Designing identity of a new material: a new product design approach

BERGERET, Lorraine, BASSEREAU, Jean-François and AOUSSAT, Améziane

Published version

BERGERET, Lorraine, BASSEREAU, Jean-François and AOUSSAT, Améziane (2009). Designing identity of a new material: a new product design approach. In: Undisciplined! Design Research Society Conference 2008, Sheffield Hallam University, Sheffield, UK, 16-19 July 2008.

Undisciplined! Proceedings of the Design Research Society Conference 2008.
Sheffield, UK. July 2008

Designing identity of a new material:
a new product design approach

Lorraine Bergeret, Product Design and Innovation Laboratory, Arts et Métiers Paristech, Paris, France

Jean-François Bassereau, Product Design and Innovation Laboratory, Arts et Métiers Paristech, Paris, France

Pr Améziane Aoussat, Product Design and Innovation Laboratory, Arts et Métiers Paristech, Paris, France

Abstract
The present research is a design practice-based research based on the industrial development of a new concrete. The research focuses on the development of the specific identity of a new material. The research is aimed at demonstrating that product design can be used as a new strategy to create the material identity and thus to differentiate from existing materials. In order to design material specific identity in new products, we need to understand the perception process of shaped materials. Therefore we conducted exploratory study of materials recognition in products. We identified two types of products: the "messenger" products are specific shapes characteristic from the material; the "wrong messenger" products are imitations of other well known materials. The results of questionnaire about material recognition show that it's more or less easy to identify material according to each product (whether it's familiar or new shapes; whether it's imitation or specific shapes and whether it's well known or new material). We conclude on two types of shapes: on the one hand some familiar and typical shapes make easier and more certain the material recognition; on the other hand some new shapes make people more uncertain of what it is made of but more amazed. Designing amazing new shapes can be used as a new differentiation strategy to create the specific sensory identity of each new material. It means that the product can be a really useful support to fully communicate about a new material, beyond the traditional material samples.

Keywords
New Material; Sensory Identity; Product Design

Introduction

Context
How can a new unknown material become recognized?

In 1968, while plastics and other synthetic materials had appeared on the market for a few time, Baudrillard (1968) observed the following cultural material typology: On the one hand the noble old and natural materials and on the other hand the synthetic new ones. The old materials benefit from a

strong added value. To take place on the market the new materials are obliged to look like the old ones. For example, the plastic (with the Bakelite) was first used to make cheap imitation of noble wood products.

The present research focuses on the development of the identity of a new material. The research is aimed at demonstrating that product design can be used as a new strategy to create the material identity.

Identity is defined as the "individual characteristics by which a thing or person is recognized or known" (wordreference.com, n.d.).

The research is a design practice-based research (Pedgley & Wormald, 2007) based on the industrial development of a new material thanks to product design activity. The research takes place in a small size enterprise which wants to design new products from a new concrete material. It's a concrete with many particular performances in both aesthetic and technical attributes: It is much more resistant than an ordinary concrete (thanks to its density) and is able to reproduce a lot of textures and can take a lot of colours (thanks to its small granularity). There is a big potential for new shapes and new visual, tactual and even sonorous aspects. However the specific properties of textures reproduction make it an even more particular case about the question of identity: indeed, as we can see on figure 1, ordinary concrete is already often used to cheaply copy wood or stone. We consider there is a loss of recognition.

Figure 1: flagstones and garden borders in concrete which copies wood and stone

(leroymerlin.fr, n.d.)

Research orientations

Existing method for material innovation

Ashby and Maine (2002) proposed an investment methodology to help identify promising materials innovations and to make success in the market

place. A market analysis is part of the methodology. It is based on a market's trade-off between performance attributes and cost. According to the authors the material innovation is viable when the material offers best performances for a similar cost or similar performances for lower cost. The last possibility is the most often used. We consider this methodology as a "substitution" strategy between old and new material: the goal is to find the more common points between the two materials. Thus we consider this method doesn't take into account the specific aspects of the new material that is to say what is the most different from all the existing materials.

