Do We Need A New Camera Vision System In Future? One of Two Realities; One of The Two Must Be True

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ABSTRACT

Do we need a new camera vision system? To answer this, we need to choose between the realities. At least one of these interpretations must be true (1 or 2). The authors try to demonstrate the only possible questionable reality is only one of the two realities. Whilst the authors attempt to propose answers to the question, both pathways are possible. Interpretation 1 indicates that the world has the same colour as in our minds while Interpretation 2 justifies that colour is relative and cannot be determined. It also implies new knowledge, which is difficult to be accepted. Readers have the choices to choose. Nevertheless, at the end of the day, readers will have to choose one of the options available (no choice). Interpretation 1 or 2; the reality is then derived from the chosen one.

KEYWORDS: Vision system; Bio-physics; Light; Tetra and dichromatic; Colour

Full Article - *Physical Sciences*
Received 12 October 2017 **Revised** 23 October 2017 **Accepted** 26 October 2017 **Online** 2 November 2017

TRANSACTIONS ON SCIENCE AND TECHNOLOGY

THE COLOUR MYSTERY UNDER NATURAL LIGHT- ARE LEAVES BLUE OR GREEN?

What happen in the main source of light? The conversion of energy occurs in a nuclear fusion process in the sun, which is the conversion of Hydrogen to Helium. Besides other energies, the sun releases the main energy, known as an Electromagnetic Wave (EM), which is the source of the meaning 'colour of nature'.

Almost the entire EM spectrum affects objects on the earth. Leaves are green because of the photosynthesis process. They absorb most of the EM energy around 570nm and 440 nm, which indicates the interpretation of the human mind towards the colours red and blue respectively, whereas most of the EM energy around 540nm can penetrate the thin leaves (which appear to be green in colour if viewed from the bottom, whereas the thick leaves will look black in colour if viewed from the bottom due to the all related frequencies (green) that are reflected back). The frequency's energy that is equivalent to the need or absorptions of the material will be absorbed by an object (like an accurate radio station frequency receiver). Therefore, each of the returned energy is equivalent to the least or most unwanted 'colour' energy.

The reflection of GREEN EM, which is less needed is certain. However, it is uncertain whether the colour of the leaf itself is really 'GREEN'? Whereas, On Planet X, if leaf X's photosynthesis process absorbs all EM energy of medium and low frequencies, the leaf will appear to be in blue-violet colour. Do the leaves have an actual GREEN or BLUE-VIOLET colour? Is colour characterised as the OBJECTIVE (Interpretation 1) or RELATIVE (Interpretation 2)?

INTERPRETATION 1 - OBJECTIVITY

There are two stands regarding this matter. Ones cannot escape from these two ways of thinking. First, ones could interpret that the colours really exist, out there. However, the interpretation made must be accurate for humans, and for the trichromatic species of animals (equivalent to 3 colour cones in human). It means that the reality (Interpretation 1) must be exact with what humans are seeing just like what they have seen over the past decades (Figure 1).

Figure 1. Interpretation 1: Objectivity.

There are animals that see with 2, 4 and 5 colour cones (Hanson, 2012). For animals that can only see with less than three coloured cones, Interpretation 1 forces humans (who believe this way) to interpret that the animals are actually not able to see the nature correctly. This is when the human's view is on the accurate standard, thus, a dog, a cat and other animals with 2 colour cones (dichromatic) cannot see the nature exactly (according to human's standard). Please refer to the example of a reflection view from different perspectives of a landscape as depicted in Figure 2.

Figure 2. Interpretation 1 forces the truth that: Dogs are colour blind, not humans. Imagine, a dog sees its blood as green in colour, but we do not even aware of this fact.

Researchers found that, humans and dogs perceived the world differently from one another (Miller & Murphy, 1995; Neitz *et al.*, 1989; Pongrácz *et al.*, 2017; Gerl & Morris, 2008). They even confirmed it since in the 2008's article (Gerl & Morris, 2008). See Figure 2, shows the example of colour comparison (Pongrácz *et al.*, 2017).

