

## PERCEIVING ENMATTERED FORM

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*If the eye were a living creature, its soul would be its vision. (De Anima, 412<sup>b</sup>18–20)<sup>1</sup>*

### Introduction

According to Aristotle, the sense organ takes in the perceptible form (*aisthêton eidos*) without matter (*hylê*). And this enables one to retain perceptions and representations (*phantasiai*) after the *aisthêta* have gone (425<sup>b</sup> 22–25). Or in a more authentic formulation:

*We must understand as true generally of every sense that sense is that which is receptive of the form of sensible objects without matter, just as wax receives the impression of the signet-ring without the iron or gold, and receives the impression of the gold or bronze, but not as gold or bronze; so in every case sense is affected by that which has color, or flavour, or sound, but by it, not qua having a particular identity, but qua having a certain quality, and in virtue of its formula. (424<sup>a</sup> 17–24)*

In this essay, I intend to depart from this celebrated formula, entertaining little hope to add anything of consequence to the numerous interpretations of this particular passage alone. Primarily, I am certainly not qualified to examine what Aristotle might have thought when he formulated this enchanting proposal that the form can be extracted, leaving matter behind. What I intend to do is simply provide some reflections that are inspired by this fabulous insight.

Of course, the question remains how meaningful this kind of exercise could be. The difference between the intuitions that guided Aristotle more than two

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<sup>1</sup> All translations are given according to the Loeb Classical Library edition. (Aristotle 1936; translated by W. S. Hett)

millennia ago and a researcher who is dizzy from just entering the brave new era of positron emission tomography and functional magnetic resonance imaging, may be too dramatic. It is not unlikely that modern intuitions have a very recent origin and only a painfully scrupulous archeological excavation of meaning could reveal, if ever, what Aristotle really thought by saying, for example, *nous*. (Putnam 1986) Not disputing the view that the classic mind-body debate is a relatively modern innovation whose whole spirit was quite alien to the ancient Greeks, one cannot overlook the fact that there may be some common element in *Weltanschauung* that has not changed so much during the last two thousand years. This interpretation implies, of course, that there was nothing obscure in the ways how Aristotle thought. As Russell has said, he was a professional teacher, not an inspired prophet. His works were critical, careful, pedestrian, without any trace of Bacchic enthusiasm. (Russell 1996:174) As a consequence, most of his formulations come out prosaic and commonsensical. (Sorabji 1996: 211) In this particular respect, there is a striking resemblance between Aristotle and James Gibson, practically the only thinker to be taken seriously who challenged Berkeleian empiricism which dominated perceptual theory for three centuries. It is remarkable that his ecological approach to visual perception is also provocatively terrestrial and mundane. (Gibson 1979)<sup>2</sup> Aside from their common inclination towards prosaic language, they seem to share some basic intuitions as well. For example, they both believe that there is no awareness independent of that which is perceived. As Gibson writes:

*Perceiving is an achievement of an individual, not an appearance in the theater of his consciousness. It is a keeping-in-touch with the world, an experiencing of things rather than a having of experiences. It involves awareness-of instead of just awareness. It may be awareness of something in the environment or something in the observer or both at once, but there is no content of awareness independent of that of which one is aware. (1979:239)*

This is an echo of Aristotle's conviction that "the activity of the sensible object and the sensation is one and the same". (425<sup>b</sup> 6) If there is a separate sense perceiving sight itself, either the process will go *ad infinitum* – there should be a sense perceiving of perceiving sight –, or a sense must perceive itself. (425<sup>b</sup> 16–18)

In the same manner as Aristotle rejected the emanation theory, Gibson claims that no information is transmitted from the perceptual object (the object that the observer is aware-of) to the observer. There is nothing "communicated" from the object to the eye of the observer. The ambient array of light is the medium through which the contact between the observer and the perceived object is established. Gibson's medium is similar to Aristotle's transparent air or water through which

<sup>2</sup> "Gibson's solutions to traditional difficulties are sometimes in an important sense similar to positions held by Greek philosophers." (Ben-Zeev 1981:111)

the sensitive soul is in direct contact with the perceived objects. As Aristotle says, "it would be better to say at once that sensation is caused because the sensible object sets in motion the medium of the sensation, that is by contact and not by emanation". (440<sup>a</sup> 17–20) They both believe that ideas are not prerequisite of perceiving: "The ability to perceive does not imply, necessarily, the having of an idea of what can be perceived. The having of ideas is a fact, but it is not a prerequisite of perceiving. Perhaps it is a kind of extended perceiving". (Gibson 1979:250) Aristotle provides a good example of disassociation between perceptions and beliefs: the perceptual appearance of the sun is quite small, only a foot across, but we may believe that it is very large. (428<sup>b</sup>3–10) They both, Aristotle and Gibson, are in the camp of associationists when they speak about combining sensation across different modalities. Gibson writes: "Sensations of one modality can be combined with those of another in accordance with the laws of association". (Gibson 1979:245) This is an almost exact replica of a passage from *De Anima*: "The senses perceive each other's proper object incidentally, not in their own identity, but acting together as one, when sensation occurs simultaneously in the case of the same object, as for instance of bile, that is bitter and yellow; for it is not the part of any single sense to state that both objects are one". (425<sup>a</sup> 30 – <sup>b</sup> 3) And for the final example, the whole of Gibson's theory of perceptual invariants extracted from the ambient optic array is very similar to the Aristotle formula: the sensation is that which is receptive of the form of sensible objects without their matter. Thus, as I wanted to illustrate, the basic intuitions of two thinkers may be very similar despite more than two millennia between the dates of their birth.<sup>3</sup>

