Food package chromatic design: A case study applying model Sens-Org-Int

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The purpose of this paper is to present an application of Visual Perception Model Sens-Org-Int to a chromatic analysis of food packages. Sens-Org-Int Model was devised by the present author, published and awarded in IVLA's (International Visual Literacy Association) 2007 *Book of Selected Readings.* The model differentiates three processes that occur in human perception: sensory impressions, organising processes, and interpretive processes of visual perception. Sens-Org-Int Model was devised in an attempt to differentiate which principles or laws of design are common to all human beings with normal eyesight from the concepts that are not common to everyone. Those that are not common therefore are learned or otherwise acquired. This theoretical model is now put into practice, in an attempt to analyse food packages. This paper, thus, shows the results of such analysis conveying some important information on food package chromatic design. Results include reasons on why some chromatic packages work better than others.

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Introduction

Orange is the complementary colour to blue. However, in terms of its use in design, how can this information be of any help? Perhaps if we know the human perceptive effect of using a pair of complementaries, along with its communicational value, well, that could be of some use. Then, designers could choose to use such pair in order to achieve their visual communication intention, if that is to be the case for that certain design project.

With this in mind, the purpose of this paper is to present an application of Visual Perception Model Sens-Org-Int. The model differentiates three processes that occur in human perception: sensory impressions, organising processes, and interpretive processes of visual perception. Sens-Org-Int Model was devised in an attempt to differentiate which principles or laws of design are common to all human beings with normal eyesight from the concepts that are not common to everyone. Those processes that are common, have a very special importance for designers, due to the communicational value that each may offer. Those that are not common therefore are learned or otherwise acquired, and also have other communicational values. This theoretical model is now put into practice, illustrating these perceptional processes with their communicational values in the case of a chromatic food package.

Model Sens-Org-Int

Sens-Org-Int Model, published and awarded in IVLA's 2007 *Book of Selected Readings* [1], differentiates the three processes that occur in human perception: sensory impressions, organising processes, and interpretive processes of visual perception. This model takes into account psychological approaches to perception, both experimental as well as physiological, including findings on neuroscience, and unites these approaches with the traditional visual literacy approaches used in design. With such a framework, applied to colour, professionals dealing with images, can differentiate concepts related to chromatic visual literacy valid as "laws" from those concepts that cannot be generalised to all human beings.

In the 19th century, perception was studied as a *passive* stamping done by exterior stimuli on the retina. It would then reach the visual cortex, the zone of the occipital cortex that receives stimuli generated in the retina, resulting in an identical image (isomorphic) as the primary stimulus.

Modern psychology refutes this notion and views perception as an *active* process that involves the search for corresponding information, the differentiation of essential aspects of an image, the comparison of these aspects with each other, the formulation of appropriate hypotheses and the comparison of these hypotheses with the original data [2-8]. Familiar and non-familiar images can be differentiated by longer or more contracted paths of perception [4].

Telford [9] differentiated sensation from perception in that the first comprises a simple conscience of the dimensions of experience, whilst perception implies the sensation and the meanings that are attributed to the experience. Thus, for this author, the determinants of perception are: context, constancy, distance, perspective, interposition, brightness, position, direction, accommodation, convergence motivation, emotion, and personality.

Theories about perception tend to emphasise the role of either sensory data or knowledge in the process. Some theorists have adopt a data-driven or bottom-up stance, or synthetic approach, according to which perception is direct: visual data are immediately structured in the optical array prior to any selectivity on the part of the perceiver proposed by Hering [10], Gestalt theories, and Gibson [11]. Others adopt a constructivist, top-down or analytical approach emphasising the importance of prior knowledge and hypotheses, defended by Berkeley [12], Helmholtz [13], and Bruce, Green and Georgeson [14].

The human brain has been studied in many details, and one way of organising the study of different functions of the brain, was to divide it in areas. Thus, in terms of visual perception, the most important area is the visual cortex, consisting of the primary visual cortex (also called *striate cortex* or V1) and the extrastriate visual cortical areas, containing areas V2, V3, V4 and V5.

