

# Bio-Physics Concept for Camera Vision Hypothesis of Colour White

Shahrudin Zakaria<sup>1</sup>, Syed Najib Syed Salim<sup>2</sup>, Mohd Hanif Che Hasan<sup>3</sup>,  
 Maslan Zainon<sup>4</sup>, Norazlina Abd Razak<sup>5</sup>

<sup>1-4</sup>Faculty of Engineering Technology, <sup>5</sup>Faculty of Electronics & Computer Engineering  
 Universiti Teknikal Malaysia Melaka, Malaysia

<sup>1-5</sup>ORCID: 0000-0001-7206-9339, 0000-0001-9782-8389, 0000-0003-0008-696X,  
 0000-0002-8542-4448, 0000-0001-7268-2803

## Abstract

In the myriad of colours, black and white are strange colours to be discussed. Since black (the colour that one perceives) is not in the Electromagnetic (EM) spectrum, it is duly suggested that black is an interpretation of the brain in which the existing “no signal” concept is also discussed in the article. The same goes to the colour white, it is not in the EM spectrum too, so it is also duly proposed as an interpretation of the brain. The concept of white as combination of colour is also discussed in the article. It is insignificant to discuss about both these colours of their existence in the reflection of colour representation since their non-existent in EM spectrum is similar to the colour pink or magenta. There is a hypothesis (for white light colour theory test) at the end of this article, the authors welcome any scientists or engineers or researcher all over the world to assess, deliberate and prove the truth of this theory.

**Keywords:** colour white, bio-physics, light, vision, tetra colour system.

## INTRODUCTION AND THEORY

If one take a stance that the reflection of light is derived from its intrinsic colours, therefore, the colour pink deserves to be accepted as a mental accessory colour. Should the real world have another objective reality which is outside our brain [1]. This colour will not be discussed detail in this paper. But in the world of art, all colours including pink, black and white exists in a colour pencil box. What will be discussed is its representation to the retina at the back of the eye. Meanwhile, black and white colours are proposed as conceptual colours (will be theorized in this article). However, the combination of real and ‘imaginary’ colours are also parallel with the world standard colour reference often used; i.e. the CIE Chromaticity Diagram (by International Commission on Illumination), this reference recognizes both of the colour sets and this standard continuously to evolves since it is established in 1931 [2].

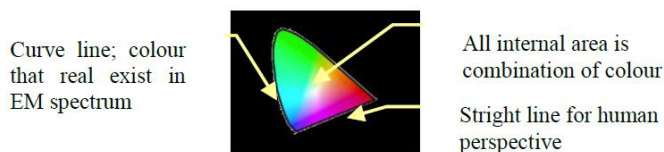


Figure 1: The CIE Chromaticity Diagram.

The black and white concept theory will be discussed using examples. Suppose there is a creature, X. It has 3 sensor cones and is able to detect 3 types of different energies (p, q & r). Cone p detects red EM energy while q and r detect on the area of infra-red frequency. Please look at Figure 2 (where, the human eye is blind towards q and r).

Type of wave	Ultra-violet	Visible Light	(p) (q) (r)	Infra Red
Wave length area (m)	$10^{-8}$	$0.5 \times 10^{-6}$ (B) (G) (R)		$10^{-5}$

Figure 2: The creature X has 3 colour cones. Cone p (red), while q and r in the infra-red section.

As for humans, when the brain detects no image signal, the brain projects it as dark. On the other hand, when the three colour cones (RGB) detects three balanced signals, the brain will project it as ‘white’. Next is a theory of creature X, if there are signals around a triangle block (as shown in Figure 3(a)) and there is no signal in the centre reaches the eyes sensory organ, then the triangle colour seen should be the concept colour which is ‘no colour’ or ‘black’ or ‘dark’ as a corresponding description of the object. At the same time, if a green laser coincidentally flashes towards the centre of the triangle, the triangle remains in the black-concept for the creature X even though humans are able to detect the green colour from the triangle.

