

# LETTING OBJECTS SPEAK

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## ABSTRACT

Communication is not limited to the use of words and sounds. Artefacts can also emit multi-sensory cues and generate affordance. Decoding some products can be challenging, especially if we think of smart communication devices and their complex nature. Designers must therefore carefully consider rhetorical qualities of a user interface in order to create a product that is meaningful and easy to use. This involves understanding the human cognitive process and how people make sense of things. This paper presents a teaching approach, which introduces fundamental theoretical notions of human perception and cognition. Using theoretical, analytical and creative elements, the course teaches undergraduate design students not only how to observe, isolate and decipher semantic qualities of artefacts, but also how to inject sense-making messages into products to denote a use and/or connote a value. The goal is to increase students' ability to design meaningful and accessible products and provide them with tools, which enable them to communicate through design in subtle or explicit ways.

*Keywords: Cognitive process, semiotics, product semantics, teaching method, evaluation process*

## 1 INTRODUCTION

To communicate thoughts and ideas we use not only verbal and non-verbal forms of expressions such as speech, written language, sign language, gestures, sounds, but also artefacts of all sorts (images, drawings, models, prototypes, products, etc.). Since the early 20<sup>th</sup> century linguists, psychologists or philosophers have studied cognitive processes and the evolution of signs and their meaning. Marketing and design have also started recognizing the value of such insights. It helps them understand what drives for instance customers' purchase decisions, or why some prefer a certain brand to another. Thus they are able to better target design and marketing efforts.

More recently, though, progressive design thinkers push for responsible and human-centred approaches, stressing the need for design to "shift gear" and create products that are useful, meaningful, and intuitive to use [1]. In fact, some urge design to be responsive to society's needs and address genuine problems such as the aging population, the demographic shift, or the massive proliferation of information and communication technologies (ICT) and its effects on society and consumer behaviour [2]. The rapidly changing digital world and its complex nature is indeed a challenging paradox for many, not only for seniors. Without a doubt, ICT make information access and social connectivity possible, yet, by targeting professionals and younger generations, they also tend to promote a generational divide. Peoples' lack of familiarity or even the natural diminishing physical and cognitive capacity (due to aging) is often not taken into account, making unfortunately the highly sophisticated products inaccessible. Scientist, designers and politicians are nevertheless convinced that ICT will be able to solve certain society problems, and help for example an aging population to live more independently and socially connected [3].

So, how to design accessible products that are meaningful to users? It seems apparent that designers need to learn to focus not only on how to design new product features, but also how to communicate them. Obviously, fundamental notions of cognitive psychology need to be taught. Such insight can help designers to adopt a human-centred and a context-sensitive design approach.

This paper will present a course, which adapted theoretical fundamentals of cognitive psychology and human factors for undergraduate design education. We will briefly explain the theoretical content of this course, its structure, the evaluation methods, as well as present the evaluation methods that help to test assimilation of knowledge and student's ability to apply it to design. In the final section we will talk about observed challenges while pointing out benefits and limits of this course and its teaching method.

## 2 THEORETICAL FRAMEWORK AND COURSE STRUCTURE

The course introduces third-year industrial design students to fundamentals of cognitive psychology. An emphasis is placed on grasping the concept of human perception and cognition and how it relates to design. It teaches students to observe their surrounding and seek out objects, signs and cues that carry meaning. They learn to apply theoretical knowledge in order to communicate through design. Students thus discover how shapes, colours, textures, materials and sounds can generate affordance and how to use these means consciously to generate messages. The course addresses the following theoretical notions:

- Physiological and psychological process: sensation, perception and cognition [4][5][6]
- Visual Perception [7][8]
- Gestalt theory, Gestalt psychology and principles of visual organization [9][10]
- Semiotics and the theory of signs [11][12][13][14]
- The semantic differential and Greimas' semiotic square as analytical tools [15][16]
- Categorization and the structure of natural and arbitrary categories [17][18][19]
- Product semantics and the measurement of meaning [20][21][22]
- Multisensory product experience
- Metaphors and analogies in design
- Qualitative information gathering in design (methods and tools)

The evaluation process involves four exercises and one exam, which are presented and illustrated in this chapter. Each is designed to assess the comprehension of the theoretical subject and students' ability to apply the knowledge to a design problem:

1. Exercise 1 - Understanding and manipulating the Gestalt Laws
2. Exercise 2 - Identifying and distinguishing signs and their meaning (symbol, icon, index)
3. Exercise 3 - Analyzing semantic qualities of products
4. Exercise 4 - Categorization
5. Final Exam - Putting theory into practice

### 2.1 Understanding and Applying Gestalt Laws

The introductory theory modules explain how people perceive, think and communicate, how culture, education, experience, and personal beliefs affect human perception and the understanding of the surrounding. Parallels are being drawn to design and how people perceive things such as order, harmony, chaos, ambiguity, and how they interpret cues.

