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**FOR MODERN APPRECIATION OF PLATO'S AND  
DEMOCRITUS' VIEWPOINTS ON COLOUR DERIVATION**

*Or that anything appears the same to you  
as to another man?*

Plato<sup>1</sup>

According to the tradition, the phenomenon of light and colour was studied as early as by Pythagoreans; however, their ideas on the point are not available nowadays.<sup>2</sup> Notes on pre-Socratic philosophers' colour perception are rather scarce. As concerns Democritus, Plato, Aristotle and Theophrastus, our awareness of their theories on colours is comparatively complete.

Atomist Democritus was the first philosopher which tried to work out the colour theory. Besides, he admitted existence of four primary colours (white, black, red, greenish-yellow (green)) (De Sens., 73-78),<sup>3</sup> and stated that the shape of atoms determined their colour: white atoms were straight, smooth and transparent, while black ones were crude and uneven. Red atoms resembled those of heat, but were larger in size. Admittedly, Democritus gave up his principle as concerns the greenish-yellow (green) atom and described it as solid and empty without referring to its shape. Along with this, Democritus regarded all the rest of colours as combinations of the mentioned four primary colours<sup>4</sup> and offered some quite unusual mixtures as regards spectral gradation. Democritus also believed these four initial colours determined brightness

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<sup>1</sup> Plato, *Thaetetus*, 154b.

<sup>2</sup> Koliopoulos I., *Colour Perception Vision in Greek Philosophy*, in: *Filosofia*, Epethri- tou Kentrou Ereunh- th- Ellhnikh- Filosofia-, 25-26, Aqna, 1995-1996, 268.

<sup>3</sup> They will be considered below as well.

<sup>4</sup> Below, the issue will be considered in detail.

(shining, flashing quality) and intensity, which the philosopher placed higher than colour shades.<sup>5</sup>

Plato mentions colours in several of his dialogues, in several cases.<sup>6</sup> However, in *Timaeus* (67e – 68d) he offers his theory developed after "Democritus' manner", which admits hosts of colours that exist in the world are derived from the four basic colours. However, unlike Democritus, Plato believes the primary colours include white, black, red and "flashing, bright" (*lampron*) instead of the greenish-yellow (green), which marks a principal difference between the worlds of colours as perceived by the two philosophers. In Democritus' opinion, it is white colour that determines brightness, while Plato attaches the function to "flashing, bright", which in fact is not a colour term. In Plato's opinion, white colour helps to the derivation of lighter colours.<sup>7</sup>

What can be said about the conceptual links between the ancient Greek colour theories and the modern scientific data?<sup>8</sup> Ancient philosophers as well as modern people perceived white and black as two polarities, two extreme points. However, ancient Greeks arranged colours from light to dark (i.e. theoretically, one could obtain various colours from white until one got black only) while a modern man arranges colours the way he/she sees them in spectrum (red, orange, yellow, green, blue, violet) and differentiates between the primary and complementary colours. Although ancient colour theories differ from Newton's system, scholars conclude colour perception of the classical theorists were different from that of earlier Greeks.

There is another point to pay attention to. While giving a definition of colours, modern science puts a special emphasis on two points: its optical nature and its relation to the shape detected as early as by Plato in *Meno*. According to Plato, "Figure is the only thing which always follows colour" (75b),<sup>9</sup> and "... colour is an affluence of form, commensurate with sight, and palpable to sense" (76d),<sup>10</sup> i.e. Plato was aware of the optical nature of col-

<sup>5</sup> For the interpretation and appreciation of Democritus' colour theory, see: Guthrie W. K. C., *A History of Greek Philosophy*, vol. II, Cambridge 1965, 445; Лосев А. Ф., *Принципы античного цветоведения*, в кн.: *История античной эстетики*, Москва 1963, 481-496; Prantl C., *Aristoteles über die Farben*, Christian Kaiser, München 1849, 48-58; Schultz W., *Die Farbenempfindungssystem der Hellenen*, Leipzig 1904.

<sup>6</sup> E.g. see *Meno*, 76d, e; *Phaedo*, 110b-e; *Symposium*, 211e; *The Republic*, VI, 500c-501c, 507d-509a, IX, 585b-586c, X, 601a-602e; *Cratylus* 424b-425b; *Thaetetus* 153d-154b, 156a-157a, 182a, b; *Philebus* 51b, d.

<sup>7</sup> On Plato's colour theory, see Gaiser K., *Platon's Farbenlehre*, Synusia, Festschr. Schadewaldt, Pfullingen 1965, 173-222; Prantl C., op. cit., 61-77.

<sup>8</sup> About the question, see Irwin E., *Colour Terms in Greek Poetry*, Hakkert, Toronto 1974, 26-27.

<sup>9</sup> εἶστω γὰρ δι' ἡμῶν τούτο σχῆμα, ὁμοῦνον τῶν ὀφθῶν τυχθαίνοι κρῶματι ἀπὶ ἐπομένων (75b).

<sup>10</sup> κρῶμα ὀψεῖ συμμετρο- καὶ αἰσθητόν (76d).

our as well as of the fact that its existence was motivated by its reference to a material object.