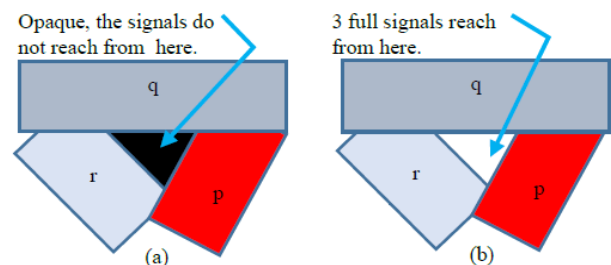


Figure 3: The creature X receive the pqr signals. Left (a): No signal in the centre. Right (b): Full signal in the centre.

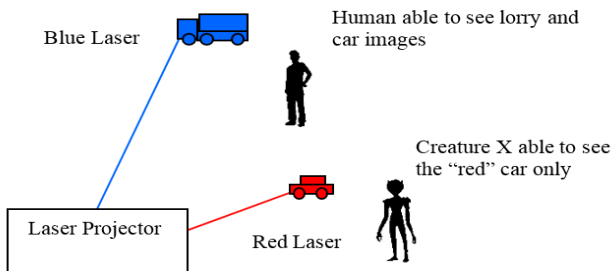
It is fine if reader disagree because this is only a theoretical assumption. It is a proposed plausible answer to provide explanations when there is no signal at certain areas, because

the mind must put something to ‘complete the concept’ of the view of its consciousness. An example of the ‘concept of completion’ is while the eyes look at an object on the blind spot, the mind interprets it as ‘white’ which is something that is needed to complete the vision consciousness (Figure 4 shows the mind projecting ‘white’ in the circle even though it doesn’t exist). The phenomenon called ‘filling in’ [2], but when one move his/her pencil to the right, the white still pretend to be there, while his/her pencil will go over it (please put own real black pencil in the middle). Amazingly the structure and black colour of the pencil are seen completely. This situation suggested that black and white ‘dot’ are actually a secondary representation in the mind or just an internal representation as the concept colour.



**Figure 4:** Focus on the triangle with the right eye (close the left eye) about 1 -2 feet, the circle disappears, the mind replace it with the colour “white”, move pencil in the middle to the right, white will still pretend to be there.

Another interesting discussion about the concept of black and white colour is; if a creature X has never been on earth and arrives here for the first time. Suppose there is a special place transmitting blue laser that is projecting a lorry image into the air at night. While the humans are able to see the blue lorry, the creature X would not be able to see anything (‘dark’/‘black’ concept applied to the creature X in this case). However, when a red laser (monochrome) draws an image of a red car, both human and creature X will be able to see that image. That is for sure. However, what is uncertain is what ‘colour’ will be seen by creature X. Something about seeing experienced.

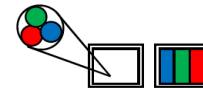


**Figure 5:** Creature X (cone p (red), q, r) and human (red, green and blue cone).

The same goes for the white concept (refer to the previous triangle block in Figure 3(b)). When the retinal cones p, q, and r receive a signal of ratio 1:1:1 (maximum), namely the Red EM energy, Infra-Red 1 and 2 (assume 800nm and 900nm as the concept values), it is proposed that the mind (creature X) translates it as the concept of a ‘full energy ratio’ or ‘white’ only in the middle triangle.

From what has been discussed so far, it is suspected that white light is not made up of all visible light spectrums learned in physics classes. It is just a mental representation concept when

three signals are of similar ratio received (i.e. which is a part of the hypothesis of this article). A typical computer screen also emits all three light components to replace the white colour (if one reads it online or at the computer). If each red, green and blue pixels are active on the screen, are gathered en masse, one will find it is as shown in the right figure of Figure 6. On the other hand, if the pixels are collected locally at 1 place, one will find something like in the figure on the left. Think about it. Isn’t it odd? TV manufacturer take advantage of human architecture. When 3 cones of retina sensing balanced radiation, it appears white, if not balanced, colour vision is perceived [3].



