturity stage of product life-cycle
Cognitive Factors	• Use of analogies	• Evaluation of current solutions/ market orientation

The participants declared that they aim to produce products that are "new to the market", which implies a target for radical innovation. However, they are currently incremental innovators and this aim only sets a potential for the firm. So the company mainly operates at the maturity stage. Company has a narrower product range compared to Company B and Company C; which can be seen in DFA analyses results.

Both technology R&D and design department seniors were asked about the product innovation process they were most satisfied with, among the processes they experienced. The two answers addressed different processes; technology R&D senior

described a process which was produced through a buyer's brief. The project ended with a novel product concept. On the other hand, design department senior described how they avoided resemblance to other products in the market by looking at general material trends, to introduce a material which has not been used before in TV context. Using a different material ended up with more clean geometry and the design was rewarded several times afterwards.

"The difficulty was, this type of concept was never implemented before… But there we could have responded quickly, we can have the needed coordination and flexibility." (Company A- Senior Engineer)

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"We always look at the current trends and report them in several ways, but in order not to design something that has already been designed… (For this project) when we looked at the trends (in the world), we saw real (natural) material usage was becoming more frequent, but was really hard to implement it to TV industry" (Company A- Senior Designer)

The example provided by senior designer represents the use of analogies by bringing in material trends from other industries, and design trends in general. However, he also mentioned that they constantly observe the market. Therefore it can be said that they are affected by design fixation, however they have a potential to employ defixation methods.

Innovation characteristics and brand identity integrity relation cues for company A

The results of the DFA study for Company A can be seen below.

The company had 8 different TV designs that were available to Turkish market. During the study, 15 different codes were defined. Among these codes, 2 of them were considered strong codes, as they appeared "very existent" in most of the products. There were 8 moderate codes, and 5 weak codes.

Figure 1- DFA scheme for Company A

COMPANY A	1	2	3	4	5	6	7	8	(16)
Medium Distinctive Radius	●	●		●	●	●	●	○	13
Overall Plasticity	●	○		○	○	●	○		8
Frame Shaped Stand	●			●				○	5
Plastic Material Effect on Stand	●			○	○	●			6
Defined Logo Area				●					2
Perpendicular Lines	●			●			○	●	7
Loudspeaker Alligned with Screen	●	●	●		○	●	●	●	13
Angular Triangle Geometry on Stand		●	○			●	○		6
Deconstructive Structure		●			○		○		4
Perspective Feeling		●	○		●	○	○	○	8
Elevation Effect			●	○		●			5
Integrity Feeling On Screen Area	●		○			●	○	●	8
Degraded Transition Between Areas		●	○	●	○		●	○	9
Lightness				●	○				3
Organic Foot Feeling at Stand		○	●			●	○		6
(30)	14	14	9	15	10	17	13	10	

Company B

Among the companies, Company B showed the highest incremental innovation capability. No radical innovation capability was detected for either technology, or design.

The analysis for innovation characteristics and brand identity integrity is discussed to be followed by a DFA analysis.

Innovation characteristics and brand identity integrity relation cues for company B

The identified codes are as follows.

Table 4: The codes of Company B for product identity integration and innovation capability relation

	Homogenous Product Identity – Radical Innovation Capabilities	Heterogeneous Product Identity – Incremental Innovation Capabilities
Strategic Factors		• Operating closer to the maturity stage of product life-cycle • Broad product range
Cognitive Factors		• Evaluation of current solutions/ market orientation • Fixation risk arising from expertise

The participant from technology R&D department explained their successful innovation processes by having fewer production faults. The senior designer mentioned a project where a product platform could be diversified by using as few molds as possible. These answers give the impression that Company B mainly concentrates on production efficiency.

"It was released without flaws, both on time and successful...the company growth that year was 25%" (Company B – Senior Engineer).

"Two designs were favored. This project was cost oriented… we could have differentiated the frames visually. Therefore investment was made… that we could also use in other projects"(Company B – Senior Designer).

Company B has a broader product range when compared to Company A. The senior designer mentioned that they frequently visited industrial exhibitions to keep up with the products in the market. As the company is mainly focused on effective production and constantly follows the market, design fixation may occur in design process.