According to modern scholars, ancient theorists denied independent existence of colours and regarded them as "the consequence of atomic movement". The idea may be considered the basis for Plank's theory.<sup>11</sup>

Recognition of the qualitative character of colours had an impact on colour terms. The theorists attempted to coin the terms matching the colour boundaries; however, in certain cases, their sense went far beyond the colour limits. Besides, the classical thinkers attempted to compensate for the lack of terms for blue and green so as to be able to describe any kind of colour representation.

It is widely admitted that Greeks perceived colours not the way modern people do.<sup>12</sup> Goethe is to be "blamed" for the idea; he dedicated a special work to the ancient Greek colour perception and terminology (1810) and was the first to start the study of the problem. He worked out a theory on the nature of colours which enjoyed a large number of followers in German, English and French painting, although it still serves as an object for wide criticism.<sup>13</sup>

According to Goethe, ancient Greeks "derived all colours from white and black, from light and darkness. Their denominations of colours are not permanently and precisely defined, but mutable and fluctuating, for they are employed even with regard to similar colour. Their yellow inclines to red on the one hand and to blue on the other. The blue is sometimes green, sometimes red. The red is yellow on one occasion blue on another. Purpur fluctuates between warm red and blue, sometime inclining to scarlet, sometimes to violet. Thus, the ancients not only seem to have looked upon colours as a mutable and fluctuating quality, but appear to have had a presentiment of the physical and chemical effects of augmentation and reactions".<sup>14</sup>

In his work, Goethe returns to and more or less rehabilitates pseudo-Aristotle's viewpoint which regards colour as the mixture of white and black, and to produce colours, white should be "darkened" or mixed with black (*De*

<sup>11</sup> Koliopoulos I., op. cit., 270.

<sup>12</sup> Apart from Greeks, the like concepts deal with other peoples of ancient civilization. E.g. it is believed Greeks could not distinguish between blue and yellow, while Romans confused blue with green and Egyptians used the blue colour in painting but had no term to refer to it. See also Серов Н. В., *Античный хроматизм*, Санкт-Петербург, "Лисс", 1995, 31-35; Виппер Б. Р., *Искусство Древней Греции*, Москва 1972, 142 ff.

<sup>13</sup> For the interpretation of Goethe's colour theory, see G. Bughadze, *Several Ideas on the Practical Application of Goethe's Colour Theory in Painting, A Few Words on Colours*, in book: *Thoughts About Future*, Kaltha, Tbilisi 1994, 1-6.

<sup>14</sup> Goethe J. W., *Zur Farbenlehre in Die Schriften zur Naturwissenschaft* 6, Vol. 2, Weimar 1957, 36-7; Goethe J. W., *Zur Farbenlehre in Sämtliche Werke*, vol. 22, München 1913, 7-42, 39-42.

*coloribus*, 1-3, 791a-794a15).<sup>15</sup> According to Goethe, colours have the ability to transform and are prone to turn into one another and thus give birth to one another. Goethe is the first thinker to provide proofs to the existence of warm and cold colours.

Goethe refutes Newton's opinion on the nature of light as stated in his *Opticks* (1704). According to certain modern critics, Goethe's ideas are based on "misunderstanding, abuse, and derision" of Newton's theory.<sup>16</sup>

In the consequence of experiments launched in 1666, Newton, firstly, discovered that the spectrum colours may converge back and generate single white light again (earlier experiments revealed the ability of a prism to decompose the white light into spectrum colours) and, secondly, he explained that bodies look coloured under the white light as they reflect some of its spectral components more strongly.

Isaac Newton's observations and his spectral theory were extremely relevant to the scientific interpretation of colour, and the XIX century impressionistic and pointillistic trends are considered its remarkable achievements. However, Goethe refused to share Newton's ideas and confronted them in his book.

The basic difference between Newton's and Goethe's viewpoints is Newton's absolute neglect of the emotional eye of a human. It is based on visual experience and consequently claims scientific objectivity, while Goethe's theory attaches special significance to the colour as created by a human eye. It is the eye that reflects the objective world and enables the sight to perceive it. Ancient Greeks believed the eye was a "kin" to an object, and that was why Plato and Plotinus considered it "born by the sun". Presumably, this very mystical conception inspired Goethe's well-known words:<sup>17</sup>

Wär nicht das Auge sonnenhaft  
Wie Könnten wir das Licht erblicken?  
Lebt nicht in uns des Gottes eine Kraft,  
Wie könnt uns Göttliches entzücken?

So, the eye sees the colour it itself creates and this very personal, subjective perception makes the objective law as all human eyes obey one universal law, have the same common basis.<sup>18</sup>

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<sup>15</sup> For details, see Gottschalk H. B., *The De Coloribus and His Author*, *Hermes* 92, 1964, 59-85.

<sup>16</sup> For the modern appreciation of Goethe's teachings see Irwin E., op. cit., 3-17, Maxwell-Stuart P. G., *Studies in Greek Colour Terminology*, Vol. I, GLAUKOS, Leiden E. J. Brill 1981, 1-6.

<sup>17</sup> Kolipoulos I, op. cit., 267-268.

<sup>18</sup> For details, see Bughadze, G., op. cit., 1-2.