Studies about perception material properties

Several studies (Ashby and Johnson, Kesteren, 2008; Karana, 2007) show the importance of the material perception attributes. Johnson and Ashby (2003) proposed to create a precise and adapted language to describe and classify the material perception attributes (proper to product design). They stressed the need for product designers to have a translation of material technical properties in physical items (as material samples). Karana (2007) explored what kinds of aspects of materials are significant for product designers: In the early stage of the design process the most significant aspects are the sensory properties (that is to say: colour, texture, thickness, warmth, softness, smoothness, stiffness…). Kesteren (2008) proposed tools to help product designers in defining the sensorial properties of materials required when they design a new product. These studies confirm that physical material samples are useful to understand the material possibilities (see also Saakes, 2005).

However the existing material samples don't take into account the shape process of each material. Manzini (1986) shows how the shape, geometry and dimensions directly influence the materials properties: For example, a short bamboo stick is stiff when a long one seems flexible. In a technical approach Ashby (1997) also developed a correlation between shape and materials. For each material there are specific shapes, geometry and dimensions to optimize the necessary quantity of raw material. In a sense these specific shapes constitute a physical vocabulary for each material. Thus we consider the shape as part of the sensory material properties. We expect that specific shapes exist for each material and that it is part of the material identity.

Design as a strategy of recognition

Karjalainen (2007) proposed a specific design method. Product design is used as a strategy to create visual brand recognition. According to the author, the designers integrate specific sensory details in their design (as shapes, choice of colours and materials) in order to make the brand identity perceptible. It means they translate some brand specificities in physical aspects of the products.

Thus we propose to use product design as a strategy to create material sensorial identity. We expect specific designs can support material identity as they can support brand identity. We expect products will be able to translate the whole material potential in terms of texture, colour and shapes too.

In a study about material perception and incongruities between vision and touch, Ludden (2004) compared effects on perception process when a novelty is visible and when a novelty is hidden. The "visible novelty" product

looks unfamiliar and the certainty about how it will feel when touched is very weak. The "hidden novelty" product looks familiar but feels different from expected and people are certain about how it will feel before touching. The "hidden novelty" products are some kind of "trompe l'oeil" products. The materials of these products strongly resemble other materials. Ludden shows a correlation between the familiar look and the certainty about how it feels: More the product looks familiar and more the certainty grows. These results show that, in the case of "hidden novelty" products, the new unknown material is confused with certainty with a well-known material. We expect when the new material looks like a well-known material, the new material doesn't attract attention at all. Thus we expect as a strategy to enhance a new material that the novelty of the material has to be visible (to be well perceived).

Exploratory study

In order to design material identity in new products, we need to understand the perception process of shaped materials. Therefore we conducted exploratory study of materials recognition in products.

First we analyzed many products among current designs from pictures (method inspired from Johnson, 2003 and Ludden, 2004). From this we've identified two types of products. Each type is representative of one phenomenon in the material perception process. We propose the following typology: (typology inspired by Ludden, 2004)

-the "messenger" product: it contributes to the material identity. It translates some material specificity in physical shape.

-the "wrong messenger" product: it gives wrong information about the material properties. It's like "trompe l'oeil" product.

Figures 2 and 3: on the left « crystal virus », design Pieke Bergmans / on the right : « puddle table », design Susan Bradley

Here we point out two examples: on the left, we consider the vase « crystal virus » designed by Pieke Bergmans as a « messenger » object because we expect it expresses the capability of blown glass to become inflated and soft and to keep the shape when it cools down. On the right, we consider the

"puddle table" designed by Susan Bradley as a "wrong messenger" object because it owns a detail which try to make believe the material was first liquid (but the table is made from a folded sheet). It's like a "trompe-l'oeil".

Sample group

Twenty participants (aged 21-62, mean 34,7) participated and fulfilled our questionnaire. As we expected particular knowledge from professional experience could influence the results, we decided to select different types of people: Among the 20 participants, 12 were appealing to materials in their current professional activity whereas 8 were not (it means that they probably only appeal to knowledge from daily life). Among the 12 professionals, 5 were product designers. We consider product designers own a more particular sensitivity to the perceived aspects of the materials (shape, texture, and colour). However the final results don't show a significant difference between the sub groups.

Selection of the tested products

We decided to select daily life products with well-known materials (PVC plastic, wood, ceramic) to make easy the material recognition even for the no professional participants.

