COLOUR AS BODY AND SPACE – A NEW PROPOSAL ON PHILOSOPHY OF COLOUR

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Abstract

Considering the relation between Philosophy of Colour and Physics we intend to propose a new approach in order to develop this subject. This implies thinking Philosophy of Colour not only as an Aesthetics topic but also as an Ontological one. We start by directing a critic to positivist criteria that guides science nowadays having a negative impact in the exercise of Philosophy concerning any topic, including that of Colour. Then we briefly distinguish Colour Psychology and Philosophy of Colour. Finally, we suggest that Philosophy of Colour should be thought along with Space since colour only exists having as reference a space, where one's body takes place (exists). Therefore, Philosophy when reflecting on colour in relation to Physics should consider not only colour but also body and space. Why and how, that is what we intend to describe.

Keywords: Philosophy of colour, physics, colour psychology, body, space.

Introduction

Nowadays, a consideration of the subject of colour has been taken over by Psychology. Therefore, this article has two mains goals: 1) to claim that Philosophy has an independent and distinct approach to colour that can provide a more effective understanding of the phenomena; 2) that a Philosophy of Colour will enables us to comprehend better how the human body interacts with space.

Like any other topic that science attempts to approach nowadays, including the one of colour, there seems to be a dominant way to do so: the brain. Most sciences were taken over by this trend and Psychology is no exception. To the science of Medicine the brain always was a mysterious organ and only recently we begin to know more about it. It was surgery that eventually triggered a sense of emergency to know it better. Following a tradition of invasive treatment – that has prevailed in Western Medicine inherited from the Arabs since the Middle Ages[2] – the need to locate what areas of the brain were connected to which parts of

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[2] Lindberg D.C. *Theories of Vision – from Al-Kindi to Kepler*. Chicago and London: University of Chicago Press, 1981.

the body became essential. The question was: in case of an intervention how could it be possible to remove a tumour or a foreign body without removing a vital part of the brain that could make a person often incapacitated, paralyzed or dead? The 1990's have witnessed solid advances in brain knowledge and neurophysiology (the science that studies the nervous system) becoming a dominant science that overshadowed most sciences.

Consequently, it became mandatory for every claim in any given science (including other Medicine branches other than Neurophysiology) to consider primarily the brain in order to get acknowledgement by the scientific community. Recent discoveries about the brain, the central organ commanding the nervous system, promised not only to unfold its own mysteries but also to provide a satisfactory answer to all other sciences by claiming that every part of the body or any reaction/action takes place in the brain. By «place» we mean, it can be mapped.

The fact that during the 90's the main parts of the brain where identified as influencing this or that part of the body, or even able to provide an identification of this or that behaviour, was impressive and it still is. Our point is that the brain does not provide a full explanation on every topic and sometimes it is not at all the right starting point.

But how is this related with colour? The study of colour did not escape this dominant scientific attitude and particularly in the last decade, a renovated interest in colour has arisen being its dominant approach: the brain. This implies main assumptions on what colour is: a secondary quality as existing separate from the object, an objective property. This means that colour can be considered isolated, as an independent occurrence, as a brain stimulus that can be not only located but also measured in its intensity (in the brain).

But in our view the fact that this approach becomes preponderant, while claiming to be the only way to validate knowledge, raises a main orientation problem: should we assume that the dynamics of colour is fully explained if we are able to map it in the brain? We believe that that is not so because colour is never an independent, isolated appearance.

1. Colour and Physics

In order to better understand what we mean, let us remind a distinction: we can consider subtractive colour (paints, dyes and ink) where every colour is assumed to be subtracted from a referential *white*; and additive colour where colour in considered taking as reference any light emitted directly from any source, assuming that light is being added to a referential *black*.

Subtractive colour has had more remarkable advances than additive colour and its study belongs to Chemistry. Additive colour belongs to the branch of Physics and it has had a harder time delivering a sense of evolution.