Some scholars believe Goethe's viewpoints, along with Plato's, pseudo-Aristotle's and Plotinus' theories, bear the impact of Dalton,<sup>19</sup> others think he was influenced by alchemists.<sup>20</sup> On his part, Goethe, along with Democritus' teachings inspired Herring's theory on opposing colours as well as other, more modern methodologies.<sup>21</sup>

As concerns John Dalton's theory, in 1794, the English scientist, distinguished for the development of the atomistic theory, presented to the Manchester Literary and Philosophy Society the paper *Extraordinary Facts Relating to the Vision of Colours*. The paper considered the optical properties of the eye presently known as Daltonism, "colour-blindness".<sup>22</sup> According to E. Irwin, it is not accidental that Goethe's ideas on colour perception among Greeks immediately followed Dalton's above-mentioned paper, as the "un-usual properties" of colours in the ancient Greek language can be explained under Daltonian light as the consequence of "deficient" eyesight.<sup>23</sup>

Forty four years after the publication of Goethe's work, W. E. Gladstone, an English scholar, offered his own theory, which is believed to be one of the most convincing, and at the same one of the most unlucky.<sup>24</sup> W. E. Gladstone agrees that the ancient terms for colours are based on the contrast between light and darkness and states that people of the earlier historical periods had much less refined and thus much weaker faculty to perceive colours as compared to a modern man. For instance, in the heroic epoch, the eyesight as the sensory organ was remarkably underdeveloped. W. E. Gladstone refers to Homeric poems to illustrate the statement. He notes that a) the Homeric range of colours is jejune; b) The same word is used to denote not only different tints of the same colour, but also different colours which the modern perception finds essentially dissimilar; c) Colours used as epithets to describe the same object are "fundamentally disagreeing"; d) The most recurrent are simple colours like black and white, meanwhile the rest of colours are regarded as intermediate between "these extremities"; e) Homer seldom resorts to colours as one of the beauty aspects "for the purpose of effect". Colours fail to occur even where obviously expected.<sup>25</sup>

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<sup>19</sup> Irwin E., op. cit., 6.

<sup>20</sup> Koliopoulos I., op. cit., 268.

<sup>21</sup> Gray R. D., *Goethe the Alchemist*, Cambridge 1952, 101-32. Goethe's colour theory is sometimes referred to as Neo-Platonic (e.g. see Koliopoulos I., op. cit., 268).

<sup>22</sup> About Newton's and Dalton's theories, see *Encyclopaedia Britannica*, vol. VI, VII.

<sup>23</sup> Irwin E., op. cit., 5-6.

<sup>24</sup> Maxwell-Stuart P. G., op. cit., 1-6.

<sup>25</sup> Gladstone W. E., *Studies on Homer and the Homeric Age*, Vol. III, Oxford 1858, 458; On colour terms in Homeric epics, see Handschur E., *Die Farb- und Glanzwörter bei Homer und*

According to P. G. Maxwell-Stuart's smart and ironic appreciation, W. E. Gladstone later "reinforced" his conceptions and stated that Homer's eye organ was "in its infancy" while that of a modern man is mature and developed. Correspondingly, a modern 3-year-old-child knows more of colours or distinguishes more colours than the genius like Homer.<sup>26</sup>

W. E. Gladstone was not only well acquainted with and accepted Goethe's theory, but developed the latter's interpretations in his own works.

W. E. Gladstone's theories are based on Daltonism as well as on the scientific data on live bodies that perceive and distinguish between light and darkness only and not between colours, which compels to conclude that ancient Greeks should have been in the same position. W. E. Gladstone's ideas preceded C. Darwin's *On the Origin of Species* (1859). However, they are based on the idea of evolution of species ventured even before Darwin's well-known theory was developed (however, the notion of "the natural selection" belongs to Darwin). After Darwinism developed, the study of ancient Greeks' colour vision took a turn to this "evolutionary" direction as well. Darwinism replaced Daltonism; however, the latter would not yield completely.

In 1867, Alfred Geiger presented at the Frankfurt Assembly of Natural Studies a paper based on Goethe's, Gladstone's and Darwin's theories. The paper considered text evidence and concluded that the ancient Greek language had no words for green and blue, and the terms that later came to denote "blue" initially denoted "black". And above all, ancient Greeks initially perceived only three colours – black, red and golden (yellow).

A. Geiger's concepts were further developed by Hugo Magnus, a physician and altertumswissenschaftler. In Leipzig in 1877, he published a paper *Die geschichtliche Entwicklung des Farbensinnes*, which said that initially a human was able to perceive light and not colour. Then he started to perceive red (but sometimes failed to distinguish between bright colours, "rich in light", e.g. white and red), which was followed by identification of yellow and green. Finally, a human discerned the weakest colours in terms of light – blue and violet. H. Magnus related such a development of colour perception to the evolution of human eye membrane. In 1888, O. Weise also supported A. Geiger's and H. Magnus' theories and studied a particular Indo-European origin for chromatic terms in his work called *Die Farbenbezeichnungen der Indogermanen*.<sup>27</sup>

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*Hesiod, in den homerischen Hymnen und den Fragmenten des epischen Kyklos*, Dissertationen der Universität Wien, Verlag Notring, Wien 1970.

<sup>26</sup> Gladstone W. E., op. cit., 458; Maxwell-Stuart P. G., op. cit., 1, 2.

