

DESIGN AND EMOTIONS: A DESIGN METHOD BASED ON NEUROSCIENCES

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Abstract: Many neuroscience studies put in evidence that emotions are physical conditions related to the effects of different neurotransmitters on many body organs, as a result of stimuli received by the brain, in general through perception (Panksepp, 1998; Ramachandran & Hirstein, 1999; Zeki, 2009). According to those studies, it is possible to define some properties of the artefacts, able to induce emotions in the users. The paper presents a specific point of view about Design, considered as the activity adding communication capabilities to any kind of artefact, then presents a model putting in evidence the elements involved in the emotion construction, and finally builds a scheme of suggestions able to stimulate creative solutions. The paper adds an ideal design example, suitable for understanding the various steps of the method.

Keywords: *Design methods, Emotional Design, Design Model*

1. A way to interpret design

At the beginning there was craftsmanship. Craftsmen were building artefacts basing their work on experience; each piece was done as single opera, often personalised, with high costs and low production constancy; the quality was the result of the knowledge of the author; no formalisation in the production processes prevented from transferring the abilities, and learning the art was matter of apprenticeship.

With the industrial revolution the attention to the production processes raised, formal models of it were set up, together with measurements. Industrial Design took place, transferring the knowledge from the people to the processes; serial production allowed high standardisation, constant quality, reduced costs.

More and more the industrial product provided equivalent function and qualities for equivalent prices, and the differentiation among the product was left to other aspects: the brand and the styling.

Industrial Design went a common practice, and something more had to be added: the so called "Design". Still now, the designer is able to embody within a product different meanings, not necessarily related to the product functions, able to convey some kind of emotion (see Figure 1).

But the activity of the designer, beside the strong structure of the designing process (Munari 1980), is mainly related to creative capabilities (Mari 2001), and, despite the huge Design Schools, in order to become a designer, people must evolve by himself, without written and guaranteed rules.

Nevertheless, if Design is a way for conveying emotions through perceptual aspects of the artefacts, it is possible to provide conceptual tools able to stimulate the creative thought. The aim of this paper is just to introduce a framework of methods and tools in that direction.



Figure 1. Three kind of vacuum cleaner: the first recall the typical archetype of such a product; the second recalls, through formal quotations, a military tool, transforming the housewife into a *marine*, fighting the dirty; the third (silver and transparent plastics) recall science fiction, and transform the user in a *Ghostbusters*.

So, Design is not simply the activity to provide the proper artefact with the proper qualities /functions, usability, ergonomics, affordance, robustness, safety, economics, maintainability, disposability, and so on; a design artefact must be considered as a triplet made of (Maiocchi & Pillan 2009):

- *Functions*: the ability of the artefact for which the user will get it; not only the primary functions (to clean, for a vacuum cleaner), but also secondary (to compact, to have big wheels for stepping on stairs, and so on);
- *Shape*: the geometrical (size, profile, curves, colours, etc.) and sensorial (softness, noisiness, etc.) characteristics, able (as we will see in the following) to drive primitive emotions;
- *Meaning*: the many aspects, possibly metaphorically recalling other contexts, able to give to the artefact a meaning unrelated with the goal of it.

2. The Emotion Construction

According to our goal, we model the construction of the emotions within the brain a user as follows (Zeki 2009)

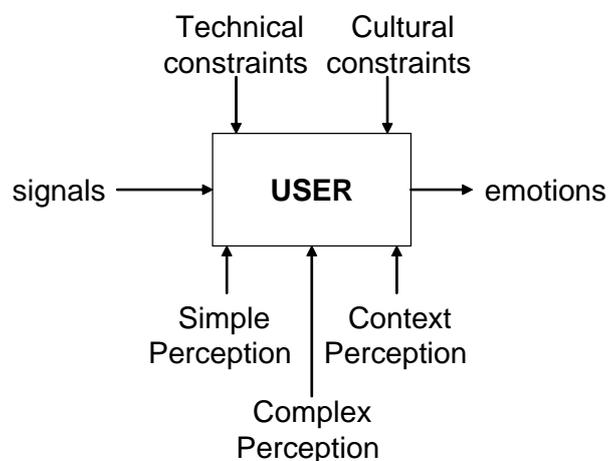


Figure 2. A schematic model of the emotion construction

1. *Signals*. First, external physical signals (e.g. light) reach perceptual organs.(e.g. eyes):