Figure 4,5,6 : Selected products for the questionnaire

The first product (Figure 4) is a basket designed by Delo Lindo in 2000. It is made of PVC extruded tubes glued together and cut out. We selected this product because we expect that it is possible to recognize the original material thanks to the visible texture and colour (grey and brilliant) but also thanks to the visible tube shape (which is proper to PVC). However the shape generated by the process is quite particular and we expect it brings a new vision of this well-known material and shows new possibilities. The product is part of what we called "messenger product".

The second product (figure 5) is a dining table designed by Carina Bergs for Ikea. This is mainly made of white painted all-wood. We selected this product because we expect that it is possible to recognize the original material mainly thanks to the typical and well-known shape (especially the turned piece for

central leg). Moreover we find interesting that the table with its white paint finish has a quite neutral texture (without visible wood knurls). The product is part of what we called "messenger product".

We expect the main difference between the PVC basket and the wood table is the novelty of the shape. Moreover, we expect the PVC plastic of the basket is recognizable thanks to the texture and the shape whereas the wood of the table is only recognizable thanks to the shape (because of the neutral texture).

The third product (figure 6) is a pitcher that we found in a cheap products shop. It is made of ceramic but it looks like an old and used enamel metal pitcher thanks to spurious usury marks and traditional shape and white and blue enamel. We selected this product because it's what we can call a "trompe l'oeil": it disorders the perception and recognition of the original material process. The product is part of what we called "wrong messenger product".

Figure 7 & 8: Selected products for the questionnaire

We selected two other products among the pieces we are currently creating in the context of our product design practice. The both are made of our new particular concrete (presented earlier).

The first one (figure 7) is moulded from a porcelain teacup and has an extra hole to the side to be used as a small bench pot. We created this product to show the possibility to make really delicate pieces with the original texture and details reproduced. As it is very similar to real porcelain piece (shape, brilliance and nearly white colour), it can be classified among "trompe l'oeil" family as the pitcher above. However we expected that some small differences in the texture (slightly less glossy and more grey) are enough clearly visible to make people wondering from what it is made.

The other product (figure 8) is moulded from a shape made with expanded foam (which naturally made some blisters during inflating). The product is a door stop. We created this product to show the possibilities to make any complex and irregular shapes and not straight shapes as often seen in furniture pieces made from this kind of new concrete. We expect the shape is strange enough that people may really wonder from what it is made too.

According to us, the main difference between the teacup shape and the foam shape is that the teacup makes people really much more think about something they already know (more familiar shape). However we expect the both are enhancive for the material.

Procedure

The 20 participants received a questionnaire by e-mail. It means they answered without any other information. The pictures measure 6 x 6 cm and we added the height of each product in order to give the scale.

The questionnaire consisted of 4 main questions. The 4 questions were the same for each product.

First, we asked a preliminary control question to check that people didn't know the product before. The question was asked as follows: "*Have you already seen **this** product before ? Yes/No"* In the case when people have already seen (and touched) the product, results would be skewed.

In the second question, we asked to identify the material used in product. The question was asked as follows: *According to you, what material is this product made of?* When people could name a material we measured certainty (on five point scale: *not certain at all / rather not certain / fairly certain / rather certain / completely certain*) and we asked to notice the main clue for identification of the material (choice between *texture / colour / shape / other please precise /I don't know*). When people couldn't name any material, they had to tick the box "I don't recognize" and answer to the following question: "*in this case, do you think that it is a material you haven't seen before yet?"* This question was asked to make the difference between someone who is conscious that the product is made from a material different from what he already know (that is to say a new unknown material) and someone else who hesitate between many material because the product is not significant enough.

Finally, with two other questions we measured whether the shape looks new (on five point scales *not new at all* / rather not new / fairly new / rather new / *completely new)* and amazing (with the same scales). We expect to confirm that some chosen shapes looks newer than others and that the novelty can generate amazement and thus curiosity about material.