<sup>27</sup> For details, see Weise O., *Die Farbenbezeichnungen bei den Griechen und Römern*, *Philologus*, 46, 1888, 593-605.

The theory on evolutionary development of eyesight had its opponents as well. In 1879, in *Die Frage nach der geschichtlichen Entwicklung des Farbensinnes* published in Vienna, Anton Marty criticized A. Geiger and G. Magnus for neglecting the method of deduction and refuted their theory alluding to lack of evidence to testify the differences between colour perceptions of wild tribes and civilized peoples. At the same time, A. Marty referred to considerable factual evidence, paintings and decorations to prove that ancient peoples as well "enjoyed" a wide spectre of colours.<sup>28</sup> The unusual use of colours in literature was qualified as peculiar property of poetic vision and language (the idea is nowadays maintained by U. Eco as well<sup>29</sup>), and was justified by the idea that a poet is more concerned with the "brilliance of the tone than colour gradation", while the development of colour terminology was determined by the fact that Ancient Greeks had no need to create and apply technical colours. Modern experts qualify A. Marty's position as weak because of scanty factual evidence and statistic data; however, its relevance is still great. A. Marty threw light on three important aspects of the problem: archaeological (that testifies to Greek people's faculty to discern a broad spectre of colours), technological (reminds of the fact that Greeks had no need for technical colour terminology) and literary (usage of colours in literary texts is motivated by a writer's personal desire and vision). And, finally, A. Marty made it clear that physiological aspects are not the sole motivations to consider while studying perception of colours in antiquity.<sup>30</sup>

The same year of 1879, Grant Allen, a specialist of comparative psychology, published in Boston a paper *The Colour-Sense: its Origin and Development*, where he criticized Geiger-Magnus theory and alleged that the latter considered evolution as a short-term process, i.e. according to their theories, the evolution developed at a high speed, which is not testified by factual evidence. G. Allen compiled a questionnaire for missionaries, government officials and the people who have to deal with "less civilized race". They were to answer several questions including "Do the representatives of the given language group distinguish between x (blue) and y (green, violet)? The questionnaire revealed no case of failure on the part of the "less civilized people" to distinguish the colours; however, every tribe had not their own terms to denote them.

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<sup>28</sup> N. Serov, a modern researcher of ancient chromatism, refers to archaeological data to illustrate the rich colour perception of ancient Greeks (Серов Н. Б., op. cit., 31-32).

<sup>29</sup> Eco U., *Empeirie- metafrash-, Legonta- scedon to idio*, *Metafrashò Efh Kallifatidh*, *El IhnikaGrammata*, Aqhma 2003, 471-472.

<sup>30</sup> For the appreciation of A. Marty's theory, see Irwin E., op. cit., 7-8.

At the outset of the XX century, the theory of anomalous colour perception again enjoyed followers. In 1904, W. Schultz published *Das Farbenempfindungssystem der Hellenen*, which studied chromatic terminology according to colour theorists and lexicographers and attempted to detect the precise colour gradation expressed by each lexical unit (it should be noted, however, that his interpretation of colour terms are nowadays considered out-of-date and useless). W. Schultz considered as well the viewpoint popular in the ancient period on the genesis of the rainbow, theories by Plato and Democritus, Phidias' statue of Zeus in Olympia and so on. At the same time he severely criticized Democritus' ideas on the components of blue and green. According to W. Schultz, Greeks could not discern yellow and blue, could not distinguish between *prasino-* and *porfuro-*, had vague ideas about red and *κλωρο-*.<sup>31</sup> After analyzing ancient Greek terms and theories, the German scholar appreciated Greek's eyesight as anomalous.

In 1921, an article by Morris Platnauer was published on ancient Greeks' colour perception. The impact of the article on scholars and intellectuals was so great that it is still cited. According to M. Platnauer, the ancient Greek colour terminology is obviously jejune as compared to the modern one, which can be explained two ways: on one hand, M. Platnauer refers to the version of Greek colour-blindness slightly mitigating it by the assumption that Greek people's eyesight was not defective; they simply were less subjected to the colour impact than a modern man. The author is more inclined to think that Greeks were less interested and therefore paid less attention to the qualitative difference between decomposed and absorbed lights. They were more concerned with the quantitative than with the qualitative differences between colours; black and white were considered colours while all the rest was regarded as shades. There was no actual difference between chromatic and achromatic, what they found relevant was the body surface and its brightness and not the aspects of its colouring.<sup>32</sup>

M. Platnauer himself called his theory a tenable hypothesis, i.e. admitted its hypothetical nature as well as the power of its supporting arguments.<sup>33</sup>

P. G. Maxwell-Stuart offered strong arguments against the theory of Greek daltonism. He found it unusual to imagine the entire nation inflicted with daltonism; besides, he believed discussions on the point should not be limited to Homeric terminology, and correspondingly, the conclusion should not be extended to millenniums.<sup>34</sup>

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<sup>31</sup> Schultz W., op. cit.

<sup>32</sup> Platnauer M., *Greek Colour-Perception, Classical Quarterly*, 15, 1921, 162.

<sup>33</sup> For more details, see Platnauer M., op. cit., 153-162.

<sup>34</sup> Maxwell-Stuart P. G., op. cit., vol. 1, 3.