### How Can Form Enmatter?

The Aristotelian conception of form was, of course, not entirely an innovation. It was, partly at least, an explanation of the popular but obviously erroneous doctrine of *eidola* proposed by the atomists. A well-articulated description of *eidola* can be found in Epicurus: "Particles are continually streaming off from the surface of bodies... And those given off, for a long time retain the position and arrangement which their atoms had when they formed part of the solid bodies". (Diogenes Laertius 1925:577–579) These films, according to Epicurus, have the same color and shape as the external things themselves. Thus, material images or skins are stripped from the outer surfaces of objects and propagated through space as coherent units. Because they are of the same shape and color as the object, they faithfully communicate the latter to

<sup>3</sup> This does not mean that Gibson agreed with Aristotle in all details. For example, he is quite critical about Aristotle's emphasis on the passive touch, neglecting its active character. (Gibson 1966)

the observer. (cf. Lindberg 1967:325) Aristotle obviously advanced his theory of *form without matter* in order to get rid of these ridiculous material images or films in a quite strict analogy with his criticism of Democritus' view that the soul is a body – minuscule spheres – inside another one. Aristotle is aware of the fact that the acceptance of the view according to which a part of a body is representing the rest of it causes more problems than it solves. The opposition between perceptible form and matter was obviously introduced as an attempt to avoid the situation in which one part of material bodies is assimilated during perception in order to become aware of it as a whole. For Aristotle, *eidos* is nothing less than the final cause or something for the sake of which a given thing is what it is. (cf. Robinson 1989:58)

Nevertheless, the question how meaningful the distinction between form and matter is, remains. It is not easy to understand what exactly is meant by it. Like the distinction between 'whole' and 'parts', it is based on a rather vague and unclear idea. In most cases, it is just a confusion of reality with its description or representation. Barnes, for example, believes that the distinction between form and matter was invented for opportunistic reasons: "The truth is that the apparatus of matter and form was developed by Aristotle in order to solve certain puzzles about the nature of change". (Barnes 1979:36) It is, however, more likely that the distinction was elaborated due to what can be called the *Holistic Tension*. It is quite obvious that one and the same stuff can take different forms. From one and the same block of marble, it is possible to carve a large variety of different statues. Thus, the form is, in this particular sense, independent of matter, or more figuratively *compositionally plastic*. (Nussbaum and Putnam 1996:48) The independence is obviously mutual: the same form can be realized in different materials, for example in marble or bronze. Thus, form is a formative principle by which the potentialities of the stuff are realized. "The matter and the form are *contingently* related: the matter might have had a different form, and the form might have been found in different matter." (Cohen 1996:58) However, the mutuality between form and matter is not complete. Bronze would be no part of the form even if all the circles that have ever been seen were of bronze. (Cf. Cohen 1996:59)

It is, of course, possible to divide the whole body into parts in such a manner that one of its parts is what one can call the form, and the rest is the matter. This leads automatically to the dubious consequence that was mentioned above: how can a part have a role of something which is and can only be a function of the whole body. Although the whole body can be partitioned into smaller segments, it is obvious that there could be attributes which are formulated in such a way that they are valid to all of its segments. Or in Aristotle's own formulation, "all the parts of the soul are present in each of the two segments, and the two half-souls are homogeneous both with each other and with the whole; which implies that although the parts of the soul are inseparable from one another, the soul as a whole is divisible". (411<sup>b</sup>26–30) Thus, the description of the whole body in

terms of its parts is fundamentally incomplete.<sup>4</sup> This incompleteness of the partitioning is, as I believe, the main source of the *Holistic Tension*: although it may be very economic to describe the whole body as being assembled from clearly defined parts, it may be insufficient for a comprehensive description of the object. There are many things that can only be said about the object as a whole or about a certain configuration of its elements at least. For example, many things can be properly defined through their function. The heart is whatever performs such and such function in animals. (Nussbaum and Putnam 1996:35) If the heart stops beating and serving its function, it is even inappropriate to call it heart any more. It is not really heart any more; it is heart only in name. (cf. Cohen 1996 about Aristotle's *Homonymy Principle*) The formula (*logos*) of a house is the covering to protect from damage by wind, rain and heat. Any of the components from which the house is built – stones, bricks and timber – alone or in a list is not sufficient to describe what is really meant by house or shelter. The *logos* of the house is not localizable in any of its constructive elements. In the best case, it is applicable to the architecture of the house – a specific way how stones, bricks, and timber were assembled to make up a building.<sup>5</sup> However, the form in this case is not a blueprint according to which the house was supposedly or actually built. It is not, logically or otherwise, *before* or *behind* the building. Form and matter are, as it was lucidly said by Nussbaum and Putnam, “very actively together: not only together but indissolubly, as one thing”. (Nussbaum and Putnam 1996:42) It is not a powerful external force which adheres form and matter together. They are together from the very beginning and it is more likely a defect of our language that first tears the indissoluble into separate pieces and only after that starts to worry how to join them again. In order to provide a complete and adequate description of the object, it is necessary to describe how a certain formula can be enmattered (*logoi en hylēi*), expressed in materials. For example, affection of soul such as anger and fear are inseparable from the matter of living things:

