Research Essay

Is Qualia Meaning or Understanding?

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Abstract

By arguing that qualia is meaning or understanding, a new framework for understanding consciousness is developed. In this way, the meaning of yellow and red are uncovered. The suggested solutions are that yellow means “source of light” and red means “important”. Also, in the process of arguing that qualia is meaning, remarkable similarities in the structure of qualia are uncovered. In this way, a reason for why very hot and very cold water feel the same, is given. The same behaviour is also shown to take place for colours.

Key Words: qualia, meaning, understanding, consciousness, colour, yellow, red.

Introduction

When looking at the colours, we are faced immediately with a problem. Why do they look the way they look? Why is red red? Why is yellow yellow? When asked, a physicist will tell you a beautiful story about light and its frequencies and how each colour corresponds to a specific frequency. But all this picture is misleading[1]. The main reason is that, for once, colours are qualia and they are created in the brain. There is no connection between the qualia of colours and whatever the light is doing outside of our brain. Unfortunately, the picture is very prevailing in society and in our educational systems, that the children grow up with this idea that colours are inextricably mingled with light, and so, the question “Why does red look red?” is very rarely raised. In this paper, the nature of qualia is analysed. It will be shown that qualia is meaning. One very simple reason for this is that each quale means something. The quale “1+1=2” has a very clear meaning to everyone. But there are other qualia, as for example colours, that at a first sight, it is very hard, if not impossible, to know what they mean. By presenting a broad analysis of qualia in general and then of particular cases, we would come up eventually with an explanation for the meanings behind yellow and red, and so, explain why they look the way they look.

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[1]Because the confusion is unfortunately persistent, I must stress out here, that by colours I'm referring strictly to the subjective experience of colours. For example, let's say that for the 700nm light I see red and another person sees what I would call green. In order to avoid ambiguity, by red I call what I see as red. By green I call what I see as green, etc. This should be clear to anyone from the start, but unfortunately people get confused about this aspect. Another way to avoid confusion is to postulate that everybody sees the same thing. And this is well justified for the colour yellow. If you ask someone what is the brightest colours that he/she sees, and the answer is yellow, then most likely it is the same colour for both persons.

The Nature of Qualia

How does one even begin to address this problem? The first thing that one encounters when first meeting with qualia, are their tremendous diversity. And the difficulty arises when someone tries to find the similarities between, for example, colours and sounds. How can such different manifestations of consciousness have anything in common with each other? At a closer look, though, few main common characteristics appear, as for example, ontological subjectivity, quality and unity. But even though both sounds and colours are subjective, each have a specific quality, and are each one well defined unity, the difference between them still begs the question: "In what respect does a sound differ from a colour?" "What makes a sound to be a sound and a colour to be a colour?" One answer to this is that each quale has its own content. But this is just a hand-waving answer, not really explaining the difference. In order to really explain the difference, the content must be specified. But what can the content of colour red be? Is it even possible to answer this question? In order to do so, we need to have a closer look at the structure of qualia.

Kant divided our consciousness into two parts, sensibility and understanding. Sensibility is comprised out of what we experience from our senses, like colours, sounds, smells, feelings, emotions. Understanding, on the other hand, is made up of concepts that lie under the control of reason. Apparently, the division is well justified. But is this division a fundamental one? Or is it merely an apparent one? Let's have a closer look at both parts, and see if we can find some elements that will allow us to consider both one and the same thing. Let's first start with understanding and take a case where understanding occurs. Let's assume that we want to understand something, as for example Pythagoras Theorem. In order to do this, we take a Mathematics book. We read a while and try to figure it out the logical argument presented in its pages.

After a little effort and concentration, something new happens. For a brief moment of time, so brief that it is only an instant, we understood. So what happened? What is that instant in which we understood Pythagoras Theorem? If we have a closer look at it, we discover few properties. First of all, its nature was ontological subjective. That moment was experienced by us, in a subjective manner. Secondly, it has a specific quality. There is one thing to understand Pythagoras Theorem, and there is another thing to understand Relativity Theory. They both have their own specific feeling to them. And thirdly, it is unified. It is one specific experience that occurs in only one instant. So, what we discover, are the very properties of qualia. The understanding of Pythagoras Theorem is a quale. We acquired the quale of Pythagoras Theorem, and by its very way in which it feels, we know that we understand the theorem.