Neither U. Eco shares the version of Greek daltonism and has published several works on colour perception in antiquity and in modern period. According to the Italian scholar, the very phenomenon of daltonism is a social enigma which proves hard to localize and explain because of language problems.<sup>35</sup> There is one point to consider: those who suffer daltonism perceive colours in a different way, but link the results of their perception to the common language system. For instance, such people do not see a leaf as green but call green the colour they see<sup>36</sup> (i.e. we see different colours but call them the same conventional name).

In 1927, F. E. Wallace's dissertation *Colour in Homer and in Ancient Art* was published. The author attempted to study the chromatic terms in Homeric texts, detect their gradation as far as possible and compare them to the pieces of ancient art at his disposal.

In 1933, Alice Kober's dissertation *The Use of Color Terms in the Greek Poets, Including all the Poets from Homer to 146 B. C. except the Epigrammatists* was published. Like F. E. Wallace, A. E. Kober also attempted to determine the precise colour gradation as represented in chromatic terms in order to provide for her conception on the lack of "problem" regarding colour perception in Antiquity.<sup>37</sup> According to modern scholars, the weak point of the work is the lack of evidence to be obtained after consideration of word-forms and their transformations in the course of centuries.

In 1939, K. Jonas presented a research supporting M. Platnauer's conception. According to him, Greeks were at least partly afflicted with colour-blindness – especially as concerns the blue colour – and saw their own painting the way different from ours.<sup>38</sup>

In 1920s-30s, along with colour-related terminological and stylistic issues, other problems entered the scope of scholars' interest as well. E.g. In 1927, K. Meyer published in Freiburg a work called *Die Bedeutung der weissen Farbe im Kultus der Griechen und Römer*, and in 1936, Gerhard Radke's dissertation *Die Bedeutung der weissen und der schwarzen Farbe in Kult und Brauch der Griechen und Römer* appeared in Jena which dealt with the religious dimension of colour and referred to a large amount of material.<sup>39</sup>

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<sup>35</sup> Eco U., op. cit., 472-473.

<sup>36</sup> Linksz A., *Physiology of the Eye*, Grune & Stratton, New York 1952, 2, 52.

<sup>37</sup> Also see Kober A. E., *Some Remarks on Color in Greek Poetry*, *The Classical Weekly*, April 30, 1934, 189-191.

<sup>38</sup> Jonas K., *South African Architectural Review*, November, 1939.

<sup>39</sup> For more details, see Radke G., *Die Bedeutung der weissen und der schwarzen Farbe in Kult und Brauch der Griechen und Römer*, Universitäts-Buchdruckerei Gustav Neuenhahn, Jena 1936. In terms of methodology, J. André's *Etude sur les termes de couleur dans la langue latine* published in Paris is regarded as a model for corresponding studies. In the introduction to

In 1952, R. A. Cole, in his unpublished dissertation *Adjectives of Light and Colour in Greek Lyric Poetry from Alkman to Bacchylides* attempted to present various dimensions of colour i.e. chromatic gradation in Homeric and Hesiod's texts, in cyclic poems, in pre-Pindaric lyrics, Pindar poems, in Aeschylus and Bacchylides. R. A. Cole, like A. E. Kober, ignored the senses of the chromatic term that do not refer to colours.<sup>40</sup>

The discussion revived in 1958, when R. D'Avino published an article *La visione del colore nella terminologia greca*, in which the scholar studied the terms ἀργός, πορφύρεο-, πολιο-, χανθός, κίωρος with regard to their etymological aspects.

In 1959, Jürgen Werner's article *Blauer Himmel bei Homer?* was published which is considered among reputable works in this sphere. The German researcher compiled his contemporary conceptions and through their analysis rejected the viewpoint on the reference of Homeric epithets σιδήρεο- and κάλιο- to blue colour.<sup>41</sup>

In 1962, Gerhard Reiter's work *Die Griechischen Bezeichnungen der Farben Weiss, Grau und Braun* was published in Innsbruck in which the author, unlike A. E. Kober, F. E. Wallace and R. A. Cole, considered both prosaic and poetical texts and even analyzed certain post-classical terms. Remarkably, G. Reiter believes the terms μάλο-, ἀλφο-, ἐλεφαντινο-, ἀψυδῆ-, γοιοειδῆ- also refer to the white colour. As compared to his predecessors, the German researcher paid more attention to the critical analysis of the problem while the development of colour concepts escaped his thorough consideration.<sup>42</sup> G. Reiter also wrote an article on colour composites, one of the most important linguistic components of ancient Greek chromatisms.<sup>43</sup>

the research, the French scholar briefly considers the problem of Greek colour perception and terminology. J. André presents classification of Latin colour terms (groups them into "families"), offers a lexicological and stylistic investigation in which he dwells on colour symbols, poetic and prosaic styles, considers imitation of earlier passages by later authors and pays special attention to authors whom he considers "distinguished" by their usage of colours.

<sup>40</sup> Horst Farenholtz' dissertation *Farbe, Licht und Dunkelheit im älteren griechischen Epos* defended in Hamburg in 1985 deals with the contrast between dark and light. The same topic is considered in G. E. R. Lloyd's *Polarity and Analogy: Two Types of Argumentation in Early Greek Thought* published in Cambridge in 1966.