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<sup>4</sup> Aristotle obviously anticipated both insights and difficulties which accompanied the Gestalt psychology. Despite voluminous explanations, the description in terms of ‘parts’ and ‘wholes’ remained ambiguous. (Ash 1995:173) It is clear that there are two types of partitioning, that is describing an object as consisting of several ‘parts’. The first constitutes genuine parts that are able to produce a genuine whole; the other one is absolute or mechanistic, often corresponding to naïve and uncritical description of the world. (Köhler 1929) As it was noted by Ash (1995:1), Gestalt psychologists did not claim, contrary to a popular belief, that the whole is more than the sum of its parts. Rather they maintained, that there are perceptions – *Gestalten* – that are fundamentally different from a collection of sensations, parts, and pieces. A physical state or process could be called *Gestalt* if it has qualities or produces effects that cannot be derived from the similarly constituted (*artgleiche*) qualities and effect of their so-called ‘parts’. (1995:172)

<sup>5</sup> “If I can predict what bricks there will be in the world, it does not follow that I can predict whether there will be houses. For that, I should need to know at least how the bricks were arranged, and perhaps also that the arrangements had at some time been used, or intended to be used, as shelters.” (Sorabji 1979b:63)

*But the natural philosopher and the logician will in every case offer different definitions, e.g., in answer to the question what is anger. That latter will call it a craving for retaliation, or something of the sort; the former will describe it as a surging of the blood and heat round the heart. The one is describing the matter, the other the form [eidos] or formula [logos] of the essence. For what he states is the formula of the thing, and if it is to exist, it must appear in appropriate matter. To illustrate it: the formula of a house is a covering to protect from damage by wind, rain and heat. But another will mean by house stones, bricks and timber; and another again will mean the form expressed in these materials to achieve these objects. Now which of these is really the natural philosopher? The man who ignores the formula and is only concerned with the matter, or only the man who is only concerned with formula? Probably the man who bases his concept on both (...) We were saying that the affections of the soul, such as anger and fear, are inseparable from the matter of living things in which their nature is manifested, and are not separable like a line or a plane. (403<sup>a</sup>29–403<sup>b</sup>19)*

Indeed, many concepts, used either in everyday conversation or more sophisticated reasoning, are fundamentally inseparable. The meaning cannot be attributed to any part of object, only to it as a whole.<sup>6</sup> Russell formulates the pressure of the *Holistic Tension* on Aristotle very clearly:

*To understand Aristotle's doctrine of the soul, we must remember that the soul is the 'form' of the body, and that spatial shape is one kind of 'form'. What is there in common between soul and shape? I think what is common is the conferring of unity upon a certain amount of matter. The part of a block of marble which afterwards becomes a statue is, as yet, not separated from the rest of the marble; it is not yet a 'thing', and has not yet any unity. After the sculptor has made the statue, it has unity, which it derives from its shape. Now the essential feature of the soul, in the virtue of which it is the 'form' of the body, is that it makes the body an organic whole, having purpose as a unit. A single organ has purposes lying outside itself; the eye, in isolation, cannot see. Thus many things can be said in which an animal or plant as a whole is the subject, which cannot be said about any part of it. It is in this sense that organization, or form, confers substantiality. (Russell 1996:183)*

It is exactly the same tension that leads to the oxymoron that the cause is not always precisely the sum of effects. Many who have recited the enchanting formula "the whole is more than the sum of its parts", in fact, owe a debt to John Stuart Mill who made a transparent distinction between two possible forms of description, mechanical and non-mechanical. He observed that there are phenomena, especially mental ones, which cannot be described exhaustively by their mechanical decomposition into parts or elements – into sort of parts that can be perceived and distinctly localized. Beside mechanical parts, there can be more abstract parts that cannot be directly perceived or localized. Mill pointed to many obvious cases where mental chemistry appears to take place. In all these situations,

<sup>6</sup> Cf. the category mistake. (Ryle 1949)

the constituting elements generate, rather than compose, the phenomena.<sup>7</sup> As it should be clear from the previous exposition, my own position in this particular question is eliminative. I think that it is not very productive to believe that there are two ontologically different states, mechanical and non-mechanical. In all situations when the whole appears larger than the sum of its parts, it is more productive to revise our language, rather than to suppose that we are facing different realities. Aside from "sortal" terms or simply nouns, which are basically collections of individual particulars they are composed of, there are many "non-sortal" terms or nouns as well. (Cf. Strawson 1959:168) Most likely, there is something wrong in the way how parts were defined. It is possible, for example, that some forces that are acting between parts were forgotten when the list of parts was composed. If these forces or other emergent<sup>8</sup> properties are not credited to belong to the list of genuine parts, then it is simply a rather dubious and unproductive practice of describing reality. And the same is probably true concerning form and matter.