According to the prevailing concept of science, the development of colour knowledge had his major breakthrough in physics with Isaac

Newton (1643–1727). His work *Opticks* (1704) stated, among many other things, that «light consists of particles of different sizes, those associated with red being the largest and with violet the smallest»[3]. An important moment for colour theory was the passage from the concept of particle to the one of wave. Thomas Young (1773–1829), contradicting Newton's theory, defended that it was not *particles* but *waves*, and different wavelengths that could explain the existence of different colours. Later on, Hermann von Helmholtz (1821–1894) developed this idea originating what would be known as wave theory of light.[4]

At this point, it is relevant to mention that Newton, Young, Helmholtz and others investigating colour were interested primarily in the phenomena of light and that implied reflecting not only on physics but also on optics. So the eye and its interaction with lenses, prisms and filters were evaluated. What we believe it is very important to acknowledge is that already at that time it was known that to reflect on the phenomena of light implies to reflect on Space because of the concept of depth that is crucial in optics. By the 1850's «the discussion was limited to: consensus on two-dimensional spatiality is 'given' in retinal image, while, on the contrary, the localization of the object in depth (if not always the intuition of depth itself) is an empirical and acquired capacity»[5].

What Helmholtz considered to be the biggest issue concerning physiological optics was how much of perception was due directly to sensation and how much to experience and training.[6] For instance, Ewald Hering (1834–1918) became Helmholtz's biggest opponent at the time and their main cause of disagreement was on binocular vision (where both eyes are used together). In binocular perception, one of the point-object images of one of the eyes always prevails over the other. According to Helmholtz, Hering's explanation on why this happens was too strongly rooted on physiology while he himself was inclined for a more psychological explanation[7]. The psychological explanation was suggested to him by his student, Wilhelm Wundt (1832–1920), that later on would become decisive to create psychology as an independent discipline and who has also who studied the brain, trying to find 'which part affects what'.

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3 Achinstein P. *Particles and waves: historical essays in the philosophy of science*. NY: Oxford University Press, 1991. P. 14.

4 And also the Young-Helmholtz theory, about the trichromatic colour vision where they have anticipated the existence of red-green-blue photoreceptors in the eyes that allowed colour vision (that are now known to exist and were named cone cells).

5 Cahan D. *Hermann von Helmholtz and the foundations of nineteenth-century science*. California and London: University of California Press, 1993. P. 178.

6 Cahan, op. cit., p. 186.

7 Ibid., p. 176–181

2. Colour Psychology and Philosophy of Colour

Having gotten to this point, it is crucial to ask: what is then the difference between Colour Psychology and Philosophy of Colour?

Colour Psychology has its ground principles in what we have described up until now: it is the study of colour dominated by scientific principles established according to exact sciences[8] in which the eye and the brain play the main role. Both are framed in what has become the dominant medical sense, i.e. holding all explanations based on internal (invasive) causes and favouring part over whole.[9]

Philosophy of Colour is something else and its distinction is important both in principle and orientation to the study of colour. Of course that eye and brain can be considered in Philosophy of Colour but the mapping that that knowledge provides should not be accounted as a cause but as a consequence. A consequence of a much bigger picture that involves more than the eye and brain in the physical sense. We will try to provide a brief description of what a Philosophy of Colour is in order to distinguish it from a Psychology of Colours.

Consider the stars, light bulbs, candlelights, plants, animals, precious stones, rainbows, sky and sunset. These are a few things were colour (light) is a relevant topic. The effort to understand how one can grasp colour considering all colour phenomena is very challenging. Even more because observation makes it clear that colour is a dynamic element and not a static quality.