Visual analysis primarily takes place in the visual cortex, which is performed by specialised neurons [15, 16]. It has the influence of secondary zones of the visual cortex forming mobile syntheses of visually perceived elements under the modulating and regulating influence of other non-visual zones of the cortex [4].

Before synthesis can occur, the visual cortex must stabilise the image, because when the image reaches the retina, it lasts no longer than 1 to 1.5 seconds if the eye is not moving [17]. Stabilisation occurs by the formation of an after-image in the occipital zone that can last up to 20 to 30 seconds [18, 19]. In the 1970s Zeki [18] identified a small area of cells on each side of the brain that seemed specialised in responding to colour, which he named V4.

Processes of Primitive Vision considered bottom-up by neuroscientists, which are processes that do not require previous knowledge and are not determined by learning or experience, are the perceptions of movement, depth, form and colour vision. Colour can even be produced experimentally by a magnetic stimulus on V4 causing the “vision” of coloured rings and halos, the so-called cromatophens [20].

Findings in neuroscience have mapped the visual pathways [18, 21-24] and have determined that perception occurs through a neural cascade, activating areas of the brain that are often very far apart. Thus, perception does not occur through isolated processes in the brain.

Sens-Org-Int model was devised in an attempt to differentiate which principles or laws of design and art are common to all human beings with normal eyesight from the concepts that are not common to everyone. These that are not common therefore are learned or otherwise acquired. Therefore, this model unites the synthetic and the analytical approaches to psychology as well as neuroscientific and physiological explanations on how the brain works, and relates these to classical design principles. With this framework, we are then able to tell, from the classical design “laws,” which ones can truly be considered a principle valid for all human beings from those that cannot.

The term law sometimes carries the connotation of something that was decided by someone or a group of people. Therefore, it is natural to want to question or subvert these for the sake of creativity. Now, when we consider the model, we can differentiate what truly is a law that cannot be questioned simply because it was not decided by someone. We are talking about the nature of the human eye and the human brain and not about someone’s decision that could be questioned.

The proposed model of Visual Perception is shown in Figure 1. The variables intrinsic to the model are SENS (Sensory Impressions), ORG (Organising Processes) and INT (Interpretive Processes), respectively explained below.

Sens variable is related to the sensory information received through the pupil in our visual sensory organ. This aspect of perception is a phenomenon that occurs in the eye only, still in the form of light, before it becomes neural signs in the retina.

Org variable is related to organising aspects of perception that occur starting in the retina, including what is considered the primary visual cortex, mostly in area V1 of the striate cortex. Org is related to the bottom-up approaches of visual perception in psychology. The phenomena of perception that occur as Org are what can be considered as laws in art.

Int variable refers to the elaboration of Org in the extrastriate visual cortex, including approximately areas V2, V3, V4 and V5 of the brain, and moving on to other areas of the brain. This variable refers to the top-down approaches to visual perception in psychology. It is in this moment of perception, that neural cascades occur, which undergo the interference of motivation, emotion, personality, culture, knowledge, etc. This aspect of perception causes variation and interpretation in art and design and in the proposed model, is called interpretive processes.

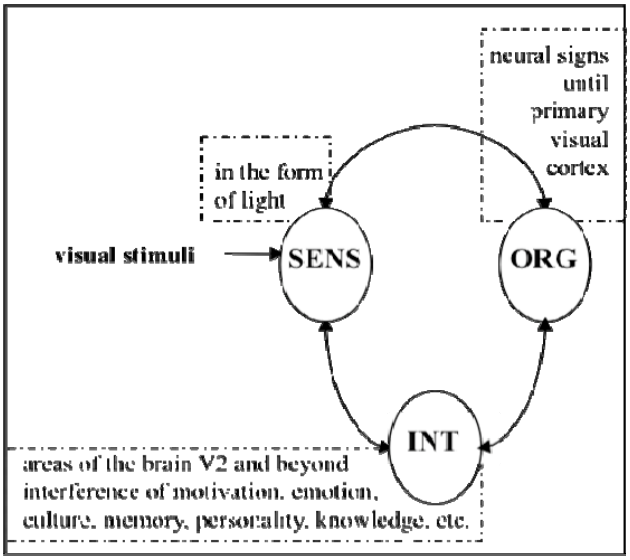


Figure 1: Proposed model of visual perception.