After completing the first theory modules on cognitive process, visual perception and Gestalt psychology, students face their first evaluation exercise, which consists of applying Gestalt Laws: *closure, proximity, similarity, figure and ground, prägnanz (also referred to as law of simplicity and law of 'good figure'), common fate, continuity, etc.* Knowing how to use the Gestalt principles can give a designer a competitive advantage since it allows him consciously to communicate through design by structuring and layering information, highlighting key features as well as emphasizing or deemphasizing elements in a specific manner. For example, cognitive ergonomics seeks to ensure machine operator's safety by accentuating certain functions of the user interface. One of the requirements is to emphasize the safety switch in an unambiguous fashion. This can be achieved by differentiating the switch through colour, size or shape or by isolating it from the rest of the controls. Obviously, such design cues can be created more or less subtle. In certain circumstances, as in this case, the cues need to be monosemic (unambiguous). In a different context, subtle and polysemic cues (multiple meanings) might be acceptable, even desirable (see section 2.5).

For the purpose of the first exercise, students have to select a simple visual element: a line, a dot, a letter, or symbol, than arrange it in a variety of ways within 5cm x 5cm squares. They had to begin with a single element, and progressively multiply, scale and deform them starting in an orderly fashion and finishing in chaos. The most interesting configurations are to be selected and annotated by referring to all perceivable visual phenomenon (Gestalt laws).

The abstract treatment of the exercise has been purposely chosen because it helps not only maximize creativity and imagination but also allows students to focus on the visual effect it generates. Thus, students learn to focus on composition and layout and to create conceptual ties to Gestalt principles that they are trying to represent. Figure 1 illustrates the type of result this exercise produced. Left: initial exploration, right: final selections with annotations.

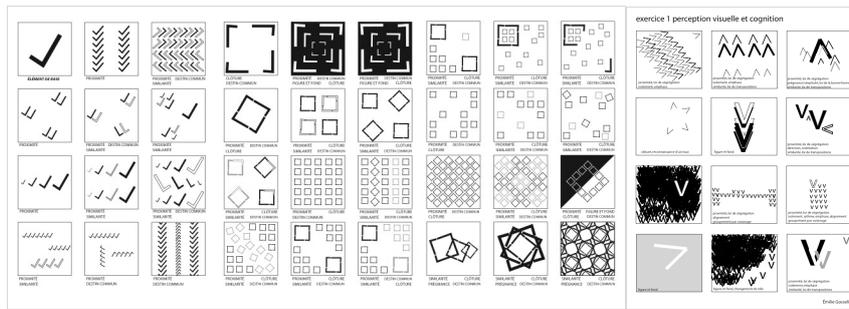


Figure 1. Gestalt principles application exercise by K. Di Girolamo (left), E. Gosselin (right)

## 2.2 Understanding signs and their meaning

Saussure and Peirce, the founding fathers of semiotics or semiology, explored since the early 20th century sign systems and the cultural context in which they emerge. Saussure is known for establishing the relationship between the *signifier* (the form a sign takes, written or acoustic) and the *signified* (the concept that a sign stands for) [11]. Peirce's introduced a third component: the *interpretant* (sense that a sign generates). Yet, more significant for design is nonetheless his statement: "Nothing is a sign unless it is interpreted as a sign." [10]. It clearly suggests that signs need to be intelligible, in order to be understood. This module teaches signs, the theories behind, and how to distinguish icons, indexes, and symbols [10]. Students learn that **symbols** have no resemblance with the concept that they represent and thus require knowledge of established rules of interpretation (language, alphabet, numbers, etc.). **Icons**, on the other hand, have a strong resemblance with the concept that they represent and are therefore easy to grasp since they are often literal depictions of the object or concept that they stand for. Their simplified or abstract representations are called pictograms or pictographs. Where as, an **index**, as Peirce explains, indicates something, like "a clock indicates the time of day" [11]. They are only tied to the object "as a matter of fact" and have very little or no resemblance to the concept they stand for other than the consequential logic. [11]

The application exercise involves selecting a domain, discovering related signs and analyzing them. Since signs are rarely pure, but rather composed, students need to identify its nature and isolate the symbolic, iconic or index qualities of each, while referring to the signifier/signified relationship and explaining how to interpret them. Figure 3 below shows an extract of students' work.

