



Color Realism: True or Not?

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The sole author designed, analyzed and interpreted and prepared the manuscript.

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Commentary

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ABSTRACT

Color realism refers to that things are colored, or colors are real. Although the view goes in a minority opinion, Byrne & Hilbert defend it based on the physical properties of color and the peculiarly assumed hue-magnitudes. However, hues are mind-dependent and cannot be used as a measure of the physical properties of things. As a result, the defense fails to justify the proposition of color realism.

Keywords: Color; realism; hue.

1. INTRODUCTION

In their work entitled "Color Realism and Color Science," Byrne & Hilbert defend the view of color realism. [1] This essay contends that the defense is invalid. The argument goes as follows:

Section 2 introduces a central debate on the validity of the color realism; Section 3 summarizes Byrne & Hilbert's argument of the Reflectance Physicalism; Section 4 analyzes the congenital deficiency of the argument; and, Section 5 gives a conclusion.

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2. CENTRAL DEBATE

Color realism refers to that things are colored, [2] or colors are real. [3] It claims that physical objects are colored, and that colors are physical properties. [4] At least since the 17th century, the validity of color realism has remained a central debate over such a primary issue: whether colors are real (objective or mind-independent), or, they are merely illusory (subjective or mind-dependent), or, something else. [5]

Until now, the problem has increasingly triggered vigorous disputes, and becomes the subject of a renewed burst of attention. [6] A bundle of propositions has hitherto been formed, including, but not limited to: (1) Realism or Objectivism or Materialism; [7] (2) Dispositionalism or Subjectivism; [8] (3) Projectivism; [9] (4) Eliminativism or Irrealism or Fictionalism or Illusionism; [10] (5) The Ecological View; [11] (6) Relationalism; [12] as well as additional digressions like, Independent Ambiguism [13] and those on naturalistic theories of content. [14]

3. BYRNE & HILBERT'S ARGUMENT

Among these theories, color realism goes in a minority opinion at least among color scientists. [15] Albeit the fact it is, Byrne & Hilbert expressed their dissent against popular color theories on their color-realist ground. They proposed a so-called Reflectance Physicalism, i.e., colors are the surface spectral reflectance of light, i.e., the proportion of incident light the object is disposed to reflect at each wavelength in the visible spectrum. [16] The theory is established based on the three assumptions as follows: [17]

- (1) Objects are featured by color-constancy and illumination-independence, and human visual systems are able to recover from the responses of the three kinds of cone photoreceptors;
- (2) Colors of objects are caused by the light of illuminants which reaches eyes and stimulates the three kinds of visual cone photoreceptors, after reflected by the objects; and,
- (3) Visual experience represents objects as having proportions of hue-magnitudes—when things look to have certain amounts of hue-magnitudes, they look determinate colors; different determinate hues determine different colors. Here, hue is a certain attribute of visual sensation, [18]

including four unique types: red, yellow, green, and blue, [19] while a hue-magnitude is the proportionality of one hue among a sum of hues possessed by an object. [20]

While the first assumption solidifies conditions of any plausible version of physicalism to identify colors in the causal process that underlies the color perception, the second one describes the importance of the spectral reflectance of light in the illuminant-object-stimulus chain where colors are perceived as a property of the object; by contrast, the last one offers an innovative ingredient which characterizes the theory as the most elaborated version of color realism.

The paradigm of Reflectance Physicalism is used as a distinctive philosophical tool to defend color realism. It is also used to counteract common objections by clarifying various positions and central arguments. The theory has been considered as the only theory which does not “have serious difficulties” or is not “unmotivated;” thus, it “can be smoothly integrated with much empirical work”. [21]

On the one side, the theory stresses the physical properties of color resultant from the surface spectral reflectance of light: (1) Colors are identical with types of surface reflectance and each color is a type of reflectance; [22] (2) Two types of reflectance are of the same type if and only if the both have the same relative amounts of 3-cone visual lights at short (S), medium (M), and long (L) wavelengths; [23] (3) Things look the same (different) in color when they are of the same (different) reflectance type with the same (different) amount of S, M, and L lights in the stimulation of our visual 3-cones in the same way (different ways). [24]

On the other side, in view of the peculiarly assumed hue-magnitudes, the theory holds that (1) Things look to have different amounts of hues, and objects seen as colored are represented as having proportions of hue-magnitudes; [25] (2) Although something with an amount of hue is not perfectly alike in color, there is something in common between hue and color: things look determinate colors because they look to have certain amounts of hue magnitudes; [26] (3) A group of four hue-magnitudes (R: reddish; G: greenish; B: bluish; Y: yellowish) are necessary for an object to possess certain values of the hue-magnitudes; [27] (4) The hue-magnitudes are themselves physical: a hue is unique just in

case it has only one hue magnitude, while it is binary if it has some amount of multiple hue magnitudes; [28] (5) The four hue-magnitudes, R, G, B, and Y, could be derived from the cone outputs in stimuli in terms of the relative S, M, and L responses: R is reached if $M < L$ for (M-L); G is reached if $M > L$ for (M-L); B is reached if $S > (M+L)$ for $[S-(M+L)]$; and Y is reached if $S < (M+L)$ for $[S-(M+L)]$. [29]