### How Can Matter Take the Form of Another Body?

The common premise of all ancient theories of vision was that there must be some form of contact between the object of vision and the visual organ. (Lindberg 1978) There must be physical contact between the sense organ and the object of perception. And in this sense what is perceived by touch is directly contacted. (434<sup>b</sup>12–13)<sup>9</sup> In this view, it is not surprising that touch was regarded by

<sup>7</sup> It is perhaps not too excessive to reproduce here the entire famous passage about mental chemistry:

*When many impressions or ideas are operating in the mind together, there sometimes takes place a process, of a similar kind to chemical combination. When impressions have been so often experienced in conjunction, that each of them call up readily and instantaneously the idea of the whole group, those ideas sometimes melt and coalesce into one another, and appear not several ideas but one; in the same manner as when the seven prismatic colors are presented to the eye in rapid succession, the sensation produced is that of white. But as in this last case it is correct to say that the seven colors when they rapidly follow one another generate white, but not that they actually are white; so it appears to me that the Complex Idea, formed by the blending together of several simpler ones, should, when it really appears simple, (that is, when separate elements are not consciously distinguishable in it), be said to result from, or be generated by, the simple ideas, not to consist of them. (Mill 1966:379)*

<sup>8</sup> "The scientific meaning of emergent, or at least the one I use, assumes that, while the whole may not be the simple sum of the separate parts, its behavior can, at least in principle, be understood from the nature and behavior of its parts plus the knowledge how all these parts interact (...) It is curious that nobody derives some kind of mystical satisfaction by saying 'the benzene molecule is more than the sum of its parts,' whereas too many people are happy to make such statements about the brain and nod their head wisely as they do so". (Crick 1994:11)

<sup>9</sup> Sorabji believes that Aristotle was probably influenced by the etymology of the word for touch – namely, *haphê*, a word which was still often used with its original meaning of contact. (Sorabji 1979a:86)

Aristotle as the prototype for all senses. (Cf. Freeland 1996) His desertion of the concept of material images confronted him with another complicated problem: how to compromise the fundamental concept of action – that which acts and that which is acted upon must be in contact or “in one immediate place” (*Phys.* 226<sup>b</sup>21–227<sup>a</sup>7) – with the lack of material messengers travelling from body surfaces and acting upon the transparent humor (eye-jelly) of the observer’s eye. The solution proposed by Aristotle suggests that the visible object sends its visible qualities through a transparent medium (air or water) to the observer’s eye. For example, colored bodies produce qualitative changes in the medium – which is transparent –, and these changes are instantaneously propagated to the eye-jelly. Thus, although the sensitive soul is not in the immediate contact with the visible object, material contact has been established through the transparent medium joining the visible object and the recipient eye into a single causal chain. However, the distinction between immediate and mediated contact is not too great. Under certain circumstances, touch can also lose the direct contact with its object and become, like vision, mediated. For example, a blind man who is using a stick to find his way is still, through the mediating rod, in material contact with the external bodies supporting or obtruding his path.

The idea that in order to perceive something, the recipient organ must become in a certain way similar to the perceived object – the concept “like is only known by like” – is the inaugural intuition behind many if not all ancient and naïve theories of perception. Indeed, how one can become aware of red without becoming literally or quasiliterally red? Or how can one perceive a triangle without becoming, in a certain sense, triangular? The *Resemblance Theory*, as we can call it and according to which the sensitive soul takes on the properties of the object, was the prevailing doctrine until Descartes questioned the basic underlying intuition. (van Hoorn 1972:164 ff.)<sup>10</sup> Perhaps since Berkeley’s *Essay towards a New Theory of Vision*, it became a more or less standard understanding that our sensory impressions are more like conventional symbols which have no resemblance with the forces or events that are evoking them. For Hermann v. Helmholtz, it was already ridiculous to think that sensory events may have any resemblance with the respective physical events, even though the first are caused by the latter. It is meaningless to ask about their similarity as it is senseless to ask what is the color of sound – red, yellow or green. Mental representation and its object belong to two completely different worlds which are incomparable as are colors and sounds, printed words and their pronunciations between one and another. (Helmholtz 1910:18)

<sup>10</sup> Of course, it was Galilei who originally introduced the concept of secondary qualities: “Hence I think that tastes, odours, and so on are no more than mere names so far as the objects in which we place them are concerned, and that they reside only in the consciousness (...) if the living creature were removed, all these qualities would be wiped away and annihilated.” (Cited in Drake 1957:274)