When it comes to the study of colour, it is common to find J. W. von Goethe's *Theory of Colours* (1810) quoted as a work of historical interest only, being that few dwell on what exactly is at stake there, focusing on random sentences that appear to be obvious concerning colour behaviour observation. The work has three different parts: physiological colours (those that concern the eye itself), physical colours (additive) and chemical colours (subtractive).[10] What Goethe intends to provide, more than an exhaustive account of all possible observations on colour, are guidelines for the study of colour, providing orienting principles. How does Goethe do that? In order to understand that we have to consider where those sentences point at as a whole and not so much to each individual sentence. They show us that colour is a dynamic phenomenon, not at all attached to the object itself only. Any serious consideration of colour must take into account that colour does have its own dynamics. That it is not only the eye that perceives colour but also that colour allows itself to be seen in a certain way and that way is what Goethe describes. Before studying colour, Goethe has studied plants (*Metamor-*

8 On the distinction between Psychologism and Phenomenology, the approach we are taking here see: Husserl E.. *The Crisis of European Sciences and Transcendental Phenomenology – an Introduction to Phenomenological Philosophy*. Evanston: Northwestern University Press, 1970.

9 Fuchs T. *The Mechanization of the Heart: Harvey & Descartes*. USA: University of Rochester Press, 2001.

10 Goethe J.W. *Theory of Colours*. Massachusetts and England: MIT Press, 1978.

phosis of Plants, 1790) and that was the beginning of his approach to science through the concept of morphology. A plant is not only something that can be used to make colour but also it can teach about colour dynamics.[11] He has also studied animals that provided interesting observation possibilities for his comparison method (that then evolved to morphology) and also at the time a few colours were made out of animals (like carmine, used to dye the reddish coats of the British army during the 18th century).[12]

3. Philosophy of Colour and Physics

How can Philosophy of Colour embrace physics nowadays? In order to answer to that question, we consider that Goethe's theory of colour is more than just a theory that is considered historically. It is also relevant to understand recent approaches.

Goethe's theory of colour opponents (that Hering later on developed) was conceived based on observation: yellow demands violet; red demands green; and orange demands blue. Meaning, there are six colours that work in a group tension of two. This opposes to Helmotlz's theory of three primary colours (red, blue, green). Goethe's proposal originates in observation of colour in nature according to what the eye perceives and Helmotlz's is based on experiments that later on medicine proves to actually correspond to the eye's three cones. Both statements are possible and legitimate.

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11 On Goethe and science see: Borttoft H. *The Wholeness of Nature – Goethe's Way of Science*. Edinburgh: Floris Books, 1996; Uberoi J.P.S. *The Other Mind of Europe – Goethe as a Scientist*. Dehli/Bombay/Calcutta/Madras: Oxford University Press, 1984; Fink K.J. *Goethe's History of Science*. USA: Cambridge University Press, 1991; Molder M.F. *O Pensamento Morfológico de Goethe*. Estudos Gerais – Série Universitária. Lisboa: INCM, 1995; Steigerwald J. Goethe's Morphology: Urphänomene and Aesthetic Appraisal // *Journal of the History of Biology*. 2002. Vol. 35. P. 291–328.

12 Chemically, new ways to create new pigments, as well as new demands for colour names, have always been claimed. The chemical process of doing colour is similar to a food recipe. You would have to mix specific ingredients and mix them in a certain way and proportion and then you have the colour 'x'. Like any recipe demands, knowledge on how to stabilize a colour once it is applied or knowledge on which ones resist more time than others is very important. For one who knows about colour, it is known that some colours take longer to make and others are faster and also that some fade faster and others slower. Because colour, in the past, was made from plants, animals or minerals, a colour could be of a specific country, a region, or even only known (in its making) to few. The material on which it is be applied also has to be considered. Painted silk dresses are a good example of the interaction between additive and subtractive colour. In the 18th century, silk was an expensive material and it was therefore highly praised but it was even more so because it was a good fabric to paint on, which assured a distinct and unique dress. Also the fact that the fabric would react differently according to movement and light impact made its use very attractive. See: Lowengard S. *Interactions Between Techniques and Ideas*, The Creation of Color in Eighteenth-Century Europe at http://www.gutenberg-e.org/lowengard/B_Chap01.html (last accessed: October 1, 2010).