2. *Simple Perception*. These signals are immediately interpreted by the brain, through simple abstraction processes (f.i. some brain areas are able to “see” only slope at 45°, while other only at -45°, and their co-operation produce the interpretation of any other slope; again, our brain guarantee the persistence of the colour perception, allowing us to see green things as green, also in absence of green components of the light, and so on);
3. *Complex Perception*. More elementary signals are interpreted and recognised in their mutual relationships, as an embedded brain abstraction activity; for example, we (but also lower level animals, such as chickens) have a part of the brain devoted to recognise faces; again, parts to recognise houses; possibly, the phenomena studied by Kanizsa (Kanizsa 1997) or by the Gestalt; again, symmetries, order, rhythm, contrast, rounded or angular shapes, and in general what has been described in Ramachandran & Hirstein (1999). It has been proved that such kind of recognitions are able to provide emotions (i.e. to determine the secretion of some neurotransmitter related to pleasure, fear, or other feelings); we will manage this level of emotions through local hints;
4. *Context perception*. Further levels of recognition happen, taking into account a wider context; some of those recognitions are embedded (such as social structures, family or simply chairs); other, more subject to change, are related to everyone’s personal experience; in any case, those recognitions are responsible of very strong emotions; we will explore this kind of recognition with metaphoric structures (Lakoff & Johnson 1980) and semantic maps;
5. *Constraints*. The emotions are submitted to an acceptance evaluation; beside technical and economic constraints (preventing the designer in doing something or the buyer in buy something), cultural values can dramatically influence the evaluation and then the acceptance; Hofstede et al (2010) examine which values are typical of different cultures (countries or groups within a country), providing the consequent behaviours of the people; the maps provided by the authors allow to understand whether or not some meaning of the product will be accepted or refused by some cultures.

The model allows us to define the steps to drive a designer in creating emotioning products:

1. *Goal*. Having a brief, the designer must define the kind of market to be addressed, the purpose of the project, the functions and so on; i.e. al the element that will make the final artefact suitable for the declared purpose;
2. *Emotions*. An artefact could be a symbol for luxury, for robustness, for modernity, for tradition, and so on; which is the stereotype of the user? Which his/her values? Which are the metaphors to be used?
3. *Simple perception*. According to the point above, which are the elementary shapes we should prefer?
4. *Complex perception*. And which structures should we involve?
5. *Context perception*. Which are the semantic networks able to represent the metaphors related to the stereotypical user?
6. *Constraints*. Our analysis involves values unacceptable by some of the target present in the brief?

In the following we will shortly show the conceptual tools we suggest for each step, with a final example.

3. Conceptual tools for meaning induction

The conceptual tools proposed are sketched according the above steps: Emotions, Simple Perception, Complex Perception, Context Perception, Constraints.

3.1. Emotions

It is quite difficult to classify the emotions in order to make them usable for our purpose; classifications as the ones provided by many authors investigating in the field are more related to a

single psychological disposition (Cytowic 1993), while other, deeper, show how complex is the subject, with many concurrent phenomena (Sapolsky 2004).

We suggest to consider instead a set of stereotypes, and the related values, as we catch from the communication media.

So we provide a list such as:

Table 1. Stereotypes

Stereotype	Values
The strong male	Strength, autonomy, faithfulness, justice, ...
The pretty young woman	Beauty, delicacy, smoothness, weakness, ...
The Housewife	Practical, Clean, ...
The baby	Soft, happy, curious, ...
...	...

The list is not exclusive, and can be personalised; it works just as taxonomy stimulus. In fact we got a collection of about fifty cases, by collecting interviews from many students (among them: Activist, Bachelor, Barbie, Courtesan, Dancer, Emo, Evergreen old, Famme Fatal, Hero male/female, Farmer, Grandmother, Fashion Victim, Gypsy, Hi Tech, Housewife, Leader, Lolita, Maid, Manager male/female, Mother, Nerd, Poor, Popular, Prostitute, Rich, Spinster, Sportive male/female, University Student, Trasgressive, TV journalist, TV showgirl, Upper Class male/female, Vamp, and so on).