The idea that only like can know like exists in different forms of radicalism. The most drastic form is the *Copy Theory*: in order to perceive an object, a miniature but otherwise exact copy of the object is in some way reproduced within sense organs or any other place inhabited by the sensitive soul. A particular form of the *Copy Theory* is an idea that the perception of colors is achieved by literal alteration of the eye-jelly: the inner eye literally reddens when a red object is exposed to it. Although it seems to be an attractive explanation, the *Copy Theory* is not an explanation at all. Aristotle certainly would not subscribe to this theory because the danger of a bad regression *ad infinitum* is too obvious: the existence of a copy which does not substantially differ from the original almost inevitably presupposes the existence of another observer who is looking at the copy in the same way as the first observer is looking at the original. The secondary copy in the sense-organ of the secondary observer, in turn, should have been perceived by the next observer and so on. Thus, the exact copying provides no explanation at all. Some modern 'meta-physical realist' may not see here any danger at all but for Aristotle at least the threat was real. If one has a propensity towards the copy metaphor and is not very keen to get rid of it, then one should also remember that we are dealing, if at all, with a very special kind of copying process. First, the end-product – perception – must be basically different from the original. There must be a certain transformation instead of exact small-scale re-production. Calling for a linguistic analogue, a translation from one language to another, essentially different from the first one, is needed in order to perceive something. Second, and this was obvious to Aristotle, it is not the end-product of this transformation that is meaningful but the process itself. More precisely: the perceived object must be processed (e.g. a form is extracted from the matter) and the process itself has no residue – the perception is nothing but the process itself.<sup>11</sup> But in this case, the process or act of perceiving as such is unquestionably different from the perceived object or its exact copy, whatever it could mean.

In order to see something, there must be a capacity of seeing. Plants, for example, cannot perceive because they lack this sense faculty (*aisthêticon*), sense organs which constitute the formula of this organ. Plants cannot receive form without matter; they can only change their color or temperature by admitting colored or warm matter. Perception is a certain change of the sense-organ (eye-jelly, inner ear) which faithfully (without errors) reproduces properties or states of the perceived object. Perceiving is an alteration (*alloiôsis*)

<sup>11</sup> This is only one particular manifestation of the non-residual concept of consciousness defended by Aristotle: "Hence the mind, too, can have no characteristics except its capacity to receive". (429<sup>b</sup>21)

of the sense-organs.<sup>12</sup> Thus, the basic question can be reformulated in the following way: how is the coalescence (*symphyesthai*) between the sense-organ and its object achieved during this alteration?

The basic intuition that like is only known by like suggests that the alteration involves the literal coloration of the organ of sight. (Sorabji 1996:213)<sup>13</sup> However, another equally strong intuition advocates that what is green by itself cannot perceive green. Indeed, Aristotle is stressing that the eye-jelly is colorless and the interior of the ear is soundless in order to see colors and hear sounds: "It is colorless which is receptive of colors, as the soundless is of sound". (418<sup>b</sup>26–30, 429<sup>a</sup>15–26) There is an obvious disagreement between two intuitively equally plausible requirements. First, there must be a certain resemblance between the object of perception and the recipient organ: the sensitive organ must acquire properties that are resembling the properties of the perceived object. On the other hand, the sensitive soul must lack these properties in order to perceive them: that has to be colorless which is receptive of color. Indeed, what is green by itself is not very well suited to detect greenness because it is not possible to tell if the greenness is acquired or is the property of the recipient itself which was there before an encounter with the green object. Thus, it could not be color as such but ability to change coloration (or something else) dependent on the properties of external object. Another argument against the eye-organ coloration is that the sensitive soul must be able to see many different colors at the same time which implies that the organ has to be colored, say into red and green, at the same time. Of course, there are many objects like the rainbow which have many different colors simultaneously. But it was not obvious, at the time of Aristotle at least, how to represent the sense-organ as consisting of colored or color-sensitive elements of different kinds.

These two equally plausible but contradictory intuitions are craving for a compromise. Is it reasonable to think that the sense-organs are both like and unlike their objects? Is it possible that the sense-organs are by themselves unlike (colorless or soundless) the perceptual attribute (color or sound) they are supposed to perceive, but become like through the process of perception? Indeed,

<sup>12</sup> It is, however, believed that from the alteration of the sense-organ does not follow that perceiving is purely physiological or material change. According to Barnes, it is a mere assumption that all properties of the physical objects must themselves be physical. (Barnes 1979:109) Burnyeat also holds that in the Aristotelian conception of perception, no physiological change is needed for the eye to become aware of the appropriate perceptual object. (Burnyeat 1996a) According to his interpretation, a sense-organ's taking a sensible form is simply awareness of that form without accompanying material or physiological processes. Consequently, it is possible for perception to occur without any physiological changes.