It can be noted that different authors have different names and subdivisions for the same perceptive phenomenon. For example, several authors [2-8] have stated that perception refers to SENS, ORG and INT, whilst other authors [9, 25, 26] have stated that SENS is called *sensation*, and *perception* is related to ORG and INT only. Also, we can note that Telford actually unites ORG and INT when he presents the determinants of perception as being: context, constancy, distance, perspective, interposition, brightness, position, direction, accommodation, convergence, motivation, emotion and personality; all of these refer to ORG except for the last three (motivation, emotion and personality), which refer to INT.

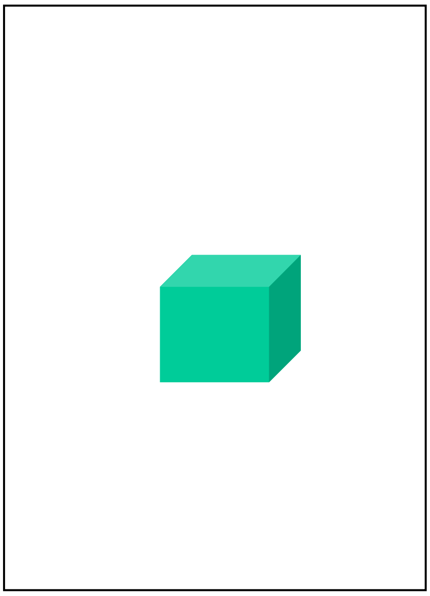
Another reason for the necessity of the present model is to unite different approaches in one stance. In psychology, for instance, there are the analytical or top-down approaches versus the synthetic or bottom-up approaches. These approaches are not, in fact, against each other, but they are complementary and if put together in one model, we get a better understanding of visual perception.

The present model may also be significant in uniting different fields of study, such as psychology, neuroscience, art and design. These four fields classically refer to visual perception, sometimes referring to it in an informal way, other times in a very technical way. The proposed model intends to unite the fields of art, design, psychology and neuroscience in such a way that it can be of use to designers and artists, and with objective scientific data as its theoretical basis.

The confusion between ORG and INT can be seen in colour design principles, for example, let's consider the colour light green. Itten [27] correctly stated that this is a calming and soothing colour. He even cited an example of racing horses that were put in stables painted in this colour, compared to horses put in stables painted red, right after the race. The first had their blood pressure lowered in a shorter period of time, compared to the latter, which had their blood pressure remain high during a longer period of time. Itten's description of green is purely ORG, as it is exclusively physiological.

Now, we often see this same green colour in other art and design books, characterising it is an elegant or delicate colour. These adjectives do not relate to physiological processes and therefore cannot be considered ORG. They are INT and should not be generalised to all human beings!

A design and art principle that commonly exposes confusion between ORG and INT is related to the representation of a cube, as shown in Figure 2. According to Itten, the way we perceive tonal values vary in terms of the tone of the background. Figure 3 shows this principle, where we can see that on the black background, the lighter tone of grey perceptually advances and the darker one recedes. The opposite occurs with the white background, and this is due to the tonal contrasts. These contrasts and the spatial effects perceived can be classified as ORG; anyone, from any culture, any previous knowledge would perceive this the same way.