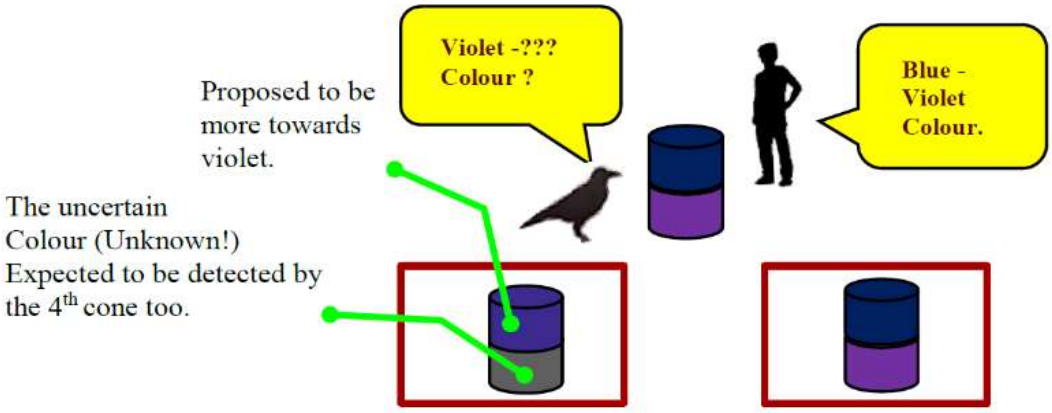

Figure 3. Some birds can see more than three primary colours. They can detect new colours beyond violet. Interpretation 1 forces the top part of the cylinder to be misinterpreted and the bottom part to have the wrong colour.

Bird is an example of animal that can see more than three primary colours (Gerl & Morris, 2008). With Interpretation 1 (Figure 3), humans are also forced to accept that birds can interpret some additional colours that humans cannot see (which can be detected and visualized by birds, but not among humans) i.e. the additional colours appear outside the spectrum that humans can see. The most important thing is that the interpretation of the additional colours is supposedly wrong! (If a human's standard is true).

These birds can see beyond the violet spectrum such as in the ultraviolet spectrum (Gerl & Morris, 2008). Therefore, (the second argument of birds), interpretation 1 also includes that combination of special colours (in the range of ultra violet) and other colours (e.g. green) as incorrect colours (as opposed to human interpretation). Note that the real colour standard is dictated only by humans.

The logical implication towards Interpretation 1 also means that a precise 'definite-equivalent' has occurred. With that, the equalization of the existence and interpretation of the reality should only be equal-defined to humans in 400-700 nm only (380-750 nm (Griffith & Brosing, 2009). The 'definite-equivalent' of A to A, B to B, and so on, if this is what really happening in reality. Note that, all the data signals after retina come in the form of electrical signals (Figure 4) and not in the optical signals any longer, even though its name is 'optic nerve'.

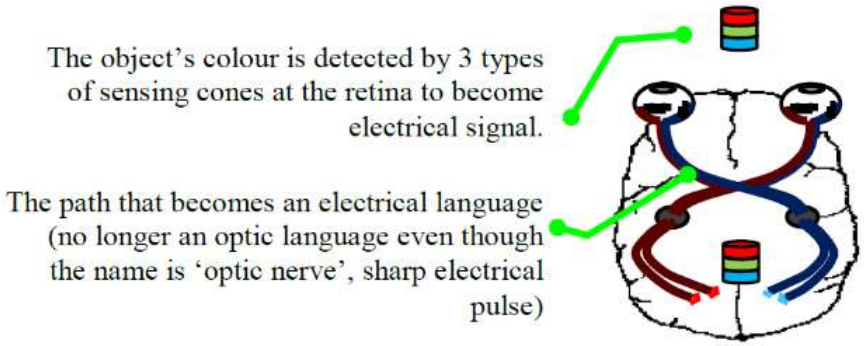

Figure 4. Electrically colour information to the brain.