<sup>41</sup> For more details, see: Werner J., *Blauer Himmel bei Homer? Forschungen und Fortschritte*, 33, Heft 10, 1959, 311-316.

<sup>42</sup> For more details, see Reiter G., *Die Griechischen Bezeichnungen der Farben Weiss, Grau und Braun, Eine Bedeutungsuntersuchung*, Universitätsverlag Wagner, Innsbruck 1962.

<sup>43</sup> For more details, see Reiter G., *Zu den griechischen Farbnamenkomposita*, in: *Innsbrucker Beiträge zur Kulturwissenschaft*, Bande 7-8, Innsbruck 1961, 241-246.

In 1968, H. Osborne published an article *Colour Concepts of the Ancient Greeks*, which says that Greeks did not paid due attention to colour gradations but for the violet-purple group. Colour vocabulary was scanty, terms were often used as synonyms and differed from one another not in terms of colour gradation but according to their brightness and intensity.<sup>44</sup>

As concerns later interpretations of the ancient Greek colour perceptions, they are chiefly based on various versions ventured between XVIII and 1960s, and offer few conceptual novelties. Special attention should be paid to Eleanor Irwin's work *Colour Terms in the Greek Poetry* (1974), where, along with quite a detailed overview of the problem, the researcher offers some interesting ideas on the contrast of light and darkness, about *κλωρο-* and *κωανο-*.<sup>45</sup> Another remarkable work is P. G. Maxwell-Stuart's terminological studies (1981)<sup>46</sup> and a research pertaining to the fields of terminological and cultural studies by Italian scholars Lia Luzzatto and Renata Pompas *Il Significato dei colori nelle civiltà antiche (Colour Sense in the Ancient Civilizations)* (1988), which deals with the magical implication of colour as well.<sup>47</sup>

With respect to the profundity of investigation and remarkable degree of novelty, particular attention should be paid to a research called *Individuality of Colour* by Elisabeth Koch and Gerard Wagner as well as two works by N. S. Serov, a Russian scholar, one of the founders of Russian "Colour Institute": *The Chromatism of Myth* (1990) and *Ancient Chromatism* (1995), which represent the synthesis of a research and mystical weltanschauung.<sup>48</sup>

What is to be said as a conclusion to the colour perception in ancient Greece? In my opinion, the theory on ancient Greeks' color-blindness was successfully and quite convincingly rejected by P. G. Maxwell-Stuart and U. Eco.<sup>49</sup> As concerns Darwinism-based theory on the evolution of eyesight, my skepticism is fostered by architectural pieces, ceramics and paintings (in particular, mural paintings) found on the Greek territory and pertaining to pre-Greek and Greek periods, the rich colouring of which testify to ancient Greeks' application of a wide range of colours in art; however, the issue can be qualified as highly specific, belonging to the field of cultural studies and therefore I would restrain from any categorical statements, more so that the problem has not yet enjoyed ultimate solution. As commonly known, modern

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<sup>44</sup> For more details, see Osborne H., *Colour Concepts of the Ancient Greeks*, *The British Journal of Aesthetics*, 8, 1968, 269-283.

<sup>45</sup> For more details, see Irwin E., op. cit.

<sup>46</sup> For more details, see Maxwell-Stuart P. G., op. cit., 1-2.

<sup>47</sup> For more details, see Luzzatto L., Pompas R., *Il significato dei colori nelle civiltà antiche*, Rusconi Libri S. p. A., Milano 1988.

<sup>48</sup> For more details, see Cepov H. C., op. cit.

<sup>49</sup> see above.

digital technology enables reconstruction and study of the painted layers of architectural finds which were earlier considered useless for scientific research and gave no opportunity to make relevant conclusions (it is planned to use the digital technology to reconstruct the whole sculptural array of Parthenon with appropriate colouring. The project is designed to produce the virtual analogy of the initial appearance of Parthenon).

Although, to my belief, Daltonian and Darwinian theories on colour perception in ancient Greece do not look sufficiently convincing, the ancient Greek world of colours obviously poses a number of questions. How can Democritus' and Plato's ideas on colour derivation contribute to the study of ancient Greek chromatism? To what degree do the two great thinkers' views reflect reality (or our reality)?

Plato's philosophical heritage covers the whole world, every sphere of human life. The wide range of Plato's concepts includes colour theory as well, which represent a system of colour perception and understanding and is theoretically expressed chiefly in *Timaeus*.

As stated above, Plato's colours theory is based on common ancient greek perception, in particular, is fostered by Democritus' ideas and the widely-known treatise *On Colours* (Diels, 68A33; A135).<sup>50</sup>

In *Timaeus*, Plato first dwells on vision mechanism (67d-68b) and then on mixing different colours to obtain a new one (68b-d). According to B. Bregvadze, a Georgian translator and researcher, "one of the most original theories in the history of ancient studies – the Plato's colour theory is directly related to Plato's understanding of vision mechanism. The theory, like a focus, incorporates such a big number of key issues of ancient optics that a small note is absolutely unable to render them even in a rather general and sketchy way".<sup>51</sup>

The paper will not dwell on the colour theory as presented in *Timaeus* and the vision mechanism analysis, or its critical appreciation; I shall consider only the passages that imply the concepts similar to Democritus' treatise.