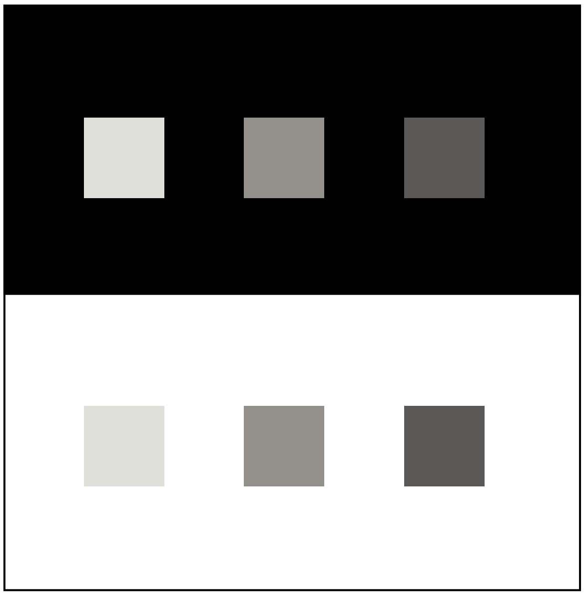
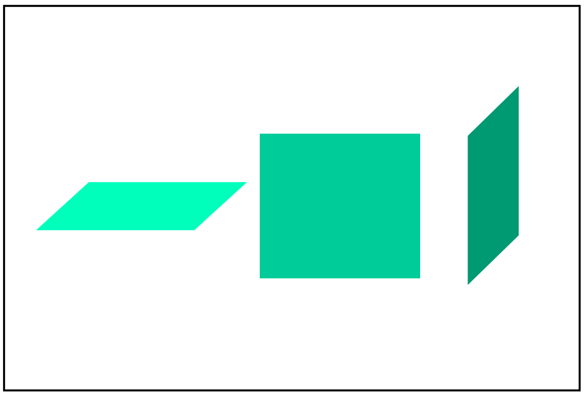


Figure 2 (left): Representation of a cube.

Figure 3 (right): Example of Itten's (1979) explantation on advancing and receding tonal value.

Now, when we see a common representation of a cube as shown in Figure 2, it cannot be generalised for all human beings. This is because this figure can only be perceived as a cube by people who have seen a cube before in their lives. It obviously is a very common element in life, but this fact should not confound our perception. The comprehension of this image as a cube is a semiotic understanding, and thus classified as INT. Only an extreme situation as Kaspar Hauser's shock with reality after living in an attic for eighteen years, viewed in Werner Herzog's film, would be able to demonstrate this [28].



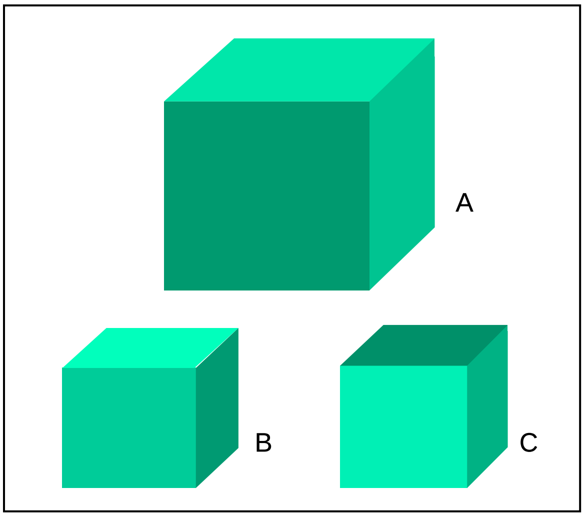


Figure 4 (left): Separated tonal value of the cube.

Figure 5 (right): Three examples of the representation of the cube.

To emphasise this, if we take the three tonal values used in Figure 2 and separate them (see Figure 4), we see that the darker tone is the one that perceptually comes forward, according to Itten's principles. But, as we can see, the darker tone is not the one used in the frontal position of the cube in Figure 2. If we wish to use the correct tones in order to obtain the best spatial effects, we should use example shown in Figure 5A. Figures 5B and C could also represent a cube, but 5A has a more spatial effect, considering that the background is white.

The confusion between Org and Int is very common in the production of images, exposing a frail visual literacy from the designer and bringing the risk of not communicating the intended message. To demonstrate, let's consider the following example.

If we were to look for images that have visual movement, we may choose the image in Figure 6, which is a photograph of Ronaldinho, one of Brazil's key soccer players. As we can see, Ronaldinho is in the air, his colleague is looking up at him, and the ball is not touching him. These visual cues not only indicate that he is moving, but also serve as semiotic signs related to the understanding of this image. To understand movement, in terms of these hints, is to see the semiotic meaning in each of the elements, that belong to Int.