Interpretation 1 assumes that the light, which reaches the retina, contains accurate information about the object. The object's replication then will be rebuilt accurately based on the information from the retina. If the photosynthesis uses red and blue EM wave energy, therefore the leaf should be green in colour (Figure 5). Whilst the re-emit green light wave coincides with the leaf's surface colour.

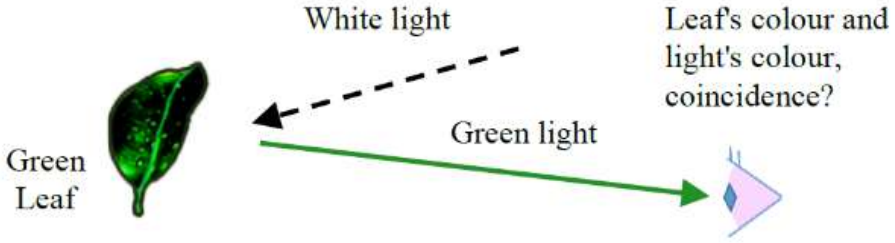

Figure 5. The green light coincides with its material's colour.

However, Interpretation 1 could also be true. Let's hold it for a while and move to Interpretation 2.

INTERPRETATION 2 - RELATIVITY

The second opinion is something that might be terrifying and hard to accept. The condition out there is uncertain, no matter what kinds of colours. This is because humans have no access to colours directly; humans solely depend on the EM wave's reflection. If two places reflect the same green colour, humans could interpret that both places will reflect the same frequency (as illustrated in Figure 6).

Recalling to the process of the leaf previously, it needs certain frequency energy for photosynthesis process (chlorophyll a and chlorophyll b). Reflection or penetration is the value of the unnecessary (leftover) energy. In the retina, the 'green' cones will only absorb energy around 540nm of the EM wave; 'green' (could be experimented using a spectrometer test).

Question: Does the frequency or wavelength of EM really 'carry colour'?

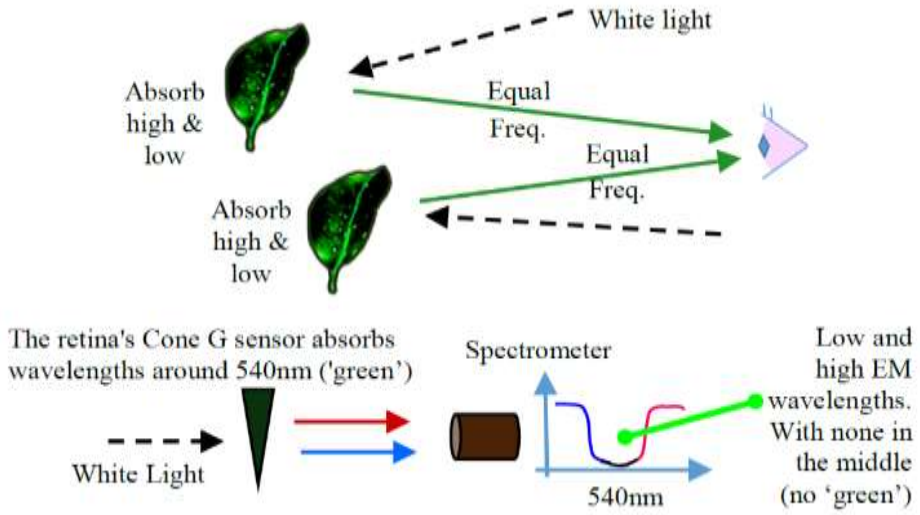

Figure 6. Top: Absorption of 'R' and 'B' by the leaf. Bottom: Proof method of absorption by Cone G by using a spectrometer.

In reality, all waves propagate to the atmosphere encompassing all objects on Earth, including other unusual of different EM wave frequency such as 'beyond red' (red-infrared border) spectrum. What is more interesting about our nature's creation is that, the EM wave such as the 'beyond red' (the unseen light after red) cannot be detected by human eyes, but can be 'seen' on the skin (meanwhile, the skin sensory receptors will capture the energy and send the signals to the brain).