According to *Timaeus*, "... colours ... are a flame which emanates from every sort of body, and has particles corresponding to the sense of sight" (67c-d). This conception is similar to Democritus' atomistic theory. A. Losev writes: "According to Democritus' treatise, the colour is a physically tangible body with appropriate peculiarities, which at the same time consists of physi-

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<sup>50</sup> Democritus' disciple Theophrastus gives a detailed account and at the same time criticizes Democritus' teaching on colours. Democritus' concepts are criticized by modern researchers as well. However, as the problem is quite comprehensive, I will not dwell on the logical shortcomings of the doctrine and Democritus' wrong interpretation of colour (for more details on the issue, see Лосев А. Ф., op. cit., 481-496).

<sup>51</sup> Plato, *Timaeus*, translated from ancient Greek, introduced and commented by Bachana Bregvadze, Irmisa, Tbilisi 1994, 444.

cally tangible atoms. Democritus' method of identifying colours with physical bodies creates the picture of co-existence and interaction of the physically tangible atoms".<sup>52</sup>

Democritus distinguishes four elements, simple colours – white, black, red and greenish-yellow (green) (κλωρο),<sup>53</sup> and regards the rest of the colours as different combinations of the four elements. The identical principle of colour derivation is given in Plato's *Timaeus*.

According to *Timaeus*, "A bright hue mingled with red and white gives the colour called golden-yellow (ξανθο-) (68b), while according to Democritus, "golden (κρυσοειδης) is derived from white and red" (76). According to Plato "red, when mingled with black and white, becomes purple (αλουργου-), when the colours are burnt as well as mingled and the black is more thoroughly mixed with them" (68c). Democritus mentions the same colours to compose purple (πορφου-), but the portions are different – red prevails while black is less in quantity (77).

Both *Timaeus* and Democritus' Treatise formulate and illustrate the common principle for colour derivation. According to Plato, "There will be no difficulty in seeing how and what mixtures the colours derived from these are made according to the rules of probability" (68d), while Democritus, as Theophrastus has it, "[states] that according to the way we mix them, there exists a large number of colours; if we make one less and add more of the other, mix more of one and less of the other. [In these circumstances] neither colour is going to resemble the other" (78).

Although Democritus' and Plato's ideas coincide as concerns the derivation of golden / golden-yellow and purple, *Timaeus* is by no means an exact copy of Democritus' Treatise. For instance, Plato considers the following colours: gray (φαιο-) (white + black), flame-colour (πυρρο-) (golden-yellow + gray), ochre (ωχρο-) (white + golden-yellow), blackish-blue (white + black) and greenish-blue (white + blackish-blue) and green (πρασιο-) (flame-colour + black).

Out of these colours, Democritus mentions only blackish-blue and green (πρασιο-). However, the process of their composition differs from the one described by Plato. Here blackish-blue is derived from blue and the flame-colour, while green (πρασιο-) is composed of greenish-yellow and purple, or the mixture of the purple close to orange and blue.

<sup>52</sup> Лосев А. Ф., op. cit., 488.

<sup>53</sup> Sometimes the term used by Democritus (κλωρο) is translated as green, which I find unacceptable (e.g. cf.: Koliopoulos I., op. cit., 268).

Plato says nothing about the properties of the so-called elemental, simple colours, and the composition of blue (ijsæt i-) (dark black + greenish-yellow) and brown (karuino-) (greenish-yellow + blackish-blue).

So, Democritus' and Plato's ideas are not absolutely identical. Plato shares and repeats after Democritus' colour-derivation principles but presents different colours, their different combinations and ratios.

In *Timaeus*, Plato does not consider colour properties which imply objectified perception of colours on the basis of consistent observance of the atomic principle as presented in Democritus' Treatise. The objectified perception of colours, to my belief, is given in *Phaedo*.<sup>54</sup>

I ventured to find out, firstly, whether Democritus' and Plato's ideas on colour derivation correspond to the real picture, and secondly, whether their concepts can help to clarify the senses implied in ancient Greek colour vocabulary. Both, Plato and Democritus present descriptions and compositions of colours, which, presumably, should help to identifying the precise sense of the terms they are expressed through.

I asked Mr. Gia Bughadze, a distinguished painter and theorist, one of the interpreters of Goethe's colour theory, to put in practice Democritus' and

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<sup>54</sup> On the objectified perception of colours in *Phaedo* see Darchia I., *Plato's Phaedo (Literature, Philosophy, Mythology, Mysticism)*, Program Logos, Tbilisi 1998, 44-47.