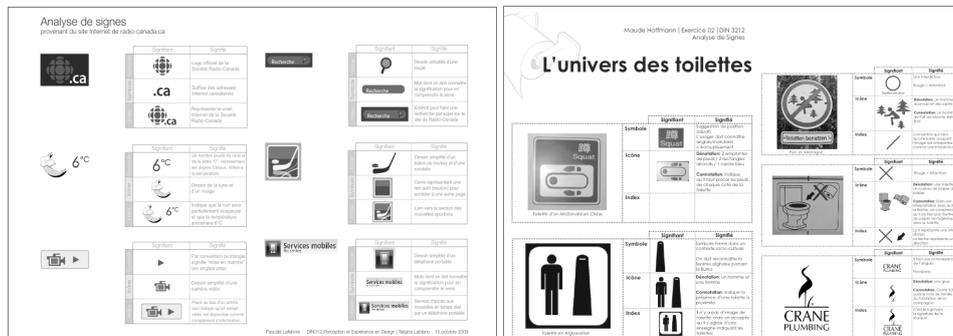


Figure 3. Sign analysis exercise by: P. Lefebvre (left), M. Hoffman (right)

## 2.3 Analyzing product semantic qualities

To communicate through objects, a designer (emitter) uses typically his cultural repertoire to code design message through shape, colour, texture, and so on. When decoding a product, the user will rely on its cultural repertoire that has been shaped by his past experiences and culture, education and beliefs. Both, the designer and user might not use the same logic and reference system when coding or encoding an object. Designers need therefore to familiarize themselves with the targeted user and his lifestyle in order to develop a *common repertoire*. In certain circumstances it is advisable to work with already established code systems when designing a new product to facilitate understanding.

In order to learn to extract such information students are encouraged to explore their contextual environment and examine how they derive meaning from things that surround them. They learn to use precise terms to describe what they see by explaining what (sign) it is that makes them perceive an

object a certain way (ugly, nice, cheap, expensive, aggressive, delicate, etc.) [20][21][22]. As illustrated in Figure 4, the assimilation exercise is divided in two parts. In the first students have to compare two objects that fulfil the same purpose, define their overall character, isolate all perceived attributes and explain how they manifest themselves [22]. For instance, high-quality materials could give a product a sophisticated look, while fluid or organic lines could hint an ergonomic or sensual character. The focus is on visual perception rather than the actual experience of a product. Obviously, both can be the quite the opposite: a chair, for example, can look comfortable; yet reveal itself rather uncomfortable, once we sit in.

The second part of this exercise aims at defining a design language [22], using image boards to illustrate three distinct semantic universes (*ergonomic, professional, feminine, etc.*). In this exercise, metaphoric images should be avoided! Obviously, images of *weapons* for example to express a *tough* and *aggressive* look, or of *feminine body parts* to represent a *sensual* character are not recommended. To avoid them, we suggest thinking of a specific product when composing image boards: *an aggressive car, a sensual car, etc.* To be inspiring, these boards need to show desired details such as an interesting texture or shape, an unusual assembly or material combinations. In professional practice such tools can help align a designer's vision of the new product image (portrait-robot) with clients or users expectations. They allow designers to illustrate how *aggressive, futuristic* or *sensual* can manifest itself, in other words "be translated" into a product.



Figure 4. Analyzing product semantic qualities by K.B. Deland (left), E. Gagnon (right)

## 2.4 Categorization

Categorization is a form of classification, similar to concept maps, except that their vertical and horizontal structure is critical since it illustrates relationship and hierarchy between and within categories [16] [17] [18]. In its vertical structure, all layers (sub-ordinate, basic, super-ordinate) are inclusive and placed in a logical hierarchical order: a *dining chair*, for instance, belongs to the basic level category *chair*, which in turn belongs to a higher level that can be called *sitting furniture*, and further up, *sitting furniture* is part of the category *furniture*. The horizontal structure uses a segmentation based on distinctive qualities of categories, which are defined by its most representative depiction, called *prototype* [19]. The sub layer of sitting furniture would contain for example concepts such as *chair, bench, couch, recliner, barstool, etc.* Categorization helps us organize concepts and group them based on their common distinctive attributes, which distinguish for example a *chair* from a *bench*.

In this exercise, students are simply asked to demonstrate their understanding of the theoretical subject matter and produce a classification model of a chosen object with the help of software such as C-Map tool. From a semantic perspective, this exercise fosters a thorough examination of concepts and what distinctive attributes define a category.