Innovation characteristics and brand identity integrity relation cues for company B

The DFA study for Company B can be seen below.

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Figure 2- DFA scheme for Company B

COMPANY B	1	2	3	4	5	6	7	8	9	10	11	12	(24)
Plasticity Feeling	○	●							○		●	●	8
Shiny Surfaces	●	○	●		○		○	●	○		○	○	12
Planarity	●						○	○			○	○	6
Linearity	●		○			●	●						7
Sharpness	●	●	●	○		○		○				○	10
Strap Effect	●					○						●	5
Color Monotony		●			○					●		●	7
Organic References At Stand		○	●	○						○		●	7
Iconicity At Stand			○			○	○	○					4
Overflowing Surfaces			●					○	●		○		6
Arc Feeling				○	○			●		○			5
Slimming at Stand		●		○	○					●		○	7
Semifinished Product Use Feeling							●	●					4
Profile Effect at Stand			○			○	●	●	○			○	8
Wave Effect at Stand									●				2
Ornament Effect									●		●		4
Detachment Feeling		○										●	3
(34)	11	11	9	5	5	6	9	12	9	6	7	15	

Company B had 12 different TV designs available to Turkish market, which is the same number as that of Company C. During the study, 17 different codes were identified. Among these codes, none of them were strong codes with a score above 16.

There were 2 moderate codes with the scores 12 and 10, which are relatively close to being weak codes. Therefore it can be said that Company B does not support integrated product identity.

Company C

Company C showed intensive design driven incremental innovation capabilities. It has only one strategic cue that supports technology driven radical innovation.

Innovation characteristics and brand identity integrity relation cues for company C

The detected codes can be seen below.

Table 5: The codes of Company C for product identity integration and innovation capability relation

	Homogenous Product Identity – Radical Innovation Capabilities	Heterogeneous Product Identity – Incremental Innovation Capabilities
Strategic Factors	• Operating at the beginning of product life-cycle (Potential)	• Operating closer to the maturity stage of product life-cycle • Broad product range
Cognitive Factors		• Evaluation of current solutions/ market orientation • Fixation risk arising from expertise

Company C senior engineer declared that they may continue developing research projects, even they do not meet current market needs anymore. This builds a potential for new product contexts that can lead to original product languages. Otherwise the company's efforts seem to be mostly led by market requirements.

When they were asked about their most satisfying innovation process, senior designer explained a product (which was not a TV), where the success was defined as producing a product that gives the exact feel of the market leader's design.

Senior engineer, on the other hand, described a project where they collaborated with customers to build a network suit, which would be applied to future products to create a competitive advantage.

"It has come to such a state that even its geometry is decided by market" (Company C – Senior Designer)

"When the product is at decision state we talk with companies like BBC, Ofcom… to decide the definition of the product… Then we took this suit to be embedded in our TV's to create a greater value" (Company C – Senior Designer).

Company C has a broader product range than Company A, and has the same number of differentiable models with Company B. They have a tendency to operate at maturity stage, as they mostly follow market. They are strictly affected by standards which are set by market, even when the product geometry is considered. Therefore they have a tendency on being affected by design fixation.

Their design department employs almost only industrial designers. Senior designer also declared he would prefer to employ more industrial designers; therefore they are prone to fixation that is originated from expertise.

Innovation characteristics and brand identity integrity relation cues for company C

The DFA results for Company C can be seen at the table below.

Company C had 12 different TV designs available to Turkish market. During the study, 17 different codes were named. Among them, none of them were strong codes.

There were 5 moderate codes with the scores ranging between 16 and 9, 3 of which are relatively close to being weak codes, one on the edge of being strong code. The other 12 codes are weak codes, and some of them are strongly existent in very few products.

Company C seems to show a product identity integrity somewhere between Company A and Company B. Also, there is one product which has some strongly existent visual codes that only appears in that product and one other.