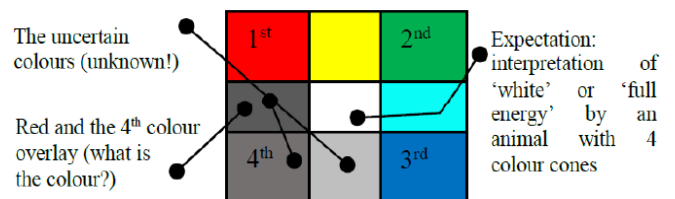
**Figure 6:** Given ratio: 1:1:1. Left: active pixels are collected locally at 1 place. Right: Pixels are separated by colours.

In addition, experienced of ‘seeing’ light (light flashes) also reported by many astronauts, scientist hypothesize that the interaction of the cosmic nuclei (cosmic ray) with the retina, causes all the ‘light’ viewing of the retina to the brain. The situation happens whether in a dark room or whenever they close their eye [4]. This support the sensation of ‘seeing’ light is not necessary directly to ‘light’ stimulation. As long as the cone activated, biology creature will see ‘light’ and if not it will see ‘black’ or dark.

Again if human can see white TV colour, creature X will see only red colour TV. Then if the creature X can fully see an EM energy within the infra-red range only (for all three cones), the ‘white’ TV is ‘black’ for it (black concept is applied to it in this case). All the above discussion about creature X and human, showed that, colour is relative, on earth, in the real case, at least human and dog already confirmed that the world perceived is different [5].

**White Colour Hypothesis (For Theory Test)**

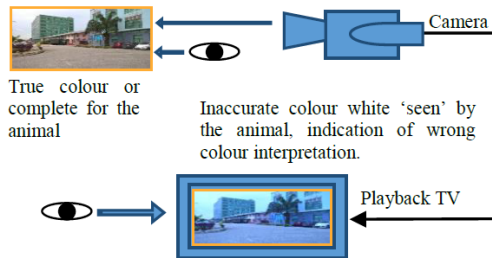
Because it is difficult to conduct experiments using creature X to prove this general ‘white’ theory, it is sufficient to use animals on earth that have 4 or 5 types of coloured cones. This hypothesis like one stone which can kill two birds. First, to prove this general concept of white light and white color in human vision. The second ‘bird’ is to open more research area about light and color vision system in the animal kingdoms. From the literature review, it is found that dog, cat and many farm animals can see with 2 colour cones, bird with 4 colour cones, butterfly (Papilio) with 5 colour cones [6].



**Figure 7:** It is expected the animal with 4 cones will interpret ‘white’ or ‘full energy’ supposedly the total light is maximum.

The Figure 7 is a representation of what the expected meaning of 'white' and 'full energy ratio' by animals that have 4 colour cones, with this, the new 'white' concept is not the colour represented in the full spectrum of visible light, but it is an interpretation of an EM energy maximum ratio for the all cones with a sufficient contrast in the displayed image. It is normal, birds can see with 4 colour system [6]. And some species of bird can see beyond violet (ultra-violet) [7]. The animals with that 4 coloured cones are expected to see the human world like a 'lack of colour' as well as a wrong interpretation of 'white' as shown in Figure 8.

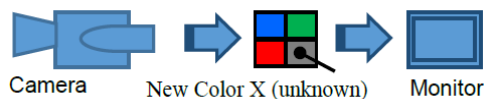
Newton is able to prove his theory with the Newton Colour Ring (Newton Disk) and Prism. The spinning wheel will generate a white colour. As for the prism, the first prism will break the light, and then the second prism will combine the lights into a white light. Newton might right in this special case (for human only). In our theory, therefore the authors suggest the below experiment as an evidence of the misunderstood theory of white colour. Please refer to Figure 8 below.



**Figure 8:** It is expected the animal with 4 colour cones to see the man-made TV that has inaccurate colour 'white'.

Note: An overview as shown in the diagram above assume the animal with 4 colour cones is able to read at the rate of image per second equivalent to humans. Some flying animals read at a higher rate, reading hundreds of images per second (it's like when one watch a malfunction TV). Therefore, if an observation experiment is to be done, the rate of image reading should be increased according to the appropriate rate for that animal (the sensor rod should also receive an adequate brightness level, because for human system, the final retinal signal is the ganglion cells, so the side effects of the low signal contrast-detecting rod can be considered negligible).