In the brain, it will be interpreted as 'heat' and not 'colour or brightness'. On the other hand, it is interpreted as 'colour'/'vision' by a creature called mantis shrimp (Figure 7). This creature has a unique vision (12/16 sensory cones system). Therefore, EM waves may not necessarily be interpreted as 'heat' or 'colour'. It is subjective to the animals' sensory system and the meaning of the interpretation as seen by their minds.

In fact, humans will forever be 'blind' to unseen waves by either eyes or skin. Examples on the use of other EM wave frequencies are for communications equipment such as computers, telephones, medical, broadcasting and so forth. Just imagine if humans can see the EM waves in other frequencies, the world will be full of telephone signals that reflect in front of their eyes every

time there is a call. Humans will also feel agitated. If it is true, then will new colours be emerged in the minds, as an interpretation of waves (that have never been seen)?

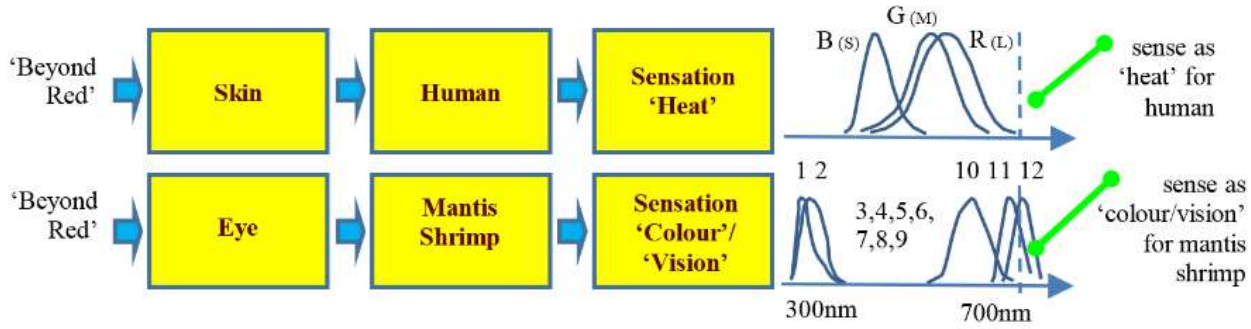

Figure 7. Interpretation of different sensations from the same input (intensity is not taken into account, just presenting the concept, complete reference for mantis shrimp in (Vorobyev, 2008).

So, are there really colours out there or is it just an interpretation? Interpretation 2 is shown as in Figure 8.

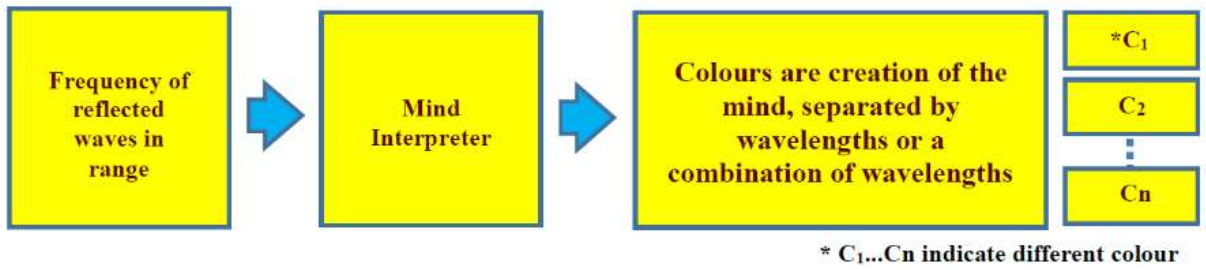

Figure 8. Interpretation 2: colour is relative among species (note: circuitry in the eye is ignored for the sake of article's direction).

Besides of the different inputs, which means different sensations as shown in Figure 7, whenever the 3 cones of the retina receives balance radiation (combination), the colour is perceived as white. And, if the radiation received is not balanced (combination), different colours would be seen (Peatross & Ware, 2015). Interpretation is illustrated as in Figure 8. So, if Figure 7 and Figure 8 are combined in meaning, it suggests the concept of having multiple cones act as a sub-branch from the main branch of the interpretation (combination of cones sensing act as 'fine-tune' in interpretation, input just like a 'signal' and it depends on interpretation within interpretation) – suggesting no objective meaning.