The difference between both of them is that Goethe focuses on colour *as it appears to the eye*, privileging a phenomenological approach; while Helmholtz, benefits physiological mechanisms grounded on the mind's ability to imagine connections and relations beyond seeing. The question is that both approaches are important to understand colour phenomena and therefore none of them should exclude the other. A phenomenological approach will get in trouble if it tries to deny physiological knowledge, and this is perhaps nowadays easy to accept. But what is also important to understand that an exclusively physiological approach disconnected from what it appears before us creates an insurmountable gap between science and man. Even if colour was mapped on the brain, or in the eye, what could be actually known about it? Would we know everything there is to know about colour then? No.

3.1. Mapping Philosophy of Colour

How can colour be mapped? We believe that the answer is very literal: colour can be mapped through the concept of space. The task is a complex one but we think that that is the way. And that was exactly the place where in the 19th century the debate was, before positivist science took over other all types of knowledge. Both Helmholtz and his rival Hering not only thought about light and colour along with space but also thought different things about both subjects. After Helmholtz's vision has prevailed, the consideration of space concerning light and colour was neglected to a purely psychological consideration where depth played a decisive role and where the interaction of coloured shapes and different coloured backgrounds (patterned or not) was taken as central.[13]

Our claim here is that in order to think colour philosophically, we have to think about it along with the concept of space. Moreover, any Philosophy of Colour is only possible if it considers space. What do we mean by this? The affinity of colour with space can be assessed in two different senses: 1) the different models that scientists and artists have created to represent colour – a geometric space of colour; 2) the priviledged interaction of light (and colour) in space perception with objects that are related with orientation, or ready-at-hand like architectural structures, forests (or a tree, or a plant) or animals. For example, this means that instead of depth we are interested in distance. In other words we are interested in the relation that the body has with space and how the body (and not only the eye or the brain) perceives colour and light.

Let us start by thinking about the relation between colour and space in a model[14]. A model aims at representing colour and it always implies to do so in such a way that it is flexible enough to be able to translate colour dynamics. In order to provide that dynamics, models involve a conception, a spatial representation that creates a shape. Whether it is a circle, a square, a cone, two cones or any other shape, those models

[13] Gestalt forms can also be included here.

[14] A good reference for the history of models is: Kuehni R.G. *Color space and its divisions: color order from antiquity to the present*. USA: Wiley, 2003.

systematically attempt to create a shape where we can relate with colour through its archetypal logic. That is, that allows us to operate with it. The space that the shape of the model creates exists nowhere and that is why we call it archetypal: it represents any colour in any space. Yet, in order we can operate with colour, shaping it (to offer a representation in space) is essential. So a model is a system of colour identification that represents colour. It is a reference map.

This allows us to consider colour and space relation in the second sense we have previously stated. The most effective model does not dismiss the need to evaluate a colour in a specific situation, in its use. For instance, when painting a house one can choose a colour using a sample where one is able to point exactly a given colour, choosing it. Still, when the sample is perceived in the wall where it is going to be applied at, it is different. Moreover, it is different when actual paint is applied to the wall. And it is also different if it is a sunny day or a cloudy day, or if it is a kid or an adult that is perceiving it, and it is also different according to the size, shape and colour of furniture, fabrics and paintings that are inside the room. The different circumstances in which a colour can appear are infinite. As Wittgenstein stated, colour perception depends on its *use* and *context*.[15] So here there is a distinction between the knowledge that allows us to grasp how colour *operates* (model) and how colour is *used* or how it appears in a certain *context*. This means that even if we know how colour operates, any colour always appears to someone, to some-body. The most reliable map to understand colour and light in its interaction with space is the body.

We are trying to propose an alternative way to think colour to the one prevailing nowadays where the brain, or the eye, are preponderant. We proceed with a peculiar example that states a similar perspective on the one we are taking on colour: though a world map is nowadays possible to draw with maximum precision and everything is able to be identified and placed in it, still, in Europe we orient the map as having the meridian in the centre but in Japan, for example, the map is oriented as having Japan in the centre. What we see here is a different example than colour that finds a common confrontation: the measures that allow the drawing of the map are precise and geography and cartography assure it, but phenomenologicaly, the way that that cartography appears is different in both countries. The same happens with colour. We perceive colour and for sure the eye and the brain (like geography and cartography) play an important role. But the orientation of what is perceived, how it appears to us, is provided in space by my own body. As it would be hard for us to perceptually accept a world map that would have Japan in the centre, it would for sure hard to perceive colour in no-space, not using the body.