Results

Results for the first question "Have you already seen *this* product before? Yes/No"

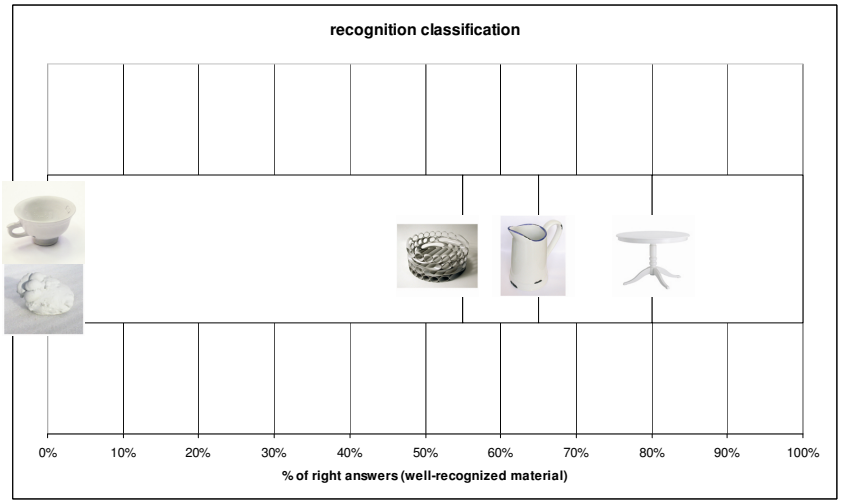
The preliminary control question doesn't bring the expected results. Although the question mentioned that only *this* product was concerned (that is to say exactly the same), part of the participants might not understand what we meant: The number of positive answers (that is to say "Yes, I have already seen this object") is significant for 3 of the products. The scores of positive answers are as follows: 55 % for the concrete teacup shape, 65 % for the ceramic pitcher, 65 % for the wood table. However there is no possibility for participants to have already seen for example the concrete teacup shape before: they may only know a similar porcelain product but not truly the same.

The results finally allow us to nearly measure the familiarity with the products as opposed to the novelty. The complete results of the first question are presented below on graph 1:

Graph 1: classification of the 5 products by % of positive answers to the question "have you already seen this product before?"

Results for the second question: "According to you, what material is this product made of?"

First, we compared the % of right answers that is to say when the material was well-recognized: for example the number of "wood" answers for the wood table or the number of "ceramic" answers for the pitcher. The product whose material is the most well-recognized is the white painted wood table (80 % of right answers) followed by ceramic pitcher (65%) and then the PVC basket (55%). Of course, as the two other products are made from a new unknown material, they have a 0% score. The results suggest a classification of the 5 products from the most recognized to the least recognize as proposed in graph 2.



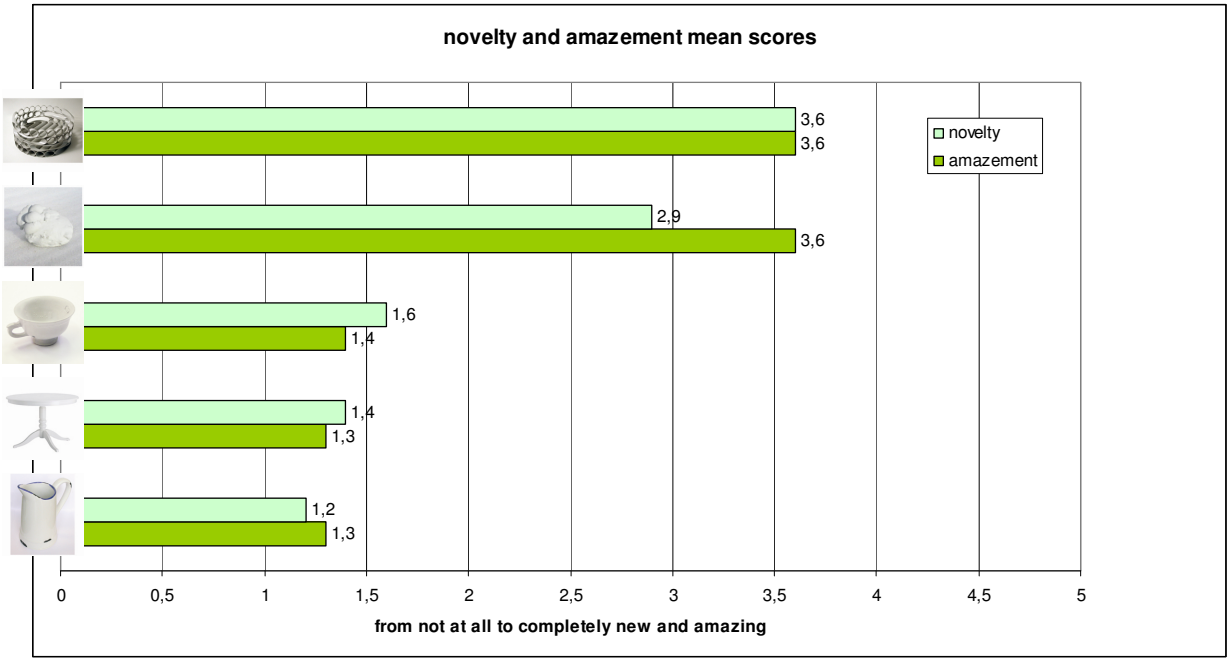
Graph 2: classification of the 5 products by % of right answers (well-recognized material) for the question of recognition of the material