3.2 Simple perception

We provide here a simple classification, according to the perceptive channels; a small sample of a larger table: is presented below

Table 2. Simple properties

Channel	Properties	Mood
Seeing	Curve lines	Soft, warm, love, ...
	Angular lines	Hard, aggressive, danger, ...
	Warm bright colours	Strong, happiness, ...
	Cold dark colours	Sadness, ...
	Half tones	Soft, delicate, ...
	Big	Aggressive
Touch
	Soft	Mild, warm, love, ...
	Coarse	Strong, hard, ...
Hearing	Sharp	Hard, cold, danger, ...
	Sudden	Danger, ...

Tasting	Sweet	...

The senses include also smell, but also heath, pain and others.

3.3. Complex perception

We adopt here the ten Ramachandran's principles (Ramachandran & Hirstein 1999):

Table 3. Ramachandran’s principles

Principle	Effect
Peak shift	Enhancement of a meaning, pleasure
Perceptual grouping and binding	Enhancement of recognition, pleasure
Contrast	Attention
Isolation	Attention
Perceptual problem solving	Instability, pleasure
Symmetry	Calm, serenity
Abhorrence of coincidence/ generic viewpoint	Disturbing feeling/calm, serenity
Rhythm, Repetition, Orderliness	Calm, serenity, pleasure
Balance	Calm, serenity
Metaphor	Recognition, pleasure (see also later)

3.4. Context perception

Finally we use here semantic networks able to explore metaphoric structures; each network should be built by the designer, according to his/her sensitivity, and we provide here a simple example (from Lakoff 2004):

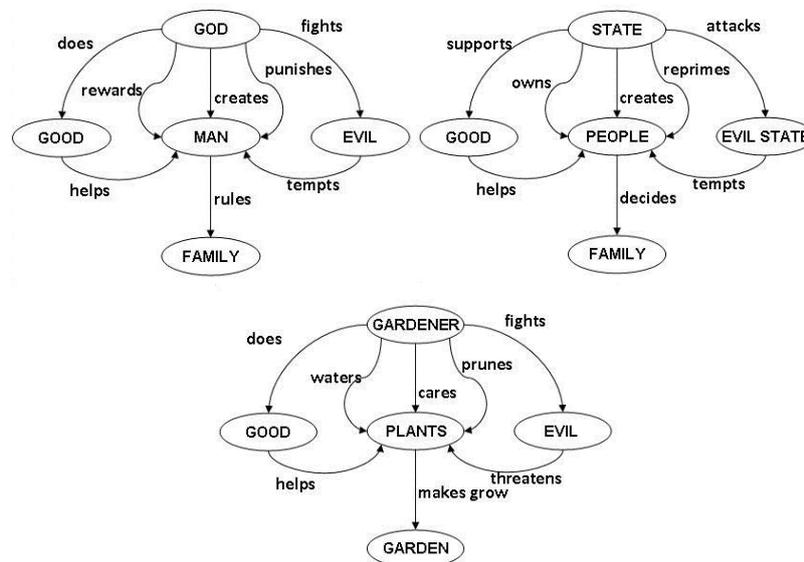


Figure 3. The same network, of the Biblical telling (left) has been used as a metaphor (never explicitly declared) during his politic discourse by G. W. Bush to support the attacks to the *rogue-states*; by the way, it is the basis of the misunderstanding within the movie *Being there* (1979) (on the right).

The metaphoric structures are very powerful, because are able to endorse a concept on a subject simply by making the brain to recognise (in a non conscious way) the structure of a well accepted system.

3.5. Constraints

Hofstede et al (2010) presents different parameters able to quality the difference in the cultures, and then in the values, of over 70 different countries.

In doing that we are able to know what is acceptable and what is not along five bipolar directives:

- Inequality acceptance – refusal;
- Masculine – Feminine;

- Individualist – Collectivist behaviour;
- Uncertainty acceptance – Avoidance;
- Long – Short term orientation.