In medicine we have an approach to the body that invests further and further in going inside the body getting more attentive to a microscopic view. The brain is perceived as containing all other organs and

[15] Wittgenstein L. *Remarks on Colour* (German and English edition). USA/UK/Australia: Blackwell, 1977.

how can they be manipulated using the brain has become a quest. And we are too impressed by that adhering to it immediately as belonging to the correct scientific attitude. But why is it that it is not as impressive the kind of knowledge that for instance reflexology claims where the whole body is accessible when one uses pressures the soles of one's feet being that each part of each foot corresponds to a certain internal organ. Or acupuncture, where the whole surface of the body is a reference map for the interior of the body.

The kind of prejudice that it is implied in approaching colour though the concept of space, or by doing Philosophy and not Psychology is very similar to this prejudice of how we think about a medical intervention in the body. Colour and light are energy and movement and our most immediate way access to them, the way they appear to us, is through the body.[16]

In our opinion Colour is therefore a topic closely related with a basic concept in Philosophy, that of Space. This implies that Colour is associated with Ontology. To question «what is colour» shares a common mystery as «what is man» in the sense that their identity seems to be unknown. But it is possible to describe how it behaves and how it can be used to edify us. Not only colour but also, our body and space these elements all work together.[17]

In a world where around 50% of the population lives in an urban environment[18], we think that it is important to acknowledge that light (colour), gesture (body) and architecture (space) must work jointly in order to promote balance. We are talking here about an ontological balance and not a psychological well-being. Of course that well-being is important but the elements we are bringing up here are not related with subjective qualities, subjectively considered individuals or taste. Light, body and architecture are the elements that describe the surface of what a human being is. It is something we all share. They are the tissue of the human skin, of all humans. The fact that these elements are not synchronized, or out of pace, does affect us. Colour is related with an important feature of what is being human. It is not only something that is attached to surfaces or it is good for painting paintings, dye clothes or painting a house. Colour is not a secondary element in our life. It has had, since early days, a connection with the cult of the sun, spirituality, agriculture and the rhythm of seasons, with energy, metabolism, body and healing. Colour, body and space shape us either in an edifying way, or not, and to recognize that is to understand that education through these elements is a way to find our own place in the world. As animals that are moved by energy, that have a body, and that move in space, not in a Garden of

16 Think of the Nordic countries where so many people, because of sunlight deprivation, use light therapy to balance their body energy that influences their mood, behaviour and ability to move.

17 Pallasma J. *The Eyes of the Skin – Architecture and the Senses*. England: John Wiley & Sons Lda, 2005.

18 And the number is expected to increase to 69.6% until 2050. *The 2007 Revision Population Database*, United Nations Website World Urbanization Prospects at http://esa.un.org/unup/ (last accessed: October 1, 2010).

Eden but in a world fully built by man. Let us think about Gothic cathedrals that were built with high precision and the stained glass windows not only told a story but also the way they were positioned enabled that when light hit on them, at a specific time of the day or during specific days of the year (like Easter), a specific element drawn in the window lit up or a part of the floor would be highlighted. So the space was like a shelter and also a calendar in the sense that would signal important celebrations that would highlight on a certain occasion. If there is a direction for Philosophy of Colour to evolve is therefore that of Space and that is a good reference map to investigate it.