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Figure 3- DFA scheme for Company C

COMPANY C	1	2	3	4	5	6	7	8	9	10	11	12	(24)
Archetype Feeling	○											●	3
Shiny Surfaces	●	●	●	●	○	○		●	○	○		●	16
Arc						●			●			○	5
Planes	●				○		●	●			●	○	10
Picture Frame Feeling							●				●	○	5
Dominant Plastic Surfaces	●		○				●	○			●	●	10
Node Feeling	●												2
Sagging Surfaces		●			○	●		●	●	○			10
Triangular Shapes		●		○						●	○		6
Unsteady Forms	○	●		●	●			○					8
Iconic Forms in Foot		○	●	○		○				○	●		6
Semifinished Product Feeling					○								1
Iconic							●				●		4
Neck Feeling	○	●		●				●				●	9
Structural Forms											●		2
Movement											●		2
Ornament							●				●		4
(34)	11	9	7	6	8	6	10	10	5	5	17	11	

Results

When the results of the two studies for each case are evaluated, there are clues that hint the proposed theoretical explanation may worth studying further.

When the innovation characteristics of the companies were analyzed, it was found that the codes that were derived from literature mostly exist in the cases, which are in line with the companies' general innovation tendencies. One exception is the employment of user centered research methods; participants declared that using those methods was very difficult as they had very short time scales to catch-up with market leaders.

The findings of case studies hint that, companies with broader product lines indeed have more scattered product identity integrities. All of the companies operate at the maturity level of product life cycle, and this may be an obstacle for providing more integrated product identities.

Company A, the only company that applies defixation by bringing analogies, seems to have the most integrated product identity. The same company also works with foreign designers, and has the most tendency, although still very few, for radical innovation in both design and technology directions.

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Also, when the codes for product identity integration and innovation capability relation are analyzed, they seem to be in line with the results of DFA analysis and innovation characteristics analysis. As the explored companies become more incremental innovation oriented with less radical innovation capabilities, their product identities become more heterogeneous. This result is in line with Dell'Era and Verganti (2007) study. Also, the appearance of the specific codes addressing the proposed theoretical explanation suggests that, the proposed strategic and cognitive factors may deserve attention.

Discussion and implications

The results of this study hint at some theoretical areas that may help to develop and analyze the relationship between innovation characteristic, design strategies, product identity and the design fixation effect.

There are still a limited number of works that compare incremental and radical innovation capabilities in technology and design. This may have to do with the point that most of the methods that explore innovation capabilities do not propose techniques to differentiate radical and incremental innovation capabilities, nor do they have an aim to do so.

However, when the strategies that build innovation characteristics are identified within case studies, it becomes a lot easier to define the consequences for them. In this study, since the aim was to define the relation with innovation types and product identity integrity, a study was done on each case to first identify strategies that may help to investigate theoretical explanations that are proposed.

The results that are proposed in this paper are in line with Dell'Era and Verganti (2007) study, and also the reasons behind these results are sought in case studies. Since clues for theoretical explanations were also found, it may be worth considering the relation between innovation, product identity and design fixation literatures.

Most of the studies in the literature that are on design fixation are not related directly to the studies that are made on radical and incremental innovation. The studies that are done about design fixation may shed a light on studies about what type of strategies may enhance radical innovation capabilities. Also, the studies that combine design fixation on product forms can be evaluated further to be integrated with studies on innovation capabilities.

For managerial purposes, the findings can help to build strategic guide for design management. Even if a company aims to operate with incremental innovation, especially design departments may apply some of the design driven radical innovation strategies to build novel visual cues to develop and sustain unique product identities. An example may be to run projects that are not related to market, just to produce novel visual cues.

Limitations and further studies

Since the theoretical base in this study depends on the existent literature, more comparative studies to define eligible strategies for innovation types and more case studies to test the relations should be done.

The theoretical explanations that are proposed here are made with the help of the few studies in the literature. These studies may be tested and improved to both test and define more strategies that are appropriate to build certain innovation capabilities. Also, more data on strategies will help to build and test new relations on product identity integrity and innovation capabilities.

Another limitation is, it is quite hard to define the weight of each strategy on both creating an innovation characteristic and its effect on product identity integrity. As it is hard to keep all other variables stable and test the effect on only one factor; the effects of strategic variables may only be assumed and assumptions can supported by other theoretical and empirical works.

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