If we now look at this image in terms of Org, we can see that it is quite static indeed. To visualise this, we can just trace a line along the major elements, shown in Figure 7. As we know from design principles, horizontal and vertical lines are more static than diagonal and curved lines [29-33]. So a better example of movement would be to use Figure 8. And to confirm the plastic forces indicated by a line, Figure 9 shows the main elements in the black diagonal line presented. In terms of Int forces, both pictures show movement, but in terms of Org forces, only Figure 8 does.

Figures 6-9 (from left to right): Photographs of Ronaldinho (used with permission of Tasso Marcelo).

One very important observation about the proposed model refers to the relationships between ORG and INT: INT can only be determined by the spectrum of possibilities proposed by ORG. To illustrate, let's consider Figures 10 and 11. Figure 10 shows lines in a static composition, whereas Figure 11 shows a dynamic composition. Each of the two compositions may be interpreted using positive or negative connotations. For example, the static composition may be interpreted as boring (negative) or serene (positive). The dynamic one, may be interpreted as confusing (negative) or joyful (positive). The static and dynamic aspects of each scheme are related to organising processes of the brain (ORG) and the interpretations of the composition being serene or joyful are all INT. Now the important thing to note here is that Figure 10 would never be perceived as joyful, nor would Figure 11 be regarded as serene. This shows the importance of ORG in determining basic visual literacy skills.

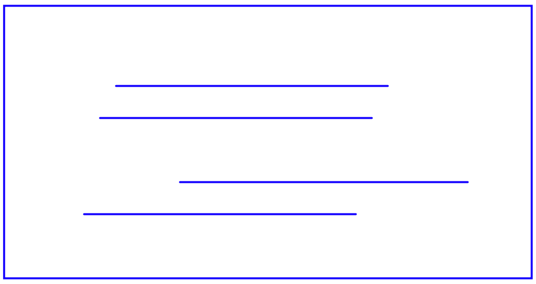
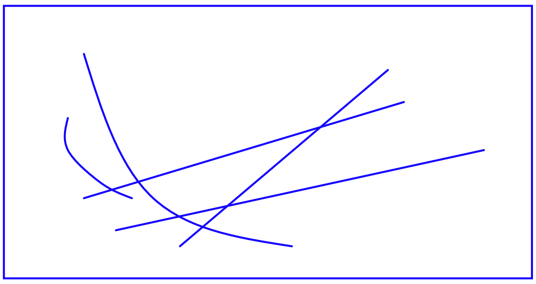



Figure 10 (left): Scheme of static composition.
Figure 11 (right): Scheme of dynamic composition.

Applying the model for a case in food package chromatic design

This theoretical model is now put into practice, in an attempt to analyse an example of food package chromatic design. In Figure 12 we have a picture of four packages of a Brazilian brand of fruit juice, designed by Narita Design office in Brazil.

Figure 12: Brazilian fruit juice package.

Starting with Int variable, which is the variable that opens a wider range of interpretations, we can see the following perception items: the iconic representation of fruits, words and a splash. These three items belong to Int (which refers to the top-down approaches to visual perception in psychology), because all of them require previous cultural codes for their understanding. For the fruits shown to be understood by the observer, he/she must know the fruit beforehand. The first three fruits are well known worldwide, but the last one, is the Brazilian fruit caju, which probably won't communicate to everyone in the world. Just as the words used, only people who read Portuguese and/or know the latin alphabet can understand what is written. Apart from these three Int perception cues, also issues of aesthetic preferences could be discussed.

Now, going to Org variable, which refers to the objective aspect of visual perception, we can see an efficient colour package design. This is so, because there are perception cues used that can be generalised to all human beings, independent of culture. These relate to the colours used, more specifically, the contrast of cool and warm colours.