How about other definitions? There is an interpretation which is almost similar, saying that whether there is a colour or not, it is not really important. What's important is that, humans can distinguish light reflection in order to facilitate the recognition of objects. This opinion should be noted seriously because the scholars in psychology/brain science field did provide important facts about colour as well.

Brain tends to interpret different colours according to the context of its surroundings. Eventually, the mind sees different-brightness (contrast) than it should be. The brain and/or mind will change the colours of A and B; see related figures (modification from lottolab.com). Therefore, the interpretation is now quite logical and strong.

Referring to this situation, an interpretation is suggested that humans are created to distinguish objects to be handled efficiently. The brain will take the background into consideration. Finally, what the mind will see is, different types of colours. Despite the fact that the light wave frequency coming from A and B is the same (An objective interpretation does not apply in this case). Readers can leave out other images by leaving the A and B areas to be certain (Figure 9).

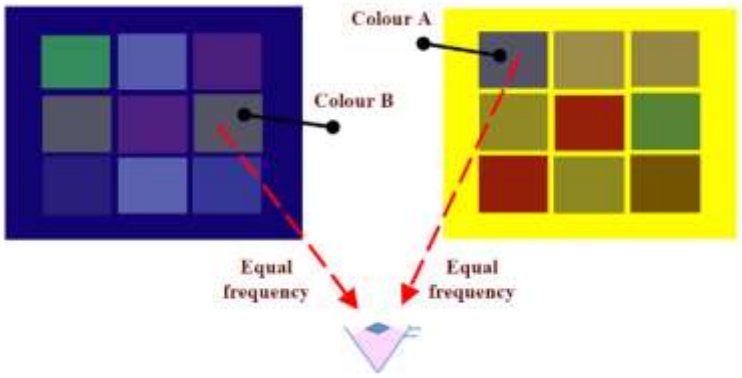

Figure 9. The mind sees that A and B colours are different even though the EM wavelength is the same.

CIE chromaticity diagram (international commission on illumination) recognizes both colour sets, a curve line shows colour exists in the EM spectrum, and a straight line for human perspective (other colours are in between the lines), and the diagram is continuously evolving for many years (Fairchild, 2005). Although many formulations have been made but the category for the colours perceived will never fit in any of its general form. This is because colours cannot be standardized including in the cases above. Another special case in which colour cannot be defined by CIE diagram, is the colour in the 'unusual light' reported by astronauts in outer space. This happens whenever they are in a dark room or when they close their eyes (Thaheld, 2009).

From many sources, it is found that many ranges of visible range are used. The common range found is 400-700nm. An example of a wider range: 380 – 750 nm (Griffith *&* Brosing, 2009), 400-750nm (Silverthorn, 2013). The authors again, would like to suggest that a standard colour diagram can never be achieved by humans or science in general, which the different range, suggesting that no specific rigid value from one human to another (Note: therefore, it also implies a questionable definition of ultraviolet (UV) and infrared (IR) ranges). Supposedly different people will have different perceptions about the colours seen (Prathap, 2016). Gender aspect may also be taken into account (Gerl *&* Morris, 2008; Gravensen, 2015).

In the previous case, Figure 9 says that it functions as to differentiate colours from surrounding. Meanwhile, in another phenomenon of colour (opposite function called "filling in") in a blind spot phenomenon (Fairchild, 2005), can be said to imitate or match the colour of the surroundings. Readers can refer to (Zakaria *et al.*, 2017) where an image of a black pencil is built in a motion (very impressive, it is suggested to test on your own). Readers will surely be surprised to find that in a conscious state, the human's mind is highly efficient in projecting colours, even though it completely does not exist at all (in motion conditions). The two distinct functions suggest that these two phenomena of colours (at least at this converged location) are merely a concept of colour in the mind –which does not exist as it should be.