<sup>13</sup> It is an interesting question to ask what colored actually is. According to a simplistic interpretation, it is the organ of vision, eye-jelly, that is colored. But Aristotle's persistent idea that the mind contains nothing except the capacity to receive may suggest that it is the act of vision that is colored. (Bernard 1987)

Aristotle is suggesting that what is unlike before things are acting upon sense organs can become like when the action is completed: "Therefore, as we have said, a thing is acted upon in one sense by like, in another by unlike; for while it is being acted upon it is unlike, but when the action is complete, it is like". (417<sup>a</sup>17–21) Thus, which is to perceive, for example, white and black must be actually neither, but potentially both:

*For perception is a form of being acted upon. Hence that which an object makes actually like itself is potentially such already. This is why we have no sensation of what is as hot, cold, hard, or soft as we are, but only of what is more so, which implies that the sense is a sort of mean [mesotês] between the relevant sensible extremes. That is how it can discern sensible objects. It is the mean that has the power of discernment; for it becomes an extreme in relation to each of extremes in turn; and just as that which is to perceive white and black must be actually neither, but potentially both (and similarly with the other senses), so in the case of touch it must be neither hot or cold. (424<sup>a</sup>1–10)*

It is not totally clear what the formula "actually unlike but potentially like" could mean. The conditional clause – being like depending on actuality – is a little bit an emergency exit from a logical contradiction according to which our sense-organs must and must not have a property P at one and the same time. However, this compromise does not answer the main question of what it means to be potentially like. Does it really mean that the eye-jelly becomes literally green when a green body is acting on the eye through the transparent medium? It seems that for a satisfactory solution, it is necessary to answer another question: is it possible that an object A becomes "green" without becoming green by itself? Consequently the question can be formulated in the following way: is it possible to be green in two different ways? Bodies are literally green but the eye-jelly becomes green without becoming really green, only sort of green.<sup>14</sup> Of course, the easiest way to avoid logical contradiction is to assume that there are two different meanings of green:

<sup>14</sup> One possibility, suggested by Philoponus, Aquinas, Brentano, and Burnyeat, is that the organ's becoming like the object is not its literally or physiologically becoming hard or warm but a noticing or becoming aware of hardness or warmth. (Burnyeat 1996b) They all deny, although for different reasons, that the eye-jelly can or need turn literally red and that the body becomes really warm when a hot thing is touched. According to these thinkers, there is a poor 'spiritual' change (Aquinas) which is not accompanied by any material or physiological alteration. However, it is difficult to see how a solitary spiritual alteration, without any further specification, can in principle explain the variety and qualitative difference of all possible sensory impressions. It is easy to agree with Everson who calls this interpretation "too hasty": "Although the actualization of the capacity is not an alteration proper, this does not mean that the change in organ, described materially, is not one either. What it does mean is that one cannot identify the actualization of the capacity with the alteration of the organ. If the latter is an alteration and the former is not, then the two cannot be identical." (Everson 1995:190)

green-one and green-two.<sup>15</sup> These two meanings of “being green” are very similar but not identical.<sup>16</sup> In order to separate them, the first will be referred to as “green” and the second as “GREEN”. The first one is actually green (whatever this means), the second one is GREEN in some special sense, “in a manner of speaking”.

I believe that a lead to this special meaning of color, sort of GREEN, can be derived from the relational nature of perception in general.<sup>17</sup> On several occasions, Aristotle is stressing that sensitivity must be a kind of ratio: “The sentient subject must be extended, but sensitivity and sense cannot be extended; they are a kind of ratio and potentiality of the said subject.” (424<sup>a</sup>27–29) For him it was apparently quite obvious that both hearing and tactual perception are administrated by the principle of ratio: “... hearing must be in some sense of ratio” (426<sup>b</sup>29); “the sense is ratio, and excess hurts or destroys”. (426<sup>b</sup>7) In the case of temperature, the relational nature of sensation becomes especially obvious. The empirical fact is that we notice only extreme (*hyperbolôn*) temperatures, hot and cold, but do not notice temperature at mid-point: “we have no sensation of what is hot, cold, hard, or soft as we are, but only what is more so, which implies that the sense is a sort of mean between the relevant sensible extremes.” (424<sup>a</sup>4–5) From this passage, it is clear that there are indeed two ways of speaking about hot, cold, hard, and soft: first, as they are by themselves and, second, as they are located between the sensible opposite extremes (*en tois aisthêtois enantiôseôs*). Thus, in this second way of speaking, the perceptual attribute is defined in relative terms measured as a position on a scale or as a ratio to extremes defining the scale. As it was noted by Robinson, Aristotle’s theory of perception is clearly a species of equilibrium-theory which requires a disruption of the steady-state as a necessary condition for effective stimulation. (Robinson 1989:65) The same principle applies to the perception of colors as well. According to Aristotle, all colors are mixtures of black and white. “It is thus possible to believe that there are more colors than just black and white, and their number is due to the proportion of their components (...) so that these colors are determined like musical intervals”. (439<sup>b</sup>25–30)<sup>18</sup>

<sup>15</sup> It would be a very modern reading of Aristotle to say that there are two different meanings of green, for example objective and subjective, whatever these two terms could mean. Bernard is stressing that Aristotle tells about the coloration of perceptual faculty only in a manner of speaking – *estin hōs kechrōmatistai* (425<sup>b</sup>22) – the *estin hōs* should not be overlooked. (Bernard 1987:155)

