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PROTOTYPICAL PRODUCT SHAPES AS A TOOL FOR AESTHETIC PRODUCT DESIGN

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Abstract

The use of prototypical product shapes allows to structure and support the intuitive aesthetic design process. Prototypicality, a cognitive variable, is the extent to which an object represents a category: it shapes our aesthetic feelings with products, affects usability, makes up the products' look, and affects products' aesthetic evaluations and preferences. A mental prototype is a category's central element. We all have artifacts' prototypical information, however, designers are not aware and do not use it explicitly. These concepts have seldom been applied in design. Consequently, we explored how to use prototypical shapes for the aesthetic design process. 1. We proposed vectorising and interpolating 32 hand drawn Pepper Mills, PMs, to get the prototypical shape. In 2, we found the most innovative, original and typical PMs (n=74, 20 PMs). 3. We then used rules to explore aesthetic design possibilities and to transfer attributes to the prototypical PM shape. PMs' aesthetics, usability, and design pedagogy issues are discussed. We suggest a structured simple way to design the product's aesthetic for non-expert designers and applicable to other aesthetic cognitive variables.

Keywords: Design methods, Embodiment design, Industrial design, Prototypicality, Product shape

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1 INTRODUCTION

1.1 The explicit use of cognitive aesthetic variables in aesthetic design

Prototypicality is defined as the "degree to which an object is representative of a category" (Barsalou, 1985). A prototype is the element at the center of a category having the average values of the attributes of the category (Veryzer and Hutchinson, 1998). A mental prototype may not exist in the physical world, but support us providing diagnostic characteristics to allow us to categorize an object. Categorization, "the process by which distinct entities are treated as equivalent" (Medin and Aguilar, 2001, p. 104 in: Wilson and Keil, 2001)), is a paramount process spreading throughout our cognition because permits us to gain in cognitive economy, i.e., make a more efficient way of our cognitive resources. When we classify an artefact as belonging to a certain category we can understand quickly and effortless what the object is and to predict which type of characteristics it possesses (Medin and Aguilar, 2001). Prototypes have some properties: they are very easily classified as members of its category; the closest an exemplar resembles the prototype, the fastest its classification is. As one of the main categorization mechanisms, we all possess prototypical information about categories of objects. Notwithstanding, designers are not aware of using explicitly this type of information. Prototypicality, among a dozen of other cognitive variables, plays an important role shaping our aesthetic feelings with products (Hekkert and Leder 2008). Martindale (1988) and Whitfield and Slatter (1979) developed a model for aesthetic preference based on prototypes: we tend to prefer exemplars of products near the prototype. This has been demonstrated for furniture, houses (Purcell, 1984), and interior designs (Pedersen, 1986), etc. Different works have explained the effects of prototypicality in the aesthetic evaluation of designed products and its impact on the user's aesthetic pleasure. Aesthetic pleasure is the gratification we get from our senses in a (semi) automatic manner (Hekkert and Leder, 2008). We define here the aesthetic design process as all the design actions undertaken to make the users feel certain aesthetic (normally pleasurable) feeling.

Rosch's et al. (1975) fundamental work on human categories provided one method to define prototypical shapes for categories of artefacts. Although important for product design, because it provides a mechanism to define aesthetic preferences, and to define product characteristics and attributes, these concepts have seldom been applied in design. Our work therefore explores how to use prototypical shapes as a basis for the aesthetic design process. On the one hand, we applied an adaptation of Rosch's et al. (1975) method to define the prototypical shape of pepper mills, PMs, by means of vectorising handmade drawings. 32 vectorised drawings were interpolated mathematically to obtain an average shape of the PM, i.e. a prototypical PM shape. On the other hand, a reference study (n=74) found which were, among 20 PMs, the most innovative, original and typical ones. Based on the prototypical PM shape we proposed some rules to explore design possibilities to enrich the PMs' aesthetics and, based on the reference study's results, to transfer attributes to the prototypical PM shape already found. Implications over functionality and usability are discussed. Design pedagogy issues of this technique are discussed. Our work suggests finally a structured but simple way to design the aesthetic aspects of a product, within the reach of non-expert designers. By providing a prototypical shape to work on, this explorative study could contribute to computational aesthetic design.