For the second phase of the experiment, testing the right colour of the 'full energy ratio' or 'white', the camera and TV must be able to record and replay (four colour system that match with 4 cone species vision system) for the verification of the maximum colour energy hypothesis.



**Figure 9:** A camera with new system for recording & replaying at the 4 colour for tetra chromatic vision system.

The scientists in this field definitely know how to choose and test suitable animals to be used in this verification experiment. It is important to note that if 'white' is only a colour concept, then it is not necessarily 'white' for the animal. The measuring parameter is the 'full ratio' colour density accepted as 'equal' or not by the particular species. Note also the range of human can see any light is varied from reference to reference. Another wider range is 380 – 750 nm [8]. This suggesting different set of subject test gives different set of value. Meaning, different people will perceive different perception about the colour being seen [9]. They also depend on age, gender [10].

## CONCLUSION

If the hypothesis about colour white is positive, thus white colour concept of the combination of visible lights should be revised. Therefore, it is proposed that 'white light' as a full energy concept for all cones of EM received. White colour is the projection in the brain as a vision conception. Other colour is then open for another research. Is 'colour' a creation? If so, thanks to the Creator that creatures are able to see this colourful universe -bestowed the blessings of being able to see colour. Nevertheless, the authors need help from the experimental scientists or scientific engineer or any researcher to verify and further support this hypothesis, as well as support the basis of this new general white light colour theory. New equipment for the camera also need to be developed that match with Tetra-chromatic system. It is assumed that for the second phase testing, it requires better technological preparation for the experiment.

Furthermore, for a hypothesis experiment that is considered highly quantitative (favoured by the neuroscientists or brain-science engineers/researcher), the proposed experiment is the comparison of the neurological signals from the animal's brain when compared, should be the negative in the first case, and positive for the second case (indication of agreement of 'white' interpretation). Suggestion of hypothesis is also role of scientific research, it should be proposed to community for verification [11]. Additional note: If vision analysis that required rounded surface (eg surface of retina) to be detect and compare, some good suggested technique can be used [12].

Authors will continue to write in this interesting domain area to further support the theory or concept. As for the readers, they can always seek for the other relevant articles if necessary.

## ACKNOWLEDGMENT

The authors gratefully acknowledge the support by Universiti Teknikal Malaysia Melaka (UTeM), library, faculty, CRIM and to thank readers who are interested in this interesting domain.

## REFERENCES

[1] J.Alfred. "Brains and Realities". Trafford Publishing, 2006.

- [2] Mark D. Fairchild. "Colour Appearance Models", John Wiley & Sons Ltd., 2005.
- [3] Justin Peatross Michael Ware. "Physics of Light and Optics". Brigham Young University, 2015.
- [4] Fred H. Thaheld. "Can biophysics tell us something about the weak equivalence principle vis a vis the thought experiment of Einstein involving human subjects?". arXiv:0906.3045 [physics.gen-ph], 2009.
- [5] Paul E. Miller, DVM, C. J. Murphy. "Vision in dogs". Scientific Report JAVMA, vol 207, pp. 1623-1634, 1995.
- [6] A.R.Hanson. "Colour Design Theories and Application; What is Colour?". Woodhead Publishing Limited, 2012.
- [7] E.J.Gerl, M.R.Morris. "The Causes and Consequences of Colour Vision". Evo Edu Outreach, pp. 476-486, 2008.
- [8] Carlson, Neil R. "Psychology: The Science of Behaviour (7th ed)", Pearson Education, 2007.
- [9] Saijo Prathap. "Colour temperature tuning to improve efficacy of white light". Procedia Technology, vol. 24, pp. 1186-1193, 2016.
- [10] Jens Gravensen. "The Metric of Colour Space". Graphical Models 82, pp. 77-86, 2015.
- [11] H. Poincare. "Science and Hypothesis". The Walter Scott Publishing, 1905.
- [12] N. A. Razak, C. Liong, A. A. Jemain, N. A. Ghani, S. Zakaria, and H. M. Sulaiman. "Firing Pin Impression Segmentation using Canny Edge Detection Operator and Hough Transform". J. Telecommun. Electron. Comput. Eng., vol. 9, no. 1, pp. 23-26, 2017.