Investigation of Plato's *Timaeus* and *Phaedo* and their comparative analysis leads to the following conclusions:

1. The dialogues consider different colour aspects: *Timaeus* has the mechanisms for colour composition while *Phaedo* presents objectified perception of colours, which once again implies that Plato's viewpoint on a certain question is not offered in a single dialogue but should be looked for in several texts, i.e. reconstruction of Plato's theories requires consideration of Plato's complete corpus.
2. Peculiarities of colour perception in *Phaedo* are impossible to understand without considering Democritus' ideas while the reference of the mentioned dialogue to Democritus' treatise becomes more conspicuous and convincing after tracing direct links between *Timaeus* and Democritus.
3. The common colour concept in *Timaeus* and *Phaedo* is expressed not only through various aspects but through various devices as well in accordance with the specific character and philosophical and artistic intentions of the dialogues. *Timaeus* presents theoretical considerations of different aspects of Plato's theory while *Phaedo* renders colour theory through its artistic aspect. It offers no discussions on the colour theory; it only illustrates what to my belief, can be qualified as unconscious expression of Plato's viewpoint. In *Timaeus*, the concept is stated by a philosopher, theorist, scholar, while the chapter on colors in *Phaedo* is narrated by a writer, artist, or even a painter, as the passages in *Phaedo* are rendered in such a picturesque way that raise before the reader visual images. In *Timaeus*, Plato explains, comments, considers, while in *Phaedo* he depicts, shows, makes us feel.
4. Comparative analysis of *Timaeus* and *Phaedo* with regard to colour understanding once again attests that while rendering his colour theory, Plato appears not only as a great thinker but also as a faultless writer and even an artist. Plato as a philosopher, a theorist, a writer and an artist is an integral phenomenon.

Plato's "recipes". The chromatic experiment exceeded all my expectations. The results are given as a chart to facilitate their presentation:

Democritus' viewpoint		
Colour combinations	Theoretical result	Actual result
white + red	golden	pink
white + black + red	purple	brown
black + greenish-yellow	blue	brownish-green
greenish-yellow + purple	green	light brown
blue + flame-colour	blackish-blue (dark blue)	brown
greenish-yellow + blackish-blue (dark blue)	brown	dark green

Plato's viewpoints		
Colour combinations	Theoretical result	Actual result
white + red	golden-yellow	pink
white + black + red	purple	brown
white + black	gray	gray
golden-yellow + gray	flame-colour	ochre
white + golden-yellow	ochre	light orange
white + dark black	blackish-blue (dark blue)	dark grey
white + blackish-blue	greenish-light blue	light gray
flame-colour + black	green	brownish-green

As shown above, with the exception of deriving gray after mixing white with black, Plato and Democritus regarded the process of colour derivation or rather the colour concept the way to be qualified as wrong from the modern point of view – at least the way absolutely different from ours. Along with the above stated physiological motivations, some other reasons should be considered.

According to specialists, the "strange" results of our experiment should not be explained by differences in compositions of paints in ancient and modern eras. Corresponding studies reveal that colour essence depends neither on the quality of the paint nor its composition. Paints of different quality and composition give different tints and nuances, but not diametrically different colours.

Researchers of ancient Greek chromatic theories explain the problem through terminological points as well. Nowadays, it is widely admitted that ancient Greeks had regular eyesight but "their terminology was wrong".<sup>55</sup> Correspondingly, the results of our experiments unusual as they are from the viewpoint of Democritus and Plato should be explained by terminological misunderstanding, i.e. we erroneously attach the ancient Greek terms the meaning they never had. E.g. I expect white and red to give golden-yellow as I believe it is what the term χανθοῦ implies.<sup>56</sup> Let us suppose it does not refer to golden-yellow as I thought it was, but to pink – as shown by the experiment; then it will appear that ancient Greeks perceived olives, cattle, human hair as pink, and in fact, the term is quite often used as an epithet to the words. So, approach to ancient Greek colour terminology requires a lot of caution.

In my opinion, while considering colour perception in ancient Greece, the peculiarities of the Greek Weltanschauung should also be taken into account and try to explain their "strange, unusual" perception of colours by their world perception that differs from ours. It also may not be accidental that Plato's and Democritus' "recipes" produce quite a limited range of colours, chiefly, different shades of brown, the colours of earth.

And finally, it should be admitted that as colour is a cultural notion, along with being a physical and chemical, physiological and linguistic phenomenon, its investigation requires diversified approach. While considering colour, we should take into account literary and ethnographical, architectural, plastic and artistic data, religious, mythological and ritual aspects, various symbols and even magic, the emotional and intellectual worlds of people, their psychology, age and even gender.<sup>57</sup>

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<sup>55</sup> Irwin E., op.cit., 14.

<sup>56</sup> The term χανθοῦ causes a great deal of confusion as it was translated or, correspondingly, interpreted; as a matter of fact, it may refer to golden-yellow, the colour of fire, blond, reddish, golden, hazel-brown and straw-colour (Liddel H. G., Skott R., Jones H. St., McKenzie R., A Greek-English Lexicon, Oxford 1940; Supplement by Barber E. A., Oxford 1968; Revised supplement by Glare P. G. W., Thompson A. A., 1996).

<sup>57</sup> Colour can acquire peculiar function even in medicine, i.e. chromatic therapy, a modern medical treatment aims at healing various diseases with the help of colours. It originated in ancient Egypt, India, China and Persia (for more details, see Amber R. B., *Crimatoqerapeia, Qerapeia me crumata*, Metafrasho Andrea- Lumperopoulou-, Kedro-, Aqhna, 1997). E.g. according to R. B. Amber, chromatic therapy treats up to 230 diseases (see the list in Amber R. B., op. cit., 284-307). By the way, chromatic therapy uses red colour to treat measles, similarly to the Georgian folk tradition (Amber R. B., op. cit., 294).