1.2 Prototypicality and the use of product's prototypical shapes to support aesthetic design: literature review

The fundamental questions about an artefact's category would be: why do we perceive that category and not others? Which are the characteristics and the limits defining that artefact's category? When does one category start to transform into another category? Let's see how the answers to these questions regard different disciplines and topics around product design.

1.2.1 Cognitive sciences research findings

Theories about categorization are not consensual (Ben-Zeev and Sternberg, 2001). No categorization model or view alone explains satisfactorily the above mentioned questions (Medin and Aguilar, 1999). At least four views on categorization can be identified (see Sternberg and Ben-Zeev (2001) for a review). Belonging to the similarity-based view there is the prototype theory developed by Posner and Keele and further by Rosch and Mervis (1975; 1976). Essentially, it proposes that "people create a representation of a category's central tendency" in the form of a prototype" p. 38. To know if an artefact is the prototype of its category it has to be judged as the one with the highest family resemblance, or sharing the most attributes with other members of the category. Importantly, Rosch and Mervis (1975; 1976) find out how we establish a hierarchy of categories. An office chair can be categorized, from a very encompassing to a less encompassing category; for instance: furniture (super ordinated level category) /chairs (basic level category)/particular classes of chairs (including office chairs)/particular examples of office chairs. Rosch et al. (1976) argue that the way we humans interact with objects are one more attribute the objects possess. They proved that the "shapes of objects show the same correlational structure as do attributes and motor (human) movements". For Rosch et al. (1976) the shape of an artefact "are the structural relationships of the parts of an object to each other" p 386.

Similarity has been posed like a powerful, but limited, organizing principle among different categorization theories. To this regard, Rosch and Mervis (1975; 1976) contributed to understand how a prototypical (geometrical) shape, corresponds to a list of characteristics defining that category (i.e., propositional information using a natural language). The prototypical shape must be highly similar to other shapes of the same category of the prototype, but highly dissimilar to shapes of other categories.

1.2.2 What Marketing, Psychology of Aesthetics and Product design say

Veryzer and Hutchinson (1998) use the "prototypicality" term, first, as: "subjective perceptions of typicality or category representativeness". Second, a prototype is a common artefact changed by designers to make them less typical; this is usually made by changing different physical characteristics of the product. Therefore, the prototypicality perceived in the artefact is affected by the changes suffered by the prototype; preferences affect the perceived prototypicality as well (Veryzer and Hutchinson, 1998). Veryzer and Hutchinson (1998) have shown experimentally that distortions of a prototypical line drawing shape of a product (they used a table telephone set and a refrigerator drawing shapes), i.e., altering formally the prototype, has a negative effect on aesthetic appreciation. Moreover, they analysed the relationship between prototypicality and unity, because when modifications are introduced to the drawings, the perceptual unity is affected.

Whitfield and Slatter (1979) investigated the effects of categorization and prototypicality on a task of aesthetics choice among furniture of three styles: Modern (Bauhaus type), Georgian and Art Nouveau. They found that Georgian were the most prototypical (n=30). Interestingly, they emphasized how style is a basis for the categorization process of aesthetic stimuli. In this way, in a task of furnishing a living-room (to choose 3 out of 33 furniture), the Georgian furniture were preferred over the Art-Nouveau's ones. They argued that social salience would be an important factor for the shaping of the prototype because Georgian furniture requires very much work for its details, and then, are expensive products.

Blijlevens et al. (2013) have shown that changing the physical properties of the prototype of the product's category is useful to make a product design look trendier and aesthetically pleasing. Blijlevens et al. (2013) define trendiness as "as an attribute of product designs that deals with the degree to which the product design follows the up-to-date styles and fashion in the market.", p 55. They found as well that people from regional markets can perceive product designs from global brands, that depart more from their prototypes, trendier and aesthetically more appealing than people in a world market. "Hence, in order to create a product design that is trendy and aesthetically pleasurable, designers take into account product designs that people are exposed to in their daily life." (Blijlevens et al., 2013) p. 55. Interestingly, Blijlevens et al. (2013) found that for "product categories with an angular prototype", curvature was positively related to trendiness and that for "product categories with a curved prototype", the curvature was negatively related to trendiness", p 58. In this vein, if a product whose prototypical shape is curved (a computer mouse or a hair dryer), it is made angular, it will look trendier. A product whose prototypical shape is already angular, for instance, a toaster or a fridge, looks already trendier. If a product's shape is deviated from the prototype, the product will be perceived as having a more novel appearance (Blijlevens et al., 2012; Veryzer and Hutchinson, 1998).