4. DEFICIENCY OF THE ARGUMENT

Byrne & Hilbert's argument is based on updating the mind-dependent perceptions in the causal process. The new vision leads to the commonly accepted color vision relevant to the mentioned three visual cones, along with the mind-independent proportions of the hue-magnitudes acquired through gerrymandering the 3-cone lights coming from object's surface spectral reflectance of some illuminant. [30]

The theory appears to be so coherent and convincing to render the non-physical process of "color perception" into a physical regime of "hue-magnitudes" to defend color realism against all the objections. These opposite views may prove fatal, as recorded in a recent literature (see details in Open Peer Commentary: pp.22-51, and Authors' Response: pp.52-59, in Ref.1). Regardless of these objections, we admire Byrne & Hilbert's extraordinary endeavor to push forward the minority "color realism" opinion to the climax, especially their courage to suggest that "colors of visual experience are in fact reflectance of objects as having proportions of mind-independent hue-magnitudes." [31]

Nevertheless, there exists a congenital deficiency in their argument to provide a valid response to such a basic question: can the supposed "mind-independent" hues be used as a measure of the physical properties of things? Let's start from the essence of Byrne & Hilbert's theory. It rests on the *employment of the reflectance-related hues to represent the physical feature of objects* beyond those mind-independent physical ones in the scientific field, such as, mass, charge, spin, charm, etc.

To make the target attainable, the theory takes it for granted that hues are determined by the power distributions of the surface spectral reflectance of light. [32] Surprisingly enough, as presented in point (4) above, the authors estimate the four hue-magnitudes with respect to the mind-dependent relative responses of the three kinds of cone photoreceptors in human

visual systems, unaware of the fact that the visual cones are assumed to recover the proportion of incident light that the object is disposed to reflect at all respective wavelengths in the visible spectrum. [33] Naturally, the paradigm leads to the following premise-conclusion reasoning:

Premise 1: Physical properties of things (like mass, charge, spin, charm) are mind-independent.

Premise 2: Hue-magnitudes are obtained by evaluating the mind-dependent relative responses of the 3-kind cone photoreceptors in human visual systems to the spectral reflectance of light.

Conclusion: Hues are not mind-independent and cannot be used as a measure of the physical properties of things.

Clearly, the *conclusion* is contrary to Byrne & Hilbert's *employment of the reflectance-related hues to represent the physical feature of objects*. This indicates that their argument has a serious inborn problem about the preliminary "hue" recognition, a concept which is unable to be resolved within the scope of the authors' elaborated paradigm.

Therefore, instead of becoming an expected compelling version of color realism to effectively identify colors with observer-independent features of the world, Byrne & Hilbert's theory fails, at the least, to defend color realism against other objections. On the contrary, it invalidates further the proposition of color realism due to the presence of the mind-dependent hue conception in their argument.

It deserves to mention that even the authors themselves admit the existence of this mind-dependent feature in their model, though implicitly: *The reflectance-types that we identify with the colors will be quite uninteresting from the point of view of physics or any other branch of science unconcerned with the reactions of human perceivers.* [34]

5. CONCLUSION

Byrne & Hilbert's theory of reflectance physicalism is supposed to defend the color realism. However, the use of the mind-dependent hue-magnitude makes it hard to justify their argument that colors are certain sorts of physical