For the results from the certainty question (on five point scales ranging from "not certain at all" to "completely certain"), we examined the mean of certainty answer for each product in two apart cases : when the answers are right (well-recognized material) and when not. For each product, except for the table, the means and the medians too are almost unchanging and turned around the third point of the scale which means "fairly certain" (the middle of the scale). For the table, and for the case of right answers (well-recognized material), the median score is growing at 4 which mean "rather certain". More precisely it means that 56 % of the participants whose answer was right considered to be rather or completely certain. It follows the first result about % of right answers and suggests that the table is the product whose material is the easiest to recognize.

We compared the % of participants who don't recognize any material for each product. The number is different from a product to another: the highest score (for the number of people who tick the box *"I don't recognize")* is attributed to the concrete foam shape (40%), then it's the PVC basket (35%) and then the concrete tea cup shape (10%). For the ceramic pitcher (0%) and the wood table (0%) everybody was able to name a material (right or wrong). When people answered *"I don't recognize"* they also answered to the question: "*do you think that it is a material you haven't seen before yet?"* However the results for this question were not significant.

Results for the third and forth questions: "Do you consider the shape new? Do you consider the shape amazing?"

In the last part of the questionnaire we measured whether the shape looks new and amazing. As we expected, significant differences between the five products appears. The mean scores for each product allow us to classify the five products from the newest to the least new as follow on the graph 3. We found a significant difference between on the one hand the PVC basket (median "rather new") and the concrete foam shape (median "fairly new") considered as new shapes and on the other hand the teacup shape (median "not new at all"), the pitcher (median "not new at all") and the table (median "not new at all") as not new shapes. The results about "amazement" are almost similar except for the concrete foam shape: it appears more amazing (median "rather amazing") than new (median "fairly new"). However, the novelty and amazement scores for the PVC basket and the concrete foam shape (that is to say the most new and amazing shapes) are very different for each participant: the answers are spread from 1st to 5th point of scales) . Thus we consider the results as less significant.



Graph 3: Novelty and amazement classification from the mean scores

Discussion

Comparison between the teacup shape and the pitcher

We classified the concrete teacup shape and the ceramic pitcher as "trompe l'oeil". But we expected that some small differences in the texture of the teacup were enough clearly visible to make people wondering from what it is made and not being fooled.

According to the results of the question 2 about the identification of the material, for the teacup shape, 80% of the participants named ceramic or porcelain (that is to say 80 % were "fooled") whereas only 35% of the participants named enamel metal for the pitcher. Thus the results don't confirm what we expected about the teacup shape. On the contrary the ceramic pitcher is less "trompe l'oeil" than the concrete teacup.

Comparison between the basket and the table

We selected these products because we expected that it was easy to recognize the original material thanks to the visible properties of the product (shape, colour, texture). The both have been well recognized (more than 50 %). But the wood table (80 % of right answers) was significantly more recognized than the PVC basket (55 %).

We also expected the main difference between the PVC basket and the wood table was the novelty of the shape. The results confirm what we

expected (graph 3): The wood table is seen as "rather not new" whereas the PVC basket is seen as "rather new".

Moreover, we expect the PVC plastic of the basket is recognizable thanks to the texture and the shape whereas the wood of the table is only recognizable thanks to the shape (because of the neutral texture). The results about "the main clue to identify" are not significant so can't be used to answer to this question. However the reason why the PVC basket is less recognized than the wood table may be because of the novelty of the shape of the basket. It also may be because the PVC is a material less known than the wood because it may be less present in daily life.