Let's now have a look at sensibility. Let's say we want to see colour red. In order to do this, we take a book about paintings and open it to a page where an apple is drawn. What happens at that moment is that in an instant, we see colour red. But colour red is also a quale. It is subjective, being experienced by us. It has a specific quality of looking red. And it's unified: it is one entity, called red.

The conclusion that we reach is that there is no fundamental difference between understanding and sensibility. One might point out at this moment, that there is actually a difference. For the case of understanding, we take some time and efforts to reach that understanding. While for sensibility, it just happens to us. But is this a real difference? I will argue that is not. And here is why. When one acquired the understanding of Pythagoras Theorem, the next time he will encounter the theorem, he will simply understand it immediately, in exactly the same manner that one sees colour red immediately. The difference is most likely not a fundamental difference, but rather a difference having to do with the brain. For the case of sensibility, there are already specialised regions in the brain that are responsible for the immediate experience of sensibility qualia. For the case of understanding, the physical structures in the brain are missing at the first encounter with the understanding. A learning process is needed, by which the appropriate physical structures are created in the brain. But after they are created, understanding will come up with the same ease as sensibility comes.

We draw the conclusion that, as far as the nature of consciousness is concerned, understanding and sensibility are the same phenomenon. In order to make things clearer for the rest of the paper, I will summarise this as follows:

Consciousness Is Understanding[2]

Meaning

Is this a fare conclusion to draw? After all, understanding is a meaningful phenomenon. When we understand Pythagoras Theorem, we acquire a certain meaning. From that moment on, when we read in a book about this theorem, we know what it *means*. Every understanding that we acquire about the world, actually means something. Understanding is meaning. But are all qualia meaning? Does red mean anything? Haven't we just uncovered a difference between sensibility and understanding? Let's proceed and see why all qualia are meaning. For this, we need to have a look at the duck-rabbit image.

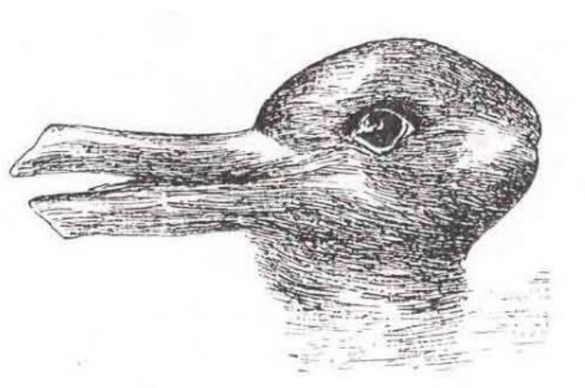

Figure 1. Duck-rabbit image. An example of how qualia and meaning are the same thing.

[2]One further aspect of consciousness is probably free will, otherwise consciousness would be rendered epiphenomenal. But since this paper is only dealing with the aspect of qualia, it is safe to say that consciousness is understanding.

This image is actually showing the equivalence between meaning and qualia. Every time we give the meaning of *rabbit*, we also experience the quale of rabbit, namely the image of a rabbit. Every time we give the meaning of *duck*, we also experience the quale of duck, namely the image of a duck.

If a more technical treatment is desired, the task of proving that qualia is meaning, can be written as "qualia ⇔ meaning". The first implication "meaning => qualia" is trivial. Since meaning is a phenomenon in our consciousness, it has all the properties that a conscious experience has, so it is automatically a quale. All meanings exist as qualia. But what about the "qualia => meaning" implication? This would imply that each quale means something. But is this really true? Let's take some examples. The "1+1=2" quale means a mathematical statement. The sentence "John went out for a walk." is again a quale that means something. The above example with the duck-rabbit image is another quale that means something. And it even illustrate that the quale changes as we change the meaning. And in this case, the meaning is not of a linguistic type, which is the most common place where the notion of meaning is used. But in this case, the quale is a visual one. So it seems that each quale that we can think of, actually means something. So the inverse implication is also true. In this way, we arrive at the conclusion that *qualia ⇔ meaning*. Of course, there still seems to be some qualia that have no meaning. Does red mean anything? In order to get there, we need to have a look at some similarities between language and colours.