Prototypicality is suitable to explain aesthetic preferences in some cases: objects closer to its mental prototype are preferred by people (Gordon and Holyoak ,1983; Veryzer and Hutchinson, 1998). However, in other cases it seems the contrary prevails (Veryzer and Hutchinson, 1998): people look for novelty and distinct products. In other cases, it may be that the prototypical product is more salient if compared with other products. For some cases, Veryzer and Hutchinson (1998) pose an economical explanation for this prototypes-preference: best products usually are costly, rare and purchased for wealthy people. Consequently, the most preferred and high-priced products may be relatively different to the typical products of the category (Veryzer and Hutchinson, 1998). Prototypicality and aesthetic appeal have been found correlated in guitars (.70), chairs (.64), cars (.55), shirts (.44), and lamps (.35). These results suggest that the more prototypical the product was the more appealing it was (Sen and Lindgaard, 2008).

Hekkert et al. (2003) explored the relationship between novelty and prototypicality in product design, two apparently opposite variables. They put forward a dual process model of aesthetic preference. Because our biological evolution, we would then prefer easy-to-categorize or typical products; there is no need of the observer's explicit awareness or intention. This process agrees with the preference for prototypes. The other, opposite process, would be a mechanism that assists us to searching for novel or atypical stimuli surrounding us. If there is a balance between these opposite forces, the aesthetic judgments would be possible (Hekkert et al., 2003). Finally, they found that people prefer novel designs only if the novelty does not affect the prototypicality.

1.2.3 Studies on Prototypicality and expertise

According to Leder et al. (2004) p.496, prototypicality is built through the daily interactions with artefacts. When there is a lot of interest in a specific product class (looking for information about the product in magazines, TV shows) it is said that there is product involvement (Hekkert et al., 2003), in other words, we may regard product-involved users as experts. Two questions arose: is the expert's prototype the same as the non-expert? Are their aesthetic preferences similarly or differently influenced by their prototypes? (Hekkert et al., 2003). Concerning the latter question, Hekkert et al. (2003) found that for the product category "cars" results were not different, not supporting the argument that experts prefer novelty more over typicality than non-experts do. They argued that such expertise-effect only exists in fine arts: the expertise difference between experts and non-experts could be more important than in other domains, i.e., industrial design, where we all have interacted many years with many different products (Hekkert et al., 2003).

1.2.4 Prototypicality and computational aesthetic design

In computational aesthetic design and related fields, there are no mentions of using prototypical shapes of products. However, it seems clear that some systems, as for instance, shape grammars, can use a prototypical shape of the product, instead of a product's particular shape, around which will be partitioned the product in different topological regions (Agarwal and Cagan, 1998), with the advantages that can provide working with a prototypical shape.

In another vein, Martindale et al. (1991) executed experiments showing that our cognitive system tends to create semantic nodes, that, when are similar, are physically closer than other nodes. This semantic field showed prototypicality; i.e., the nervous system is more activated when it perceives a stimulus typical of its class. Interestingly, they developed a neural network exhibiting this behaviour. However, literature does not mention its application to computational aesthetic design.

1.2.5 Prototypicality and usability

Creusen and Schoormans (2005) assert that atypical appearance for products, i.e. presenting alterations from the prototype is suitable when differencing the product form from others of the category is a need, making it a member of a new category per se; this allows a better communication of functional attributes. Moreover, if the product is atypical there is less comparison against other category's members, causing that new and notable features be clearly distinguished and found more important. For example, (Creusen and Schoormans, 2005), when Dyson's vacuum cleaner was released its appearance was quite different from the prototypical vacuum cleaner, making that "consumers more easily perceive its unique mechanism" p. 69. However, if a product's form is very different to the product's prototypical form, a non-expert could have problems identifying the product's category.