3.2. Colour and Computer Science

By this time we are far away from colour as a topic approached through brain areas. That is an interesting approach for Neurophysiology. But Philosophy, though it can and should consider neurophysiologic finding concerning colour, has different principles, different concerns and a different orientation. It makes no sense that Philosophy of Colour tries to be perceived as scientific before a prevailing medical, physiological, knowledge pretending that that is its expertise field because it is not. That is why Colour demands cooperation between different disciples and there is nothing wrong with that.[19]

Perhaps an unexpected research area where we can find a connection between Philosophy of Colour and Physics is computer science. There seems to be a relation between mathematics, colour and mapping when spatial data analysis takes place.

IBM visual analysts researchers Bernice E. Rogowitz and Lloyd A. Treinish have published an article explaining how data analysis is influenced according to the interval of colour wavelength selected in order to display data.[20] It is therefore important to program wavelength interval according to the type of data in order to choose an adequate range so that a correct interpretation of the information is assured. The awareness that there has to be an adequacy between the type of information and colour, programmed according to the data that is aimed at display, is a recent development of colour theory of opponents stated by Goethe and developed by Hering. Visual imaging because it considers spatial frequency of the data, data type (e. g., ordinal, interval or ratio) and the visual representation (e. g., isomorphic, segmentation, or highlighting) uses as an essential tool several colour options in order to offer the best possible display of information in order to provide the user the best pos-

[19] It is better that than a philosopher that pretends to be a neurophysiologist or a neurophysiologist that plays make belief embarking on philosophical divagation.

[20] Rogowitz B., Rogowitz E., Treinish L.A. *Why Should Engineers and Scientists Be Worried About Color?* IBM Thomas J. Watson Research Center, NY at http://www.research.ibm.com/people/l/lloydt/color/color.HTM. (last accessed: October 1, 2010). Originally in: Rogowitz B., Treinish L. *Data Visualization: The End of the Rainbow*, IEEE Spectrum, 35, December, 1998, № 12. P. 52–59.

sible interpretation. Computer science, programming (Mathematics and Statistics) though initially «flattens» all colours (digitally, no colour is slower of faster than any other) when needed a visualization of space representation is needed then mathematically colour as opponency has to be created artificially using computer language.

Closing Remarks

We started mentioning the relevance that neurophysiology has acquired in nowadays science and in no way it is our purpose to neglect its knowledge. It is just not a possibility to accept that its dominance asphyxiates any other approaches or that its' criteria becomes general criteria for any kind of thinking.[21]

Concerning Colour, and more specifically Philosophy of Colour, trying to get some progress in the topic, taking as a starting point brain and eye data can be disorienting and misleading. Brain and eye data are a consequence and not a cause. They can be considered initially but not in such a way that it constrains thinking.

According to what we hope to have shown, one possible orientation for Philosophy of Colour is its connection with Space. We believe that that connection has much to offer concerning colour phenomena and it is almost unexplored territory. Goethe and Wittgenstein are important to consider Philosophy of Colour because they contribute to remind us what are the guidelines to think about colour that actually reflect the way colour appears to us. *Colour is a bodily relation with space.* The relation between Physics and Colour has to consider bodily energy, body surface and body orientation along with light and colour. The body is the link for colour's reference map between colour (light) and space.

As far as computer science, though it approaches colour initially in a different way, breaking the «time» characteristic of colour, it is forced to get back to the principle that regulates our relation with colour. If colour would only be an element that we would operate with than perhaps a single colour range would be enough to give an account of any data, but because colour is also *use* and *context*, several colour ranges must be provided according to the different data. Computer science already knows that in order to be satisfactory it has «to bend» programming serving not only colour logic but also considering the way we process the language of colour.

Any knowledge about colour cannot be partial it has to be whole. It cannot be a phenomenon that is considered isolated or as having an occurrence in a specific part of the eye and brain, as if we relate with it with a part of the body only. We must bear in mind the idea that colour is a bodily action/reaction and that, a both way relation. An opponent dynamics at its essence if you will, like colour itself.

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[21] Gadamer has previously talked about this concerning positivist criteria and the asphyxiation of Philosophy. Gadamer H.G. *Reason in the Age of Science*. Chicago and London: University of Chicago Press, 1990.