Meaning in language and colours

The most common place where the notion of *meaning* is used, is in the field of linguistic. There, the words are said to have meaning. Of course, what we need to be careful here, is that it is not actually the word that has a meaning. The word in itself is just a group of meaningless symbols. What actually has meaning is the representation of that word in our mind. So the mode of existence of meaning is ontological subjective, meaning being part of consciousness. When we communicate with other people, even though it might appear that we communicate through words, we are actually communicating through meanings in our minds. Words are merely carriers of meaning, they are simply tools through which we transfer our meanings. Meanings are the semantic part of a sentence, while the written or spoken words are merely just the syntax of a sentence.

What matters in a sentence is its semantic content, which exists in the mind of the people who communicate the sentence. Syntax is just a convenient way of transmitting the semantics. But syntax on its own carries no meaning. This can be easily shown when someone who doesn't understand Chinese wants to read a sentence in Chinese. The only entity that he perceives is just the syntax of that sentence. But since he has no access to the semantics that existed in the mind of the person who wrote the sentence in Chinese, the syntax simply doesn't mean anything to him[3]. What is the relevance of this? Let's see what happens when we have a single syntax, but

[3] The reason that we still don't have a computer program that can do a perfect translation between languages has to do with the very nature of language. Language is first of all a meaningful phenomenon. A language operates within the consciousness of the persons who engage in a conversation, and it does this by using meanings or semantic content. What a translation software does, is to find patterns and underling structures in the syntax of a language, and based on those patterns tries to do the translation. But this approach is doomed to fail right from the beginning. This is for the reason that language is not syntax alone, but especially semantics. The structures

two different meanings. The word "rock" by itself is ambiguous in what meaning it might convey in the mind of the reader. But if we write the sentence "The mountain is made up of rocks.", we know what meaning to attach to this word. If we take the sentence "I've been to a rock concert.", we again know what meaning the word "rock" takes in this case, so we have a different subjective experience when we read the word in this context. Let's put this example in the following way: We have a stimulus: *rock*. And we have two different qualia that this stimulus creates in the mind of the reader, depending on context.

Now let's have a look at colours and be stricken by the fact that we will see exactly the same phenomenon taking place.

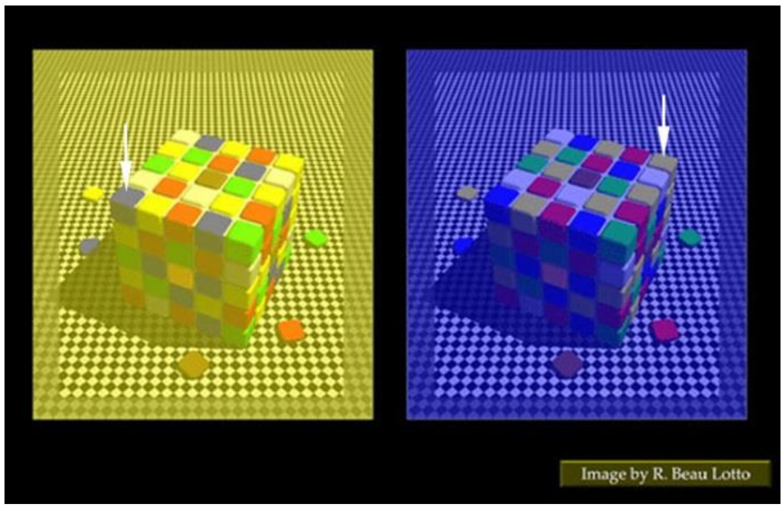

Figure 2. Colours are meaning.

In this image, the two arrows point to two different coloured squares. The square on the left is blue and the square on the right is yellow. The physicist's classical picture will tell you that in the first cube, the wavelength that hits your eyes is the 475nm one, and the wavelength on the right is the 570nm one. But as I warned at the beginning of the paper, this picture is misleading. In this example, if the two squares are brought together, they both look grey! So what is going on? How can the same grey square not only look different in the two different cases, but the way in which it looks different is that it also acquires colours! Out of nowhere! The explanation is exactly the same as for the case of linguistic. The same stimulus acquires different meanings depending on the context.