Sonderegger and Sauer (2010) compared two cell phone prototypes. The most attractive one was deemed as with a better usability. It was also the one judged as more conventional design. The unattractive, with poorer usability, had a more unconventional design. Sonderegger and Sauer (2010) showed as well how an appealing cell phone had a positive effect on usability, even if the two cell phones used had the same functionality. However, the two cell phones were perceived with no difference in prototypicality.

Mugge and Schoormans (2012) found that people links technological advancement with high levels of novelty, so, this novelty affected negatively the usability expectations of the product. They changed the prototypical colour of washing machines from white to black; therefore people expected that a washing machine high in novelty has lower usability than one with a more prototypical appearance.

1.2.6 Prototypicality in aesthetic design education

We checked important textbooks in aesthetic design education (Ockvirk et al., 2006; Wallschlaeger et al., 1992; Lauer and Pentak, 2011; Faimon and Weigand, 2004; Hannah, 2002; Gatto et al., 1978; Dondis, 1973; Wong, 1993; Gilles, 1991) to see if they explained or applied prototypicality as a variable influencing the aesthetic evaluation of an artefact, but no mentions were found. Therefore, prototypicality has been neglected in aesthetic design education.

Aesthetic design education draws heavily on intuitive decision-making; i.e. information is processed based on an affective, automatic and personal standards (Tonetto and Tamminen, 2015). Aesthetic design, i.e., searching to generate or prevent certain aesthetic feeling or (dis)pleasure in the user, is based on designer's interpretations on how to generate certain aesthetic feeling, consequently it can be influenced by intuition. Designers usually do not have explicit information about the prototypicality of a product shape, so they cannot be analytic; consequently, intuition comes to the fore by supporting the decision making process (Tonetto and Tamminen, 2005). Although necessary, this decision making is biased by the decision maker experience. It is known that expert designers possess more efficient and purposeful strategies to face creative tasks whereas novice designers tend to create more random answers (Tonetto and Tamminen, 2015), in other words, expert designers have a "better intuition". So, what happens if the designer's intuition is informed by the product's prototypical shape?

1.3 Our Research Problem

On the one hand, Rosch et al. (1976) used a pool of randomly selected images (from magazines and their own photos), to identify artefacts' prototypical shapes. The images' size was normalized and the orientation adjusted. The outlines were traced. The images were overlapped and the average shape was found. They found that "an increase in similarity of the overall look of objects was found for basic level over super ordinate categories" (p. 403). Moreover, they identified the basic level as "the most general level at which an averaged shape of an object is identifiable as that object" p. 403. Even if these prototypical shapes provide a lot of information, they have never been used by design practitioners. On the other hand, even if Hekkert and Leder (2008) and Hekkert (2015) mention more than 40 variables affecting the user's aesthetic feeling with a product, only about a dozen are applied explicitly in aesthetic design. It is for this reason that our study is exploratory. Consequently, we want to find out: 1, how to elicit a prototypical shape of a product, and make subjects draw that image on a paper; 2, how to process those images to obtain the prototypical image, and 3, to explore under which conditions is suitable to use a prototypical shape of a product as a basis for aesthetic design, in a structured process that, eventually, could support industrial designers. This would depart from the principal way the aesthetic design process is done, i.e., supported by intuition (or informed intuition). This research problem concerns a structured exploration of product’s form intended to enrich the aesthetic possibilities available to the users. Under this design philosophy, design is a means to create new possibilities to enrich users' lives, not a means to solve users' problems (Hekkert and Van Dijk, 2011).

In conclusion, our research problem is about exploring a huge solution space, but basing this exploration on a predefined shape that, being prototypical, somehow reflects sensorial and cognitive features important to the users. Importantly, our research problem does not concern how the computer can actively assist the aesthetic design process, by proposing and/or assessing aesthetic design alternatives of a product (see for example: Orsborn and Cagan, (2008), Ranscombe et al. (2012)). We only use the computer to visualize the different alternatives obtained through the application of the method presented.