Comparison between the tea cup shape and the foam shape

We expected the main difference between the teacup shape and the foam shape was that the teacup made people really much more think about something they already know (more familiar shape). Indeed, the results of the first question shows that people feel more familiarity with the teacup shape (55 % of the participants answered "yes" that is to say "already seen") than with the foam shape (5%). Moreover, for the second question about identification of the material, only 10 % answered "I don't recognize" for the teacup whereas 40 % answered "I don't recognize" for the foam shape (the highest result among the 5 products). Finally, for the questions of novelty and amazement, the results shows that the foam shape looks newer (median "fairly new") and is more amazing (median "rather amazing") than the teacup shape (medians "not new at all" and "not amazing at all"). From these results we can say that for the development of a new material it may be better to create new unfamiliar shapes which are less confused with other existing materials. It may be the way to spark off curiosity about materials.

However according to the results the teacup shape and the foam shape don't look like ordinary concrete (Nobody named this answer). Thus we expect the two products are enhancive for the material. Moreover, even if the concrete teacup shape is perceived as porcelain from a small picture, it may be positive for the material in a context of a presentation in a magazine or on a website when the name of the new material is given in the caption.

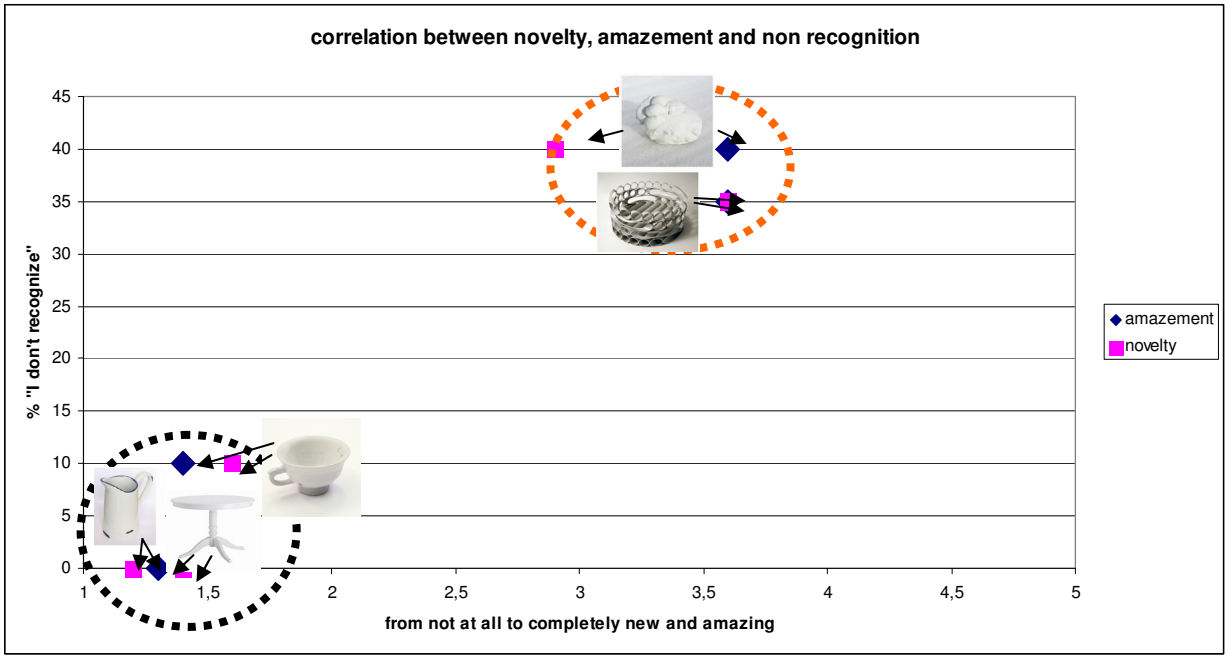
The white table: the influence of a specific shape for the material

We expected as main hypothesis that some specific shapes of products are able to represent the identity of the material that is to say to participate to the material recognition. Thanks to this study, we show that the wood of the table was the most recognized material. However it's the only product whose texture is not representative of the material itself. We expected the white paint finish was a neutral texture. The results show that 80% of the participants recognized wood but also 15% thought it was plastic. This may be because of the white and brilliant texture. This particular result somehow confirms that the

white texture doesn't contribute to the recognition of wood. However, the results suggest that the shape fully contributes to the identity of a material. It means that the product can be a really useful support to fully communicate about a new material, beyond the traditional material samples.