The two phenomena are so strikingly similar, that the only conclusion that can be draw is that we are actually dealing with a single phenomenon, and that phenomenon is the phenomenon of meaning, the differences arising from the contents of each meaning. In the linguistic case, the form that meaning takes is as words in the mind of the reader. In the colours case, the form that

with which a language operates are found in the semantics, and not in the syntax. But since semantics is a non-computational phenomenon, it is not accessible to a computer. A computer only has access to syntax, and so, by not having access to the entire phenomenon of language, a perfect translator will never be possible for a computer. What would be needed for a perfect translator, is a system that operates on the same principles that consciousness operates. As of today, the principles of consciousness are not known.

meaning takes is the qualia of colours. This example I consider to prove in a conclusive way that colours are indeed meaning. And if even the colours are a form of meaning, it strongly suggests that the postulate that qualia and meaning are the same thing, is true. Let's summaries this as follows:

Qualia are meaning

Having established our bases, we can now safely move on and try to search the meanings of colours. In the linguistic example, it is straightforward to see the meanings that we are dealing with. But in the colours example, even though we established that we are dealing with the same phenomenon, namely the phenomenon of meaning, it is not at all clear what the meanings of colours are. We are still at the stage of "What does red mean?".

At this moment we are still not going to try to answer this question. We need to see more examples of how meaning works. And only after we will uncover a certain pattern, we will be in the position of finally dealing with the colours.

Qualia Hierarchy and Composition

One feature of the unity of qualia is that it has a hierarchy component. Some qualia are more complex than others, and for qualia belonging to the same domain this complexity can be directly shown. Let's take the linguistic domain. One set of qualia are the letters of the alphabet. The next set in the hierarchy can be considered to be the words in a language. The next level can be taken as being the level of sentences. And so on until you get to novels, poems and other complex forms of language. Of course, these levels are not as clearly defined as in this simple example that I give here. But what is important is that there is indeed a hierarchy of qualia. Each level of the hierarchy gives us the ability to see its components. Even though each level is a unity, it also contains information about its parts and is itself a part in a more complex quale.

This hierarchy is present everywhere. In the visual domain, the hierarchy starts from colours, shapes, and go on to the most intricate geometrical patterns, the most amazing architecture or the most complex nature's landscapes. When we have the quale of a tree, we know that it is a tree. If we then concentrate only on the leaves, we know what the quale of a leaf is. Actually, we are able to see at all only because we understand what we see, only because we have the meaning of what we are seeing. It is probably a common experience to all of us that sometimes, when we see a new object, even though we are able to see its shapes or colours, we are unable to see the object. This is because we don't understand what that object is. Only when we understand, only when we have an "aha!" moment, we then also acquire the visual experience of the object, so only then we also have the necessary visual quale. So we are able to see a leaf only because we understand its meaning. But what about its colour? We are able to see green. But what does green mean? Before getting there, let's see some similarities between temperature and colours.

Temperature and Colours

We saw how composition in different qualia domains goes from simple to complex and gives birth to a qualia hierarchy. It would be illuminating to have a closer look at this process. What we would like to know here is if there are commonalities between how the composition works in different domains. If this process appears in many domains, it probably also has certain underlying principles that it obeys regardless of the domain in which it acts. This would mean that given two different domains, a similar construction should be observed. That would indicate that the structure that helps building qualia is the same, what would differ being only the content. Even though the structure might be the same, we will see that the content can give birth to such different final qualia that the structure can be easily obscured. The two domains that are most revealing for this hidden structure in the way qualia is composed are temperature and colours.

A phenomenon that was probably observed by each of us is how we experience the temperature of very hot and very cold water. In the first moment when we touch very hot or very cold water, the quale of temperature that we have is the same in both cases. In the first moment of touching the water, we cannot say if the water is very hot or very cold. Of course, after the first moment, our brain acquires different other information, as for example if there is steam from the water, and then the distinction can be made. But given the case when no extra information is present, the quale that we acquire when we touch an extreme temperature object, doesn't allow us to specify if the object is very cold or very hot. Why is that? In order to understand what is happening, we also need to consider the case of mild temperature. If we touch only a slightly warn or slightly cold object, we are able to specify its temperature. So what is going on? To understand what is happening, we need to remember that qualia have the ability of composition. This is of course clear for complex objects. When we hear a song, it is clearly composed of different sounds, but what about temperature? It appears to be a primitive quale. Not quite so. Since it has different behaviours in different cases, this is probably because it also has a structure.