In Interpretation 2, the interpretations of colours for humans and animals are proposed to depend on the type and number of prime cones. The interpretation of colours also depends on the

requirements of the situation or the contrast of the background. Furthermore, interpretation of sensations (perceptions) regarding 'heat' or 'colour' by the mind or the result of the interpretation of other animals, are not spared from the meaning of relativity or subjectivity (among species). If readers choose Interpretation 2, meaning, the readers are convinced that the existence of colour is not objective. Nevertheless, readers believe that there should be a 'relative' relationship among species, and expected the complete concept will be found later.

Quite interesting, Goethe Colour's theory is also toward Interpretation 2 with physiology understanding (where the details can be found in (Finlay, 2007). Problems in 'Goethe vs. Newton', will be directly discussed briefly in the following section.

DISCUSSIONS

Should it be concluded that everything is a reflection of the EM wave, which is accurately re-interpreted by the mind as 'colour' that is shown in Interpretation 1? (Suitable for human). Depending on either it is Interpretation 1 or 2, which one would readers prefer to believe? Again, if readers choose Interpretation 1, how about other animals? Are their interpretations wrong (animals' vision)?

Arguments on the interpretation 2 shows the frequency or wavelengths of EM wave could not entirely associate with colours (not fully objective). The field of psychology/brain science shows that colours could be projected by the brain, according to the colour effect of the surroundings. Colour can also be projected internally (in the case of a blind spot). However, if readers choose Interpretation 2, it also means that, Goethe's belief (who strongly opposed Newton's colour theory) could be right. Moreover, this shows that Goethe's belief in the physiology of colour could also be true (both Newton and Goethe have quite different sets of colour theory. Newton's theory is towards objectivity while Goethe's theory is towards relativity or subjectivity).

Interpretation 1 sets the actual colour towards a specific species only, which is extremely unacceptable (dichromatic & tetrachromatic system cause a human to stay in the middle (trichromatic), and this makes them hard to believe that they are absolutely in the correct world!). However, if Interpretation 2 is chosen by readers (with contradiction), is this means that Newton's theory wrong?

Hence, the conclusion also, should be related to the evidence. A hypothesis test about white colour interpretation by using a camera vision can be found in (Zakaria *et al.*, 2017). Proposing hypothesis is also a role of scientific research (Poincare, 1905), where it attempts to disapprove 'Newton's theory of white colour' (i.e. to be consistent that Goethe could be right or fully right). However, any interpretation or confidence, still respected, as there may be other accepted arguments, but yet to be discussed again (the existence of colour can be also 'belongs' to the objective world, if perception is not yet understood (Beloff, 1994).

So, what is the answer to the question in this article? Which reality is true? The logical outcome of this article found that interpretation 2 is more acceptable (when Interpretation 1 was found rejected). This means that, no one can really see the reality of natural colours correctly, the real nature of colour is supposed to exist only as relatively or subjectively among species; with tetrachromatic system (wider spectrum) supposedly to see the world differently (see Figure 10).