1.4 The Present study.

In a first experiment, we proposed a method to find the prototypical shape of PMs using normalized drawings. 32 subjects' PMs drawings were collected and the prototypical PMs shape was obtained from them. In a second, Reference study, we evaluated a set of 20 PMs' photographs along three different major aesthetic variables, to find out which particular PMs' attributes could be identified to transfer them to the prototypical PM shape. The third study explored the use of prototypical PMs shapes in aesthetic design by applying some attributes from the best ranked PMs in the Reference Study, and generating different values for those attributes. These three experiments, by providing a method to obtain prototypical artefact shapes, and applying them to aesthetic design, contribute to explore possible ways designers can apply prototypicality in an aesthetic design process, explicitly, and in a structured manner.

2 METHOD AND RESULTS

2.1 Experiment One: the Normalized Drawings and Prototypical Shapes

2.1.1 The Method

The products serving as stimuli were PMs, because their aesthetic richness, with very different appearances, availability and small size to be photographed in a standardized way (for experiment 2, using same aiming angle and illumination). We avoided problems linked to drawing errors by inviting students (n=32) of mechanical or product design engineering from Eafit University proficient in drawing (all approved satisfactorily three different drawing courses). Only subjects who did not know the objective of the study were invited. Subjects were asked to draw, to their opinion, “the most typical pepper mill”, under these conditions: 1. Draw the outline centred inside the normalizing template, of 10x10 cm (provided by the researchers, Figure 1, left) using the dotted lines if necessary. Rosch et al. (1976) had shown that it was possible to recognize an object from its outline. 2. Draw the outline avoiding any internal details. 3. The longest dimension of the PM must occupy the whole height or wide of the square 4. Draw the PM in a flat, not volumetric, view. 5. Subjects were allowed to erase as much as they want until they get a drawing they believed represented accurately the prototypical image they had in their minds. 6. Drawings were to be collected one by one, without time restrictions, in empty rooms inside the university premises to avoid any disturbances.7. None PM, physical or in image, was visible in the place of the experiment to avoid any influence or priming on the subjects.

2.1.2 The results: Combination of shapes to obtain the prototypical one

The 32 drawings were scanned, vectorised and the dotted lines were removed digitally by the authors. The 32 drawings were grouped in 16 pairs in order to average them pair by pair. To avoid any bias in manually drawing the averaged shapes, each pair, Figure 1, centre, shows an example, was overlapped and digitally averaged using a lineal interpolation command built in a commercial vector graphics editor software, Figure 1, right. Then, through a funnel process, Figure 2, we obtained the prototypical PM shape shown in grey shadow in Figure 2, centre, and in a larger detailed image in Figure 2, right.

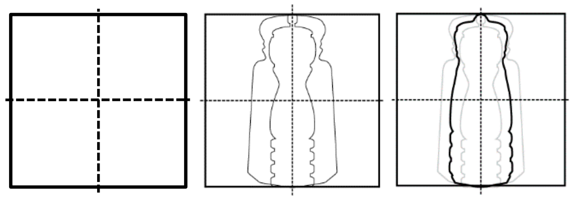

Figure 1. Left, the blank normalizing drawing template with dotted lines presenting, centre, two PMs' shapes overlapped, and right, the resulting averaged shape

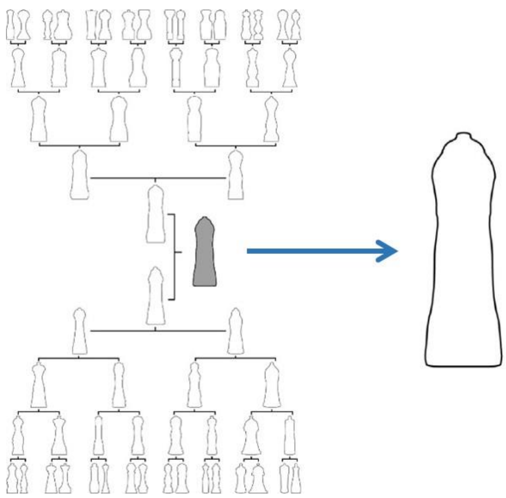

Figure 2. The funnel process, left: eight PM pairs in each array were averaged to one prototypical PM shape (in grey), which is shown larger in the right side of the image. That is the prototypical PM shape for our subjects

2.2 Experiment Two: The Reference Study

2.2.1 The Method

20 different commercial PMs were used as stimuli with different formal complexity among them: amount and variety of geons, number of colours, materials, and symmetry, Figure 3. Geons are basic perceptual forms present in the human perception of forms, and suitable to decompose artefacts in their parts (Biederman, 1987).