While designing an artefact, we can check at any level whether or not some of the above aspects are affected, in which sense and with which consequences.

4. An example

As a short and simple example of the method, we present the following exercise.

Brief. Design a new kind of pasta, easily recognisable and different from others, so than it can be considered a must, and not a choice by comparison.

According to the brief, it appears the main goal is the absence of comparison.

So we should not produce a better pasta, but a new one.

Of course, the quality of our product will be not lower than the ones presently available on the market.

More, not only the quality of the raw materials will be high, but also other required technical characteristics should be taken into account, such as the capability to catch sauces, the ease of use, the size.

First, we can add some constraint to our project:

- Pasta for everybody, adults and children, and for any country.
- According with the fact that this pasta must be clearly recognizable as different, we can orient to an upper class consumer.

Now we can start with the first step:

1. Emotion and values. The typical consumer could be depicted by a stereotype of a family, upper class, good spending capabilities, good cultural level, needs for distinctions, to be different, able to understand the differences; the mother dresses with branded classic wears, is a manager; the father is an important manager; both are about 40-45 old; they have two cars (one of the upper segment, the other smaller but of the same luxury level); they live in a large apartment, provided with any kind of comfort; they have a child, male, 9 old, with good results at the school, practicing some sports, well educated, with few friends. Of course, it is not the typical consumer family, but is the typical appearance nee for our target. It recalls the family depicted in the Tati's movie *Mon Oncle*. What the product should cry is: if you buy me you are *socially upper, serious, culturally better, more sophisticated than the average, careful to quality, concerned about health*.
2. According to the above definition, the following attributes of the shape could be derived:
 - a. Soft lines without edges;
 - b. Surfaces suggesting soft textures;
 - c. Non-aggressive lines;
 - d. Recall to tradition;
 - e. Recall to history;
 - f. Pasta as Italian product with Italian design;
 - g. Warm colour (possibly more dark than light, without reaching the yellow of the eggs-pasta, but not too white; no vegetable colours at all, as carrots, spinaches or other)
 - h. Possibly, a family with different sizes, but described as suitable for different uses (sauce consistency);
 - i. Structure of each piece easy to grasp for children and adults (think also to chopsticks);
 - j. High quality of the raw materials, and no difference in the thickness in the various parts of each piece, in order to keep the cooking "al dente".

So we excluded kinds such as spaghetti (non easy to eat) or *farfalle* (bended in the middle, then with problems in uniform cooking).

3. Now we have to cope with the Ramachandran's principles. We should avoid the peak shift (it could result in some kind of caricature, in contrast with the adjective serious); perceptual

grouping could reduce the identity of the single piece; abhorrence of coincidence/generic viewpoint could be not sufficiently distinct; the same for contrast (aggressive); we could use isolation, perceptual problem solving, rhythm, symmetry, orderliness, balance.

- Then we have to cope with the metaphoric structures; according with the above analysis, we should emphasize cultural aspect, tradition, history, Italy. So we can start to put on a sheet some keywords: *design, Italy, tradition, culture, history*; being the Italian design more recent and not with tradition on pasta, we start for the moment to discard it, trying to connect in a network the other elements; the first new keyword coming is *Renaissance*, and, as more representative, *Leonardo da Vinci*. Then we try to find some relationships between Leonardo and shapes. A quick research on Google presents the drawings by Leonardo da Vinci for the book *De Divina Proportione* by Luca Pacioli. We connect every element in a network, and we could use it in order to communicate the new kind of pasta, that, of course, will have the shapes of such solids.