Let's try to specify that structure. Take for example 3 warm objects at 3 different temperatures, say 30, 35 and 40 degrees. Each object creates us a slightly different quale. Then take 3 cold objects, say at 15, 10 and 5 degrees. They also each creates us a slightly different quale. So there is something in the quale structure that changes as the temperature changes. We thus observe that the temperature quale has an intensity component. It also has another component that informs us if the object is either cold or warm. So what we observe is that there are two types of temperature qualia. One is: *cold+intensity*, the other one being *warm+intensity*. Cold and warm can then be considered to be two aspects of the same thing, if we consider that they provide the meaning that the temperature is below or above a certain value that is taken to be the reference value. But let's not worry about this aspect in this discussion. Let's now go back to our original problem, namely why does very hot and very cold water feel the same. Since we elucidated the composition of temperature quale, this problem can easily be solved. What happens when the temperature becomes extreme (either very hot or very cold), is that the intensity component of the temperature quale is changing.

The cold/warm components on the other hand, don't change. Since their meaning is only the side relative to a reference value, they cannot change. They only tell us if the temperature is below or above a certain reference point. So the components of cold/warm are always the same. What changes is the intensity component. What we obtain at very high or very low temperatures, is a very high intensity component and two cold/warm components that haven't changed their values. We can represent this numerically in the following way: At mild temperatures, we can take the following proportion in a temperature quale: 90%warm+10%intensity, 90%cold+10%intensity.

Since the cold/warm components are dominant, we can clearly feel them, and a mild warm and mild cold objects appear distinct to us. But for extreme temperatures, the proportions change to: 1%warm+99%intensity, 1%cold+99%intensity. Basically, the cold/warm components become negligible. The only component that we can feel is the intensity component. So we feel the same thing. That is why a very hot water feels the same as a very cold water.

We just uncovered the structure behind the temperature quale. It is conceivable that the structure is much more complex than this. But for our present purposes here, this will suffice. What is important to know is that there are certain structures built into qualia. We will now emphasize that these structures can be independent of the content and that they can receive different contents and yield different manifestations. We will thus search for the same structure in the colours domain. We will see that only the content will differ, but the structure will be similar to the structure present in the temperatures domain.

We thus need to look for a structure of the form *x+intensity*. For the temperatures domain, *x* was the cold/warm component, and the intensity was the quale that informed us how cold or warm an object was. What could these components be for the colours domain? We first need to look for a quale that behaves as if it would represent an intensity, thus a quale that gradually increases in its quality. The black-and-white spectrum looks like a good candidate.

Figure 3. The intensity component in the colours domain.

In order for the black and white spectrum to qualify for the type of intensity that we are looking for, it needs to take part in a qualia composition of the type *x+intensity* such that when intensity is extreme, x is lost. What can x be such that *x+intensity* displays the desired behaviour? The only other qualia that we have in the colours domain, are the colours themselves. And amazingly, they follow the desired behaviour.

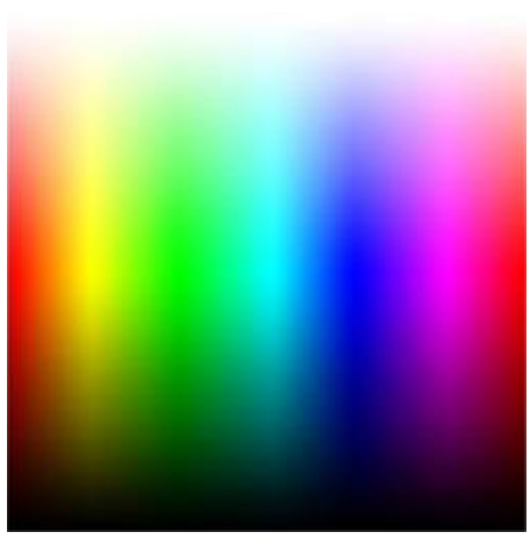

Figure 4. The x+intensity structure in the colours domain. Here x is a specific colour, while intensity is the black-and-white spectrum.