<sup>16</sup> Modrak warns that *eikon* does not imply a photographic likeness between the object and its sensory image. “If A is an *eikon* of B, A must resemble B in some respect”. (Modrak 1987:89)

<sup>17</sup> The relational here has not exactly the same meaning as it is used in analytical philosophy where color is typically regarded not an absolute but a relational property which can be formulated in disjunction of physical properties: necessarily, all and only yellow objects have such-and-such a property, and the word “yellow” rigidly designates this property. (Averill 1992)

<sup>18</sup> Aristotle speaks about two ways how stuffs can be combined: a combination of sand and sugar is a composition (*synthesis*) in which the ingredients retain their identity, a combination of sugar and water is a mixture (*meixis*) in which the ingredients are transformed or, using above cited J. S. Mill’s terms, generative. (Witt 1996:178)

The relational nature of perception implies, in particular, that there is no meaningful relations between individual items, for example green as a physical attribute and GREEN as its perceptual representation. For Aristotle, GREEN is obviously not a 'thing' (because it cannot be extended), it is rather an abstract number, ratio. In this case, however, it is impossible to speak about direct resemblance because it is meaningless to compare an object which has an extension with an object which does not. An obvious consequence of the relational character of colors insisted upon by Aristotle is that individual colors have no intrinsic properties in the sense that is typically meant by many modern philosophers. It has become a rather popular belief, contrary to Aristotle's understanding, that individual colors have certain internal properties, that is properties that are unthinkable when we try to define colors. According to this belief,

*colors are said to have qualitative features that are intrinsic in the sense that they are purely phenomenal: They have only a certain qualitative character but no intentional content. These purely phenomenal features are also nonrelational: They are features that each color supposedly has on its own independently of its relations to the other colors (they belong to the colors intrinsically). Finally, the features are supposedly simple in the sense that they have no internal structure, and do not admit of any analysis. (Thompson 1992:341)*

This view, held by Aristotle, seems to imply that the relationship between the object and its perceptual representation could be holistic in the sense explained by Quine (Quine 1982:70): there is no meaningful relation between individual items but between the whole system of representation. (cf. Putnam 1998) What is required in the case of the holistic relationship is a regular and motivated connection that exists between a set of mental states representing the color-experiences as a whole, and some mind-independent property that we mean when we are talking about colors.<sup>19</sup> The perceptual state GREEN is related to a mind-independent property green not due to its immanent qualities that in a certain way resemble the represented property, but due to its intentional content, the ability to indicate the presence of a certain kind of information in the distal stimulus. The minimal requirement for a completely relational system is to have manifold perceptual states which dimensionally and

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<sup>19</sup> The main function of color vision is to recover information about reflecting properties (which are relatively stable) of surfaces on the basis of spectral power distribution of light (which is relatively variable depending on illumination) reaching the eye from that surface. One of the most important properties of human color vision is color constancy: the perceived color of the surface will remain relatively stable in spite of the change in wavelength composition that reaches the eye from that surface. (Hilbert 1992)

by number will systematically correspond to all material states that are and can be discriminated.<sup>20</sup>

However, the idea that certain states of the nervous system have their immanent meaning is extremely enduring. Johannes Müller was probably the first who formulated, not without Kant's influence, the idea of the specific nerve energy, according to which specific exciting changes in the condition of our nerves have their peculiar qualities irrespective of external or internal causes that might evoke these states. For example, various stimulations of the optic nerve by light, electricity or chemical agents will produce invariably the sensation of light, not sound or smell which, in turn, will be produced by any stimulation of acoustic or olfactory nerves. (J. Müller 1966) Thus, there must be something in nerves themselves which determined what type of sensation they are able to produce. Later Helmholtz applied this principle of specific nerve energy to the color vision as well by assuming that color sensations are composed of three different types of optic nerves that are sustained perfectly independently of one another, being responsible for producing distinctive color sensations specific to each type of these optic nerves.<sup>21</sup>

One obvious consequence of this specificity is that if somebody will succeed in swapping photopigments in R- and G-cones, the perceived color spectrum will be also reversed: looking at grass we must feel like looking at blood because light reflecting from the grass stimulates R-cones instead of usual G-cones. The idea of reversing every color into its complement is an attractive possibility and it is not surprising that philosophers have played verbal games with this hypothetical possibility for some time already. (Shoemaker 1982) However, until recently only few were aware that this is not only a mind-game to exchange red-green photopigments, but an actual possibility that Mother Nature has already taken care of. It is generally known that the red-green color blindness results from the state of affairs that both G- and R-cones contain the same photopigment instead of two different ones. There are two different types of red-green blindness – protanopia and deuteranopia. Protanopes have the photopigment

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<sup>20</sup> This is exactly the meaning of Georg Müller's psychophysical axioms which by understandings of these times described the correspondence between perception and the neural activity: each qualitative change in sensation corresponds to a unique qualitative change in material events underlying the sensation; with a raising or lowering of the intensity sensation, the psychophysical process increases or lessens. (G. Müller 1896) Mach formulated the very same idea at least ten years earlier with a clear understanding that physiological states by themselves may not have an internal meaning. (Mach 1922:49)