It is easy to find in the chromatic literature, especially ones in art and design, some reference to cool and warm colours. But only a few texts present some discussion on the *relativity* and the *contrast* between cool and warm colours, like Wong [17], Sausmarez [34], Albers [35], and Itten [27], for each colour always interacts with the colour of its surroundings. Thus, one same colour, magenta, for example, may be considered both cool or warm; it will depend on its adjacent colour. If magenta is placed beside green, it will be considered relatively warm. Now if the same magenta is placed beside red, it will be considered relatively cool, for red is composed of magenta and yellow.

Cool/warm contrast can be classified as Org, meaning that to all human beings with normal eyesight, a same communicational value will be present. It is important to note that there may be more communicational values present, in terms of Int, but in any case, this specific Org communicational value will be always present.

The reason cool/warm contrast may be considered Org is due to the physiological factors involved in the contrast, which will be discussed below. The communicational value of this contrast is that cooler colours recede while warmer colours advance in our perception of the image.

One of the physiological factors involved in cool/warm contrast which explains the reasons it may be considered Org, is called chromatic aberration, which actually is even previous to Org, it is Sens, but here we will join them both because they are both physiological. Chromatic aberration is a phenomenon associated with lenses and thus also the human eye, where light is refracted differently depending on its wavelength. As a result, if the eye accommodates (focuses) on a distant red visual element of 700nm wavelength, a distant violet element of 400nm would seem out of focus [36]. According to Kaiser & Boynton, perhaps because the human eye is not made of glass, no correction for chromatic aberration has evolved.

Apart from chromatic aberration, there is evidence that cool/warm contrast does have more physiological impacts, explaining it being considered Org. This is due to the fact that there is evidence of excitatory and inhibitory features of channels r-g and y-b. These excitatory and inhibitory features were revealed as increases and decreases in ordinary vital signs (e.g. blood pressure, oxygen uptake, heart and breathing rates), alpha wave activity, galvanic skin response, the effect on hyperbilirubinemia (jaundice), the frequency of eye blinks and epileptic seizures, among others. Therefore, there is evidence of direct physiological connections between seeing red/yellow and feeling warmer, and between seeing green/blue and feeling cooler [37].

Other authors [38] also confirm the excitatory and inhibitory features of cooler and warmer colours. Gerard [39] found that the colour red had a more arousing effect than did blue on the visual cortical activity and in functions of the autonomic nervous system. Ali [40], using electroencephalogram analysis, demonstrated greater arousal following red light than blue light. Frieling [41] reported an experiment where subjects were asked to look into red, yellow, green and blue light. Their comments were tape-recorded and presented in accordance with Wundt's 'wind rose of emotions'. He also observed the subjects' behaviour in terms of twitching, moving. The windrose separates emotions into categories of arousing-calming, pleasant-unpleasant, tension-release. He found for red, and increase in pulse and uneasiness. For blue, he reported as calming and pleasant. Gerbert [42] had four rooms painted in red, yellow, green, blue respectively. Physiological measurements showed definite and constant results only for the red room, as an increase in arousal. In a Norwegian study, Porter & Milkellides [43] reported that people tend to set thermostat four degrees Fahrenheit higher in a blue room than in a red room.

Conclusions

This study concludes, in terms of Org variable, which refers to the objective aspect of visual perception, we can see an efficient colour package design for the case studied. This is so, because there are perception cues used that can be generalised to all human beings, independent of culture. These relate to the Org contrast of cool and warm colours.

In these examples, if the relative warmer colours were inverted with the cooler ones, of course the packages would have been able to be understood, but the wrong elements would catch the eye. The cooler colours, in this case, blues, are at the background and the relative warmer colours, in this case, the colours of the fruits, reds, oranges, yellows and purples, are at the front. This way of contrasting these colours help the consumers to look first at the colours of the fruits, since in terms of Org, these colours advance in the package composition and catch the eye. Therefore, these are examples of packages that communicate efficiently to the human eye, since their Org perception attributes are correct.

Altogether, the present author has identified eighteen chromatic Org perception attributes, that may guide the analysis of other examples of packages or other visual composition. Chromatic Org attributes may be considered as chromatic design fundamentals, since they establish objective communication values for the human eye. Hopefully, Model Sens-Org-Int may help to bring light to the chromatic composition in design.

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