Regardless of what colour we pick, they all follow the same behaviour. All colours combine with the black-and-white spectrum such that when the intensity of the black-and-white spectrum is increased, (i.e. when its value approaches white), the colours become more and more fade until they all look the same: white. We are dealing with exactly the same phenomenon as in the temperature domain. Also, if we decrease the intensity of the black-and-white spectrum (i.e. when its value approaches black), the colours not only look the same, but all visual qualia disappear. There is nothing to see anymore. The same phenomenon is taking place in the temperature domain. When we decrease the intensity, warm becomes less warm and cold becomes less cold, until we reach a point where we no longer feel either warn or cold. At that point we don't feel any temperature whatsoever. We only feel the texture of the object, or its shape, but no temperature.

We thus uncovered a common structure in the way colours and temperature domains are built. There are also differences, as for example the number of x components. For the temperature domain, x can only be warm or cold, while for the colours domain, the number of colours is much larger. In principle, there are 7 well defined colours, but their total number can be of the order of millions.

The meaning of sounds and colours

We now have all the tools we need in order to try to find the meaning of colours. We gave many examples in which various qualia each means something, we saw how various components are built into a specific quale in order to give its specific feel. The reason that we talked about qualia composition is that a specific quale is usually not only one isolated meaning, but it rather has a rich structure that combines many meanings which eventually go to give the quale its specific feel. Before getting to colours, we will first have a look at sounds. This is because we need to know the structure of sounds in order to later emphasize and important feature that colours lack while sounds have.

There are three main meanings that are built into a sound. Note that, as we also mentioned earlier, the structure of a quale might be much richer than we describe here. An interested reader may go much deeper into analysis, but we are restricting ourselves here only to the main meanings.

The first meaning is one that we also uncovered for temperature and colours, and that is intensity. A sound can range from faint to loud, the meaning which value is changing being the intensity meaning. This is correlated with the amplitude of the air waves that are touching our ears. The higher the amplitude, the louder the sound.

The second meaning is the sound's pitch. A sound can be higher or lower. This meaning is correlated with the frequency of the air waves that are touching our ears. The higher the frequency, the higher the pitch of the sound.

The third type of meaning are the harmonics that manifest themselves as the musical notes. There are 12 musical notes that form an octave, C C# D D# E F F# G G# A A# B and then again C, etc. this pattern being repeated from the lowest pitch that our ear can hear, to the highest one.

Figure 5. The twelve chroma.

Even though an octave differs from the adjacent octaves by its frequencies, a specific musical note from one octave sounds in some way identical with its corresponding musical note from the adjacent octaves. The notes are not easy to distinguish for an untrained ear, but a musician has no trouble identifying two identical tones from two different octaves.

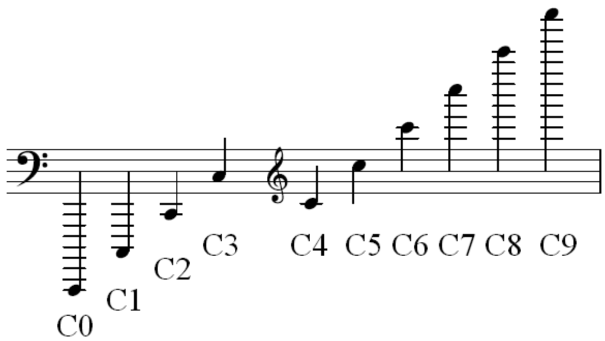

Figure 6. Identical chroma from different octaves.

An octave is the interval between a musical note and another identical musical note which corresponds to an air frequency which is half or double the frequency of that particular note. So the sounds qualia have a meaning component that helps us distinguish various harmonics of the air frequencies that are touching our ears. These musical notes are also called pitch classes or chroma. There are 12 of them.

One consequence of the structure of sounds qualia is that given two sounds that differ in their pitches, it is easy to tell which is the higher pitch one and which is the lower pitch one. This is a direct consequence of the fact that sounds have in their composition meanings that refer to the frequency of the air that reaches our ears. We will see that colours don't have this meaning.