Figure 3. The set of 20 commercial PMs used as stimuli ranging from low formal complexity (for example, PM 16) to high formal complexity (PM 18)

An internet survey provider was used to implement and apply the survey instrument. The sample consisted of any person that used a PM in her daily life. This was used as filter question to exclude people not familiarised with PMs. PMs were presented to the subjects using the normalized photographs along the survey asking for three variables in a 7 points Likert scale: originality (not original at all-completely original); aesthetic appreciation (ugly-beautiful) and typicality (not familiar at all-completely familiar). These three scales were mixed with scales from other aesthetic variables (novelty, complexity, etc.) to avoid sequence bias and to hide the real objective of the study. All the PMs were presented randomly every time the subjects responded the questions.

2.2.2 The Results

We obtained 74 valid answers (53%, female, 47% male), with predominant age ranges of 22-30 (45%) and 16-22 (22%). The top ranked PMs for each variable are shown in Figure 4.

Figure 4. From left to right: 1, the most original PM (M= 5.82, SD=1.66), innovative (M=5.36; SD=1.78) and with the highest aesthetic appreciation. 2, the most typical (M=6.06). 3, the second PM with the best aesthetic appreciation. 4, The second most innovative PM

2.3 Experiment Three: Exploration of the application of the prototypical shape

2.3.1 The Method

A 3D volumetric form, Figure 5, was generated as a revolution form based in the prototypical PM shape of Figure 2. Then, geons, not shown here, mostly torus and disks, were identified in the prototypical PM shape. The 3D form had to be changed systematically by only changing the physical variables supporting form: colour, texture and material. The objective was to keep as much as possible the geometrical information conveyed by the prototypical PM shape.

2.3.2 The Results

Manipulations were carried out over the prototypical PM shape by assigning colours, materials and textures to the 3D form, Figure 5. We tried to respect some functional elements that would be unusual in some of the materials (for instance the grinder elements on the base are usually metallic or plastic, but not of wood). In Figure 6, materials were assigned to some of the geons, trying to not to be in conflict with functional characteristics of the PMs, for instance, the PM body is transparent to allow the user to check the amount of pepper stored in the PM.

Figure 5. Up row: Mate and bright colours were applied. Down row, 14 Procedural Materials were applied. The metallic materials, plastics and woods seemed to be more adapted to the 3D form. From left to right: bronze, chrome, blue fabric, chestnut, rubber and ceramics

Figure 6. Based on the geons of the prototypical PM shape, metallic and transparent materials were applied to some of the geons

3 DISCUSSION

Due to explorative nature of this work we discuss in detail the new research questions and fields it opens. We advance some conclusions, some of them of speculative nature.

The prototypical shape in the recognition of the product's category: According to Leder et al. (2004, p.496), we would have to pick a list of the PMs with which the public interacts every day to see if this prototype was built through the daily interactions with other PMs. Anyway, why does the prototypical shape represent the category “PM”? The reason advanced talks about informed users, that have established, by prolonged interaction, many relationships with similar PMs, and not, with other different PMs (for instance the PM models without central axis-rod), that, maybe, are less common in the local market. The PMs' category, if we look only at the prototypical PM shape, would exclude other architectures and demands a central top grinder-adjusting knob.

Regarding the predictive capacity that a prototypical shape gives us, the prototypical PM shape is quite similar to many traditional (some in wood) PMs. At least two PMs, numbers 2 and 12 in Figure 3, present a strong visual similarity to the prototypical shape. Using a prototypical shape as a basis for a design could lead to an effortless and quickly identification of the products category and its characteristics. Note that the prototypical PM shape included the grinding adjusting knob, which is very common among commercial PMs. Other characteristics were anticipated as well by the prototypical PM shape: the knob, neck, main body, base, proportion between the base and the body, etc.

As we can see in Figure 6, the (prototypical) category starts to transform into another category at the moment we apply plastic or metallic materials to some geons of the prototypical (shape) volume.