properties. The theory draws no appeal to the proposition of color realism.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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4. Ref.1.
5. (1) Byrne A, Hilbert DR. Color vision, philosophical issues about. In: *Encyclopedia of cognitive science*. Ed., L. Nagel. London: Macmillan Reference Ltd. 2002;173:1-11. (2) Chirimuuta M. *Outside color: Perceptual science and the puzzle of color in philosophy*. Cambridge: MIT Press. 2015;1-18.
6. E.g., (1) Maund B. *Color*. Stanford Encyclopedia of Philosophy; 2012. (Retrieved on 19 June 2016) Available:<http://plato.stanford.edu/entries/color/#TwoForObjAboCol>
(2) Johnson K, Wright W. Colors as properties of the spectral sciences. *Erkenntnis*. 2006;64:139-168. (3) Hockey T. *Cosmology and the demise of color realism: Supplement to the 2nd meeting on cultural astronomy*. Aracne, Roma; 2011. ISBN: 978-88-548-4025-6
7. The proposition holds that colors are mind-independent, intrinsic properties of physical bodies; they are physical features or supervene on physical features. It takes two different forms: (1) Primitivism or response-independent realism (Hardin's objectivism): Colors are non-physical primitive, irreducible properties; (2) Reductive Physicalism or response-dependent realism (Hardin's subjectivism): Colors are hidden properties that dispose bodies to look colored. See: (1) ref.1: Byrne A, Hilbert DR; 2003. (2) ref.2: Kerr AS; 2016. (3) ref.6(1): Maund B. 2012. Note that (1) in ref.1, Byrne & Hilbert listed Primitivism and Physicalism (i.e., colors are physical properties of some kind) as two separate propositions; (2) in ref. 6 (1), Maund listed Primitivism and Reductive Physicalism as two separate propositions.
8. The proposition holds that color is a mind (perceiver)-dependent, dispositional property related to subjective experiences. See: (1) ref.1: Byrne A, Hilbert DR; 2003. (2) ref.6(1): Maund B. Note that in ref.6(1), Maund listed Dispositionalism and Subjectivism as two separate propositions; 2012.
9. The proposition holds that color is a subjective quality of visual experiences "projected" onto physical objects and light-sources. See: ref.6(1): Maund B; 2012.
10. This is a group of views sharing the proposition that "there are no colors in the external world." See: (1) ref.6(1): Maund B; 2012. (2) ref.1: Byrne A, Hilbert DR; 2003. (3) Zangwill N. n.d. *Metaphysics: Guide*. (Retrieved on 21 June 2016) Available:<https://www.hull.ac.uk/php/465848/HOMEPAGE/2kmetaphysics.html>
Note that, although this group is the type of Subjectivism, it stresses there is nothing that is color in the world, while Subjectivism admits the existence of color experiences. See: Marguc K. *Colors: From dispositionalism to subjectivism*. Master thesis, Supervisor: Griffin M.V., Central European University, Hungary. 2010;6.
11. The proposition holds that animal and environment are not "fundamentally separate systems," thus, properties of the environment are partly "composed" by visual observation. See: (1) ref.1: Byrne A, Hilbert DR; 2003. (2) ref.10: Marguc K. 2010;8.
12. The proposition holds that "colors are constituted in terms of relations between objects, perceivers, and viewing conditions." See: Pucko K. *Color relationalism vs. color dispositionalism*. Master thesis, Supervisor: Ben-Yami H., Central European University, Hungary. 2013;2. Note that, while color

- dispositionalism posits “too great an evidential gap between sensation and color,” color relationalism reduces “this evidential gap to almost nothing.” See: Pucko K. 2013;29.
13. The proposition holds that the concept of color is “ambiguous between the subjective and objective concepts.” See: ref.10: Zangwill N. n.d.
 14. See: Section 2.6 in ref.1: Byrne A, Hilbert DR; 2003.
 15. Ref.1. p.3.
 16. Ibid., p.9.
 17. (1) Ibid., Section 3.1; (2) Jakab Z. n.d. Reflectance physicalism about color: the story continues. Budapest University of Technology and Economics. (Retrieved on 21 June 2016)
 18. Ref.1: pp.5-6.
 19. Ibid., p.13.
 20. Ibid., p.14.
 21. Ibid., p.3, p.19.
 22. (1) Kerr AS. Lecture 16: In defense of color realism. In: PHILOS 3P: The Nature of Mind. UC Berkeley, 209 Dwinelle, 21 June; 2016. (2) ref.1. Section 3.2.
 23. Ibid.
 24. Ref.18(1); Kerr AS; 2016.
 25. Ref.1: (1) Section 3.2.1; (2) Author's response: R2.3. Hue magnitudes; (3) Ref.18(1).
 26. Ref.18(1); Kerr AS; 2016.
 27. (1) Ref.18(1); Kerr AS; 2016. (2) Ref.1: Section 3.2.1.
 28. Ref.18(1); Kerr AS; 2016.
 29. (1) Ref.18(1): Kerr AS; 2016. (2) Ref.1: Section 3.2.2. (3) Kerr AS. Lecture 17: Color primitivism (the “simple view” of color). In: PHILOS 3P: The Nature of Mind. UC Berkeley, 209 Dwinelle, 22 June; 2016. Note that (1) and (2) use different nomenclatures: (1) reddish, greenish, bluish, and yellowish; (2) red response, green response, blue response, and yellow response.
 30. (1) Ref.18(1): Kerr AS; 2016. (2) Ref.1: Section 3.2.
 31. Ref.1: (1) Section 3.1; (2) Section 3.2.1.
 32. See: Hardin C. L.: Byrne and Hilbert's Chromatic Ether. In: Ref.1, p.32.
 33. Ref.1: Section 3.1.
 34. Ibid., Section 3.1.1.

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