## 2.5 Putting theory into practice

The final exam is composed of an analytical part (completed in teams) and a creative part (completed individually). During the analytical part students study an imposed subject matter. They explore the user context, extract existing signs, jargon, acronyms, customs, etc. and probe how others (familiar or not) perceive and interpret them. They discover that meaning depends on the semiotic perspective and the depth of analysis: physical, empiric, syntactic, pragmatic, semantic, as well as social [23], as well as on the context, which "creates meaning and biases a persons viewpoint" [14]. They also explore

multiple ways of interpreting signs. Yet, teams have to weigh carefully what information is needed and how to obtain it without bias. During the second individual part, students have to interpret all gathered information and create a new object that has to meet the following criteria: communicate identified values, represent a discipline or a field, and use subtle and relevant signs to convey a certain message (honour, prestige, excellence) using disciplinary references and analogies.

The imposed topic was **trophy**. Teams had to draw from a hat a specific domain: *electronic music award, hacker of the year award, best documentary film, Nobel price for economy, gastronomy award, literature award, Formule1 trophy, humanitarian award, and many others*. Each team was asked to gather information with regards to their domain using two different investigative techniques, and later compare their pertinence for the design process. Some chose for example to interview DJs in their surrounding and question them about terms that denote them best (music, sound, wave, lighting, rhythm, computer, etc.). Some used image boards (prepared in advance) representing the semantic qualities they had in mind, and let experts put into words what they associate them with. Other students gathered information using questionnaires, semantic differentials [15] or mini-focus groups to test not only peoples' opinion on existing trophies but also what signs they associate with a specific domain. Observing and filming the contextual environment revealed itself as more useful for others. All results were summarized and presented on a poster, describing objectives, investigation methods used, and data obtained, but also discussing and criticizing approach and outcome. Students had to auto critique their findings, especially since we expected some results to be predictable or cliché.

The second part was dedicated to designing a new trophy, medal or something of that kind to represent the celebrated achievement, guided by their discoveries. The concept had to be depicted in a medium of their choice and the design intent justified. Each student, had to explain the message they were trying to convey, its pertinence, the signs used, and what they stand for according to them.

The documentary film award for instance, (Figure 5, right), tries to represent with its circular centre a *lens of a camera* that looks into the *deeper layers* of an investigated *subject matter*, which is materialized by the layered semi-transparent glass bloc. In a documentary film journalists *peel away layers* in search for the truth and thus expose in the process the audience to all aspects of a problem and *multiple viewpoints*. At the end, classmates voted for the most convincing design concepts.



Figure 5. Trophy concepts, by F. Martin (left), by A.S. Therrien (right)

### 3 DISCUSSION

The course is obviously only a scratch on the surface in terms of comprehending the complexity of human perception and cognition. The goal was by no means to tackle fundamental science nor substitute experts' knowledge in the field. We intend to raise designers' awareness about human perception and how it evolves. Many might agree, what seems new and extraordinary today will become ordinary tomorrow. Design students must learn to take the contextual environment and all perceptual parameters into account if they desire to make their design intelligible by others.

The **trophy** revealed itself as a perfect topic since its sole purpose is to connote value, be desirable and memorable. This forced students to focus on communicating values using pertinent signs in a subtle and original manner and not distract them with finding new features and functions. Some still tried, often for lack of better ideas, to add 'useful' features and were quickly redirected in their efforts. The overall results however show that students learned to think about what message to convey. They learned to consider carefully what cues to use in order to represent convincingly their domain. Yet,

some domains appeared to be more difficult than others. The humanitarian award was such an example. Some chose to symbolize *fragility of life* and the *victims*, ignoring those who the award is addressed to. Consequently, they omitted to represent the *bold and selfless gestures* or the humbling aspect of an award ceremony on the personalities that receive the awards. The less successful results can be explained by certain students' inability to detach themselves from existing clichés. Others had difficulties to transpose metaphors in a subtle manner. Although the intended messages were most of the time well justified, some results were predictable, highlighting certain students' lack of creativity and sensitivity. When asked to evaluate this course, students came to the conclusion that learned to be conscientious of the targeted audience, their lifestyles and all stakeholders (children, elderly, professionals, the sick) and to direct design cues accordingly. Many feel that the knowledge gained empowers them and allows them with confidence to justify their choices. To increase the effect of the course, it is advisable to apply these notions to more complex design problems and, if possible, test the perception and communicative qualities of design concepts by potential end users.

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