The prototypical shape and the PM's usability: Concerning usability, the prototypical shape is quite near to the most typical PM in the study. So, recognize it as a PM would be easy. By reproducing many functional products' forms, the affordances and mappings that the product offers would help the user to have a smooth usability.

The prototypical shape as design precedent: Is it possible to know how far from the prototypical shape are the reference PMs designers use to begin a new PM design? This is a problem to investigate directly on the designers' studios. However, we could provide designers with a prototypical PM shape, ask them to change it, and see what happens with the new PM in terms of typicality, for instance. Another point is to see if those changes affect the aesthetic evaluation of the new designed PMs.

The prototypical shape and style perception: Concerning, Blijlevens et al. (2013), by changing the prototypical PM shape is possible to give it a trendier look and be more aesthetically pleasing. According to Whitfield and Slatter's (1979) task of aesthetic choice among different styles, we could say that the resulting PM looks may look more classical than modern.

The change of rounded shapes of the prototypical PM shape into a PM with angular shapes has to be explored; it would make the new PM look very modern, even trendy, as Blijlevens et al. (2013) argue.

Concerning the resemblance with other members of the category, the prototypical PM shape shares the characteristics tori of more traditional PMs, but in an attenuated version, i.e., the tori possess very large radiuses. It shares also the presence and relative proportions of a base, main body, neck, grip and adjusting knob. However, to our opinion, this aspect places the prototypical PM shape perceptually near the traditional PMs, but, at the same time, the larger radii of the torus places the prototypical PM near the more modern versions. A structured procedure should be put forward to measure exactly the geometrical family resemblance and to find out if it really shares the most attributes with other members of the category. In Figure 6, even if the geometric information of the prototypical PM shape is preserved, the PMs presented tend to have a more modern or trendier look.

The prototypical shape and designer's expertise: Is the expert's prototype the same as the non-experts? Are their aesthetic preferences similarly or differently influenced by their prototypes? (Hekkert et al., 2003). The question one is important in product design today, because an interesting design strategy consists of transferring form attributes from one professional item of a category to insert them in a non-professional item, making look the last one more professional, robust, without increasing cost. These two questions remains to be explored.

The prototypical shape and aesthetic preference: Concerning prototypicality and aesthetic preference, in our case the prototypical PM shape is quite near to the second best PM for aesthetic appreciation, but is strikingly different from the first one. Taking into account that the sample of PMs was large (n=20), prototypicality was good at explaining aesthetic preferences in that case but failed into the first one. The most preferred PM seems quite novel and different to the other PMs in the sample. Moreover, people were unaware of another novel item that PM had: it is actioned as a retractable pen, using the thumb to push the button in its top to grind the pepper. It could be seen as a pouch PMs. It is important to emphasize its rather elongated proportions if compared to the others (Gordon and Holyoak, 1983; Veryzer and Hutchinson, 1998). In line with Creusen and Schoormans (2005), the prototypical PM shape would be a basis to create an atypical appearance for products if a product form different from others of the category was needed, making it a member of a new category per se; the explorations in Figure 6 go in that sense, but controlling the amount of novelty in the product.

4 CONCLUSSION

The method presented is based in core aspects of the way we know and prefer an artefact. The aesthetic effects of prototypicality in product design have been studied, but prototypicality as a basis to explore a design solution space has seldom been used from the aesthetic point of view.

Even if the exploration here presented is quite limited, is a rational basis to explore in a more structured way aesthetic solutions by design practitioners. Parametric design software to generate automatically a larger set of possibilities to evaluate them interactively by a designer, can be used too. The prototypical PM shape gives aesthetic, semantic, functional and usability information, linked to its geons, as any designer can identify (from top to bottom: grind adjuster, grip knob, neck, body, base, etc).

Typicality and novelty must be balanced in a product to obtain aesthetic pleasure (UMA project, 2015). Prototypicality offers a starting point to explore this fundamental dimension for the generation of aesthetic pleasure. Unity in variety is preserved too (UMA Project, 2015) because the regular repetition of small radio tori along the shape. A fine analysis would be possible to see how minimal distortions of the prototype affect its aesthetic evaluation (Veryzer & Hutchinson, 1998). The method presented has to be developed to improve its validity and reliability.

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