<sup>21</sup> This very concept is still presented as a central dogma of color vision science. For example, Nida-Rümelin writes: "It is a central assumption of color vision science which has been accepted from the very beginning of this empirical discipline and has turned fruitful that for any of the four phenomenally basic hue there must be some specific physiological process responsible for the occurrence of that color sensation." (Nida-Rümelin 1996:151–152) An additional assumption, very Helmholtzian as well, is that the architecture of the color vision is rigidly genetically predetermined and cannot be changed or modified.

normally contained in the G-cones not only in their G-cones, but in their R-cones as well. For deuteranopes the reverse is true: their G- and R-cones both contain the same photopigment normally contained only in R-cones. However, the production of photopigments in R- and G-cones are controlled by two separate genetic mechanisms. Therefore it is possible that these two color vision anomalies can occur simultaneously. In this case the photopigments of the two cone types are simply exchanged producing a pseudonormal vision (Piantanida 1974) in which, as it is generally believed by philosophers, the sensation of red and green is also reversed (qualia reversal). However, in real life it is very difficult to discriminate the pseudonormal color vision from the normal one. In fact, neither individuals with pseudonormal color vision themselves nor other people in contact with them are able to behaviorally distinguish them from normal persons. Consequently, without somehow "crawling into" the private world of a pseudonormal individual's sensory impressions, it would be totally impossible to say what he is seeing when he is saying that he sees "red" or "green". (Cf. Rey 1992:296)<sup>22</sup>

It is then in complete harmony with the central dogma of color vision to say that "when looking at grass the brain of pseudonormal people is in a physiological state which occupies the role of seeing something red in normally sighted people red in normally sighted people". (Nida-Rümelin 1996:154) Although it may appear to be very convincing to regard the color system encapsulated, there is an opposite possibility that cannot be excluded both on logical or empirical ground, in the limits of the current knowledge at least. The basic assumption that the nervous circuit starting from R-cones continues somewhere in the cortex will always produce the same sensation of redness – red qualia –, irrespective of the absorption spectra of the pigment, is still only a hypothesis, and not necessarily the best one. Many astonishing examples of adaptive plasticity indicate that there is no genetic master plan or blueprint that is self-actualized during the course of development. (Cf. Gottlieb 1998) Internal and external environments supply the necessary signals to the genes that instigate the eventual production of the requisite proteins under normal as well as unusual conditions of development. (1998:799) Therefore, it cannot be completely excluded that the structure of the color system is not uniquely predetermined by the morphological type of cones and other cells receiving their inputs from a particular type of cones. If so, we can assume, for example, that the sensation of red is produced not by a fixed morphologic type of cones but by any group of cones that have the absorption spectra at the highest possible region of wavelengths. In this case, any of the cones which have the highest absorption spectrum will be chosen by the color system as the one which is supposed to

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<sup>22</sup> I think that the only possibility to observe qualia reversal is to have an individual with one normal eye and one pseudonormal eye. (Cf. Boynton 1979:380 ff.) However, I have no idea whether this is possible or not.

mediate the sensation of reddish.<sup>23</sup> This is unerringly a relational view according to which two different neural structures can lie behind one and the same mental state. Another term for this property is supervenience: “a change in mental properties is always accompanied by change in physical properties, but it does not imply that the same physical properties change with the same mental properties”. (Davidson 1993:7)

### Coda

After rejecting the idea that the sensation of colors is an inherent property of nerve cells themselves, more space has been left for an answer to the main question: what kind of sense-organ alteration is needed to achieve the coalescence (*symphyesthai*) between the sense-organ and its object? It is certain that some kind of alteration (*alloiôsis*) should take place, but it cannot be a literal coloration of the sense organ – bodies are literally green, but the eye-jelly (or whatever it is that *arethê* is seeing) becomes only sort of GREEN. It is meaningless to speak about any external resemblance between states that sense organs take in order to represent certain attributes of external bodies: First, since the sense organ has no other characteristics except its capacity to receive (429<sup>a</sup>21), it cannot be described as an object which has, like material bodies, attributes such as size, form, color etc. The eye-jelly as a material body, of course, may have these physical attributes but they are irrelevant to the alteration that took place and whose purpose it is to receive the perceptible form. Second, because seeing colors is a process of finding ratios between black and white, it has no extension and therefore cannot be compared with material bodies and their physical attributes. The coalescence between the sense-organ alteration and the attributes represented by this alterations is achieved not by their external similarities but by their firm and unconditional relatedness: a certain alteration means nothing else but the property it is representing. Therefore, finding the ratio between black and white that corresponds to GREEN can happen only on one condition: that the perceptible form (*aisthêton eidos*) of the perceived object is truly green and caused, through the appropriate change of the transparent medium, the sense-organ to take in this form, that is the correct ratio between extremes which could mean nothing but GREEN.<sup>24</sup>

<sup>23</sup> Another question, of course, is about specific environmental or other signs that could indicate which of the two cones, R- or G-cones, have in fact the absorption spectrum at higher wavelengths.

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