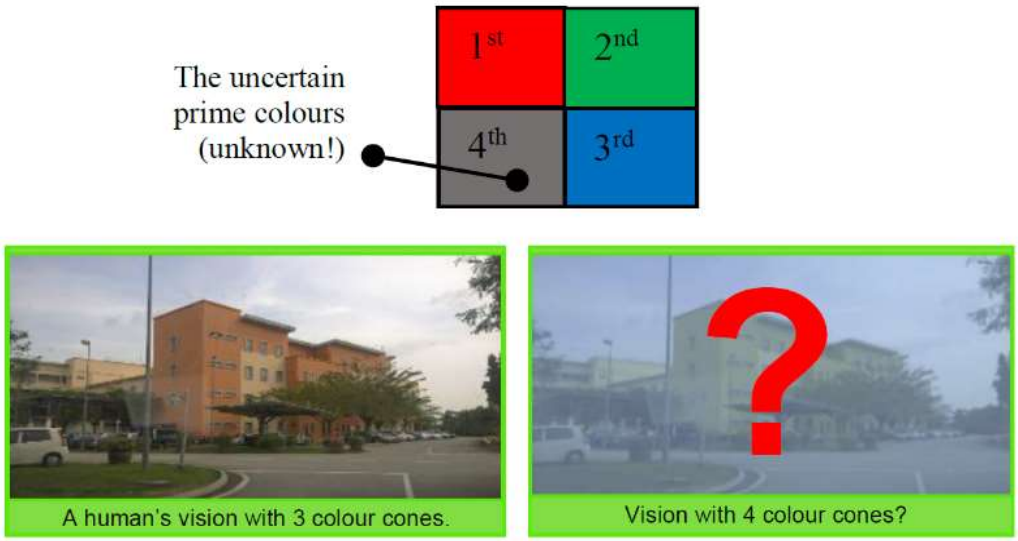

Figure 10. Vision: Normal human vs. 4 prime colour cones species.

CURRENT SITUATION

A new 'general colour model' is expected to be useful for a particular application or research area as the current colour space model was found to inadequate (Che Azemin *et al.*, 2015). Encounter such as in the case of Concetta Antico strongly supports this needs. She was found to have a high possibility of having a tetrachromatic vision system and seeing the world differently, means she could have 4 colour cones in the visible EM spectrum (Winkler & Jameson, 2014). Her special vision has attracted many researchers with similar interest. Readers might want to follow her website at https://concettaantico.com/ for latest information, where she demonstrates what she means by colour from her viewpoint. See "Tetrachromat Moon" in Figure 11 for an example. Her paintings always have beautiful views compared to normal human view for indirect comparison. Among illustration for this type of tetrachromatic is shown on Figure 8 in the article by Jameson *et al.* (2016). For quick view, readers may go to the link given in Appendix A.

Figure 11. One of the collection of Concetta Antico. "Tetrachromat Moon" © Concetta Antico. http://www.concettaantico.com. Reproduced with permission.

If readers are ready to accept the colour as 'relative' rather than 'objective' (the existence of real colour is not absolute), then, generally, they should also agree/believe that, the mutation of human cone's DNA design or the mutation of any species cone's DNA design in the future, will make them see colours differently (taking into account the current situation/evidence).

Researchers predict that 8% of the male population have 4 types of photo-pigments in the retina (cone) (Neitz & Neitz, 2000). Chromosome X determines the design of the human cone. Since women have two X chromosomes, theoretically, the percentage of women involved is expected to be higher than that of men (Neitz *et al.*, 1998). Therefore, the special case, which is now happening to Concetta Antico may not be an isolated one. However, in everyday life, it is very difficult to trace their extraordinary vision, unless they get the opportunity to discuss seriously among themselves, on the difference of colour, from their point of view respectively.

New communities might appear someday. So, think, how to build one TV that suit all audiences? In the future, researchers in this field may discover something unusual, which readers may find it difficult to accept, but they can always seek other relevant articles as well. Regarding the future visual system (electronics/else), the overall work on this article should give some insights that a new visual colour system such as monitor, etc. is expected to be 'normal' sometime in the future.

CONCLUSION

In this article, the authors demonstrated reasonable answers from questionable arguments saying that colours and sights belong to the objective world, even though the mind-brain problem is still not fully understood. From the discussion above, it shows that colour cannot be 'objective', no species can be said that they can really see the reality of natural colours correctly, colour is supposed to be existed only as relatively or subjectively among species.

ACKNOWLEDGEMENTS

The Authors appreciate the support from all parties: Concetta Antico (and her team), Universiti Teknikal Malaysia Melaka (UTeM), Faculty team, Library team, CRIM and thanks to readers who are interested in this science mystery.

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APPENDIX A

http://i.dailymail.co.uk/i/pix/2016/03/18/11/32539F3400000578-3498605-This_image_shows_a_painting_by_Ms_Antico_that_shows_her_view_of_-a-29_1458300963918.jpg (last accessed on 13 October 2017).