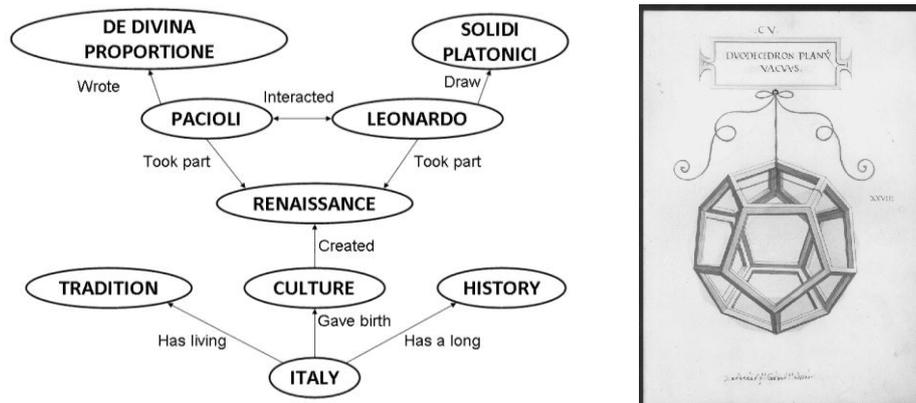


Figure 4. A semantic network on the relationships described in the text. The idea is to use the net in the communication (e.g. on the packaging), in order to make the user feeling him (herself as a person) able to understand and to appreciate so fine and deep concepts, at to take part to a cultural process. On the left, an example of the Leonardo's drawings.

So, the new pasta is defined.

- A collection named: *De Divina Proportione*, with four different formats: the *cubes*, the *octaedres*, the *dodecaedres*, the *icosaedre*; tetrahedrons have been excluded for hard edges present;
- their size will be different, according to different uses, but, being structured as thin cylinders replacing just the edges (as the drawings of Leonardo), the cooking time will be the same;
- different sizes and internal space can orient the best pasta for the best sauce (tomato for the smaller, Genoa pesto for the middle size, meat ragout for the bigger), but not in an exclusive way;
- all of them, mixable, are easy to be caught with a fork, or chopsticks, also for children;
- the colour will be light brown-yellow; the edges will be slightly rounded, the surface will be slightly knurled;
- symmetry, rhythm, orderliness, balance are deeply embedded;
- the packaging will recall the classical world in fonts, the drawings by Leonardo will appear on the box, some news about Leonardo, Pacioli and Renaissance will be present, together with the comparison between the harmony of the Divina Proportione and the harmony of the taste, the shape, the best quality of the ingredients, the equilibrium in nutritional facts, etc.

The following picture presents a sketch of the result.



Figure 5. Example of pasta and packaging.

Note that, to avoid too many problems in moulding the pasta, some of the edges are cut, in order to avoid complex and expensive machines and processes.

5. Final remarks

The example has a pure explanation goal. The method is still under experimentation. In fact, the authors experience some of the various parts in different projects, and had no the chance to apply it entirely on a single product.

In fact, the exposed process is the result of researches carried on since some years, with progressive improvements and results.

The first experience is related to the use of colours and shapes in some health care environments: according to Ramachandran's principles: a) unusual bright and brilliant colours have been used in refurbishing a Radiology Department of the INT (Istituto Nazionale dei Tumori - National Cancer Institute) of Milan, together with a permanent over-exhibition of paintings related to the theme of the life, everywhere; b) the decoration of a NMR equipment of the Ospedale Oncologico Infantile (Children cancer hospital) Pausilipon, in Naples, changing it from a incumbent machine to a toy; in the former case we have not quantitative measure, but the success of the initiative among patients and medical personnel has been very high, and all of them speak on changes in the mood and in the relationships; in the latter case, we measured the reduction of sedative drugs fall from about 30-40% of the cases, to the 2 %, demonstrating not only the impact on the emotions, but also significant medical (less intrusive drugs) and economic effects.

Other experiments have been carried on in designing some installation in the Underground of Milan, related to the change of the mood of the travellers, changing the attitude from escaping as fast as possible to the exterior, to flavouring possible new unusual experiences. A simple example is the design of an interactive panel, showing a bamboo forest, in which some birds are coming or flying away, according to the noise produced by the travellers.

The method is also under evaluation to be improved on interactions, and applied to services, in particular in the properties of the dialogues, and on computer games.



Figure 6. The waiting room of the INT (white, orange and purple, with paintings) –The decoration of the NMR.equipment at Pausilipon – Demonstrator of the bamboo forest for the underground of Milan

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