Correlation between novelty of the shape, amazement and non recognition of the material

Graph 3 shows that the results for novelty and amazement are quite similar for each product. As we expected, a correlation exists between the perceived novelty of the shape and the effect of amazement. Thus we think that shape novelty of a product will spark off curiosity about materials.



Graph 4: correlation between novelty, amazement and non recognition

Conclusion

Thanks to the study presented in this paper, we consider specific shapes of products are able to represent the identity of the material that is to say to participate to the material recognition.

In the case of well-known materials specific shapes already exist. The table has familiar forms and thus the material used (wood) can be easily identified. However it's still possible for the designer to create new shapes and to continue to develop the material potential. That is the case of the PVC basket. In the case of new material we consider the designer has to create these specific shapes which will constitute the material identity in the future. It means that the product can be a really useful support to fully communicate about a new material, beyond the traditional material samples. Product design can be used as a new strategy to create the sensory identity of new materials (shape-dimension included).

References

Ashby, M.F., & Weaver, P.M. (1997). Materials limits for shape efficiency. *Progress in materials science, 41* (1-2), 61-128.

Ashby, M.F., & Maine, E.M.A. (2002). An investment methodology for materials. *Materials and design, 23* (3), 297-306.

Ashby, M.F., & Johnson, K. (2002) *Materials and Design, the Art and Science of Materials Selection in Product Design*, Butterworth Heinemann, Oxford.

Baudrillard, J., (1968). *Le système des objets.* Gallimard.

Johnson, K.W., Lenau, T. & Ashby, M.F. (2003). The aesthetics and perceived attributes of products. proceedings of the *ICED 03*, Stockholm, 19-21 august.

Karana, E., Hekkert, P. & Kandachar, P. (2007). Material considerations in product design: A survey on crucial material aspects used by product designers. *Materials & Design, 29* (6), 1081-1089.

Karjalainen, T. M. (2007). It looks like a Toyota: educational approaches to designing for visual brand recognition. *International Journal of Design, 1*(1), 67-81.

Kesteren, I. E. H. (2008). Product designers' information needs in materials selection. *Materials & Design, 29* (1), 133-145.

Kesteren, I.E.H., Stappers, P. J., & De Bruijn, J.C.M. (2007). Materials in product selection: tools for including user-interaction aspects in material selection. *International Journal of Design, 1*(3), 41-55, 2007

Leroymerlin.fr. (n.d.) retrieved November, 2007, from http://www.leroymerlin.fr

Ludden, G.D.S., Schifferstein, H.N.J. et Hekkert, P. (2004). Visual - tactual incongruities. Surprises in products. Proceedings of the First International *Workshop on Materials and Sensations*, Pau, France, 27-29 octobre.

Manzini, E. (1986). *The material of invention*. The MIT Press.

Pedgley, O. & Wormald, P. (2007). Integration of design projects within a PhD, *Design Issues, 23*(3), 70-85

Saakes, D. (2006). Exploring materials - new media in design. Proceedings of the conference *Drawing new territories - 3rd Symposium of Design Research*, Swiss Design network.

Wordreference.com. (n.d.) retrieved November, 2007, from http://www.wordreference.com

Lorraine Bergeret

Lorraine Bergeret is a PhD candidate in the product design and innovation Laboratory at Arts et metiers ParisTech. After having studied product design at the "Olivier de Serres" school of art and design in Paris for 4 years, she obtained her Master of Science degree in Engineering Design and Innovation at Arts et metiers ParisTech in 2006. Her research focuses on how product design gives value to new materials. More specifically, she leads a practice-based design research for the industrial development of a new concrete. She

investigates how the identity of a new material may be made by product design.

Jean-François Bassereau

Jean-François Bassereau is a part-time expert in the field of sensory design within the product design and innovation Laboratory at Arts et metiers ParisTech as well as product designer at RCP Design global, a French product design agency specialized in sensory design. After having studied industrial design at ENSAD school of art and design in Paris he obtained his PhD in industrial engineering at Arts et Métiers Paristech in Paris in 1995. His research focuses on sensory design and perceived attributes of product. He is interested in modelling human perception process.

Pr Ameziane Aoussat

Pr Ameziane Aoussat is the head manager of the Product Design and Innovation Laboratory at Arts et metiers Paristech. He obtained his PhD in Design and Innovation in 1990. He is now Professor since 2001 at the same place. His research topics are innovation, design and project management.