That being said, let's move on to colours and ask immediately if colours have anything to do with the frequency of light. As we warned from the very beginning of this paper, colours have nothing to do with light. A physicist will tell you a beautiful story about how each colour corresponds to a specific light frequency, red being the 650nm light, green being the 510nm light, blue being the 475nm light and so on. But as we saw for sounds, which indeed refer to the frequency of the air, if two different pitch sounds are given, it is natural to tell which one corresponds to a higher frequency of the air, and which one corresponds to a lower air frequency. Unfortunately, this is not the case for colours. If someone (who doesn't already know the order of colours in the rainbow) is given two different colours, he has no way of telling which one corresponds to a higher frequency light and which one corresponds to a lower frequency light. This inability comes from the fact that there is no meaning in colours that refers to the frequency of light. Otherwise, we would be able to know the frequency of light with the same ease that we are able to know the frequency of air wave. But we cannot do that. There is no meaning in the structure of a colour that can inform us about the frequency of light. So clearly we are dealing with a different structure for colours.

That structure is being described by the RGB colour system, where R=red, G=green, B=blue. This system is based on the fact that the rods cells in our eyes are only sensitive to three light frequencies that would correspond to the so called red, green and blue colours. In this system, each colour is a combination of these three colours. Black and white are also included. We show here the RGB codes for the main colours, where the RGB parameters can take values between 0 and 255.

The question that now arises is if the RGB structure is all there is required in order to give a full description of colours. Does this structure determine in a unique way the quality of red? Does red acquires its quality of redness because of its position in this structure?

Colour	R	G	B
Red	255	0	0
Yellow	255	255	0
Green	0	255	0
Cyan	0	255	255
Blue	0	0	255
Violet	255	0	255
Black	0	0	0
White	255	255	255

One more set of relations are actually present in the structure of colours. As we saw earlier, if you give to a person two different colours, he will not be able to tell you which corresponds to a higher frequency of light. But what if you give him 1000 colours? Indeed, in that case, the person will be able to arrange the colours in an order. But that order will also not reflect the frequencies of light. One more feature about the structure of colours is that it is circular. You can arrange the colours in a circle such that after violet comes red. So the person required to put the 1000 colours in order will make two mistakes. One is that he will not be able to tell which is the first colour. There is nothing in the way red looks that might suggest that it should be the first colour in the spectrum. The second mistake is the order. There is no way to tell that after red there should be orange and not violet. So beside the RGB structure, there is another structure that sorts the colours in a circular way and in a specific order: ROYGBIV.

But even if we take this extra structure into account, do we have all the relations that are necessary to give the colours their specific qualities? Why would these relations make red look red or yellow look yellow? For yellow we can actually find an explanation at this point. But as we will see later on, it might not be the full story. Let’s try to give an explanation for yellow.

Let’s ask: Pick the colour that stands up from the crowd! That’s rather a weird question at first. How can a colour stand up from all the others? But at a closer look at all the colours, your attention will be drawn towards yellow. Yellow is indeed different from all the other colours. What distinguishes it, is the fact that it appears to have an intrinsic brightness. It clearly is a bright colour in a way that red is not, neither green, nor blue for example. This can only means that in the structure of yellow there is a meaning that is not in the other colours. Otherwise, we would not be able to pick it from the crowd. Is the same case as for the pitch of the sounds. We can tell that one sound corresponds to a higher air frequency than other, only because there is a specific meaning inside the qualia of sounds that lets us know its frequency.

For colours, not having this meaning, we cannot tell if a colour is at a higher light frequency than another. So the fact that yellow appears different from all the colours must be because it contains a meaning that none of the other colours contain. This can be explained at this moment by the RGB code. If we look at yellow, we see that it has R=255, G=255, (B=0). A lot of light is received by the eye when we look at a yellow object. So the brain created a colour which contains the meaning of "intrinsic brightness". Another colour that appears to have intrinsic brightness, but not quite as yellow, is cyan. And if we look at its RGB code, we indeed see that it has the code G=255, B=255, (R=0). But what about the colour that has R=255, B=255, (G=0)? That is violet. But violet doesn't appear like a colour that has intrinsic brightness. This is because of the sensibility of the eye to RGB. The sensibility for blue is much lower than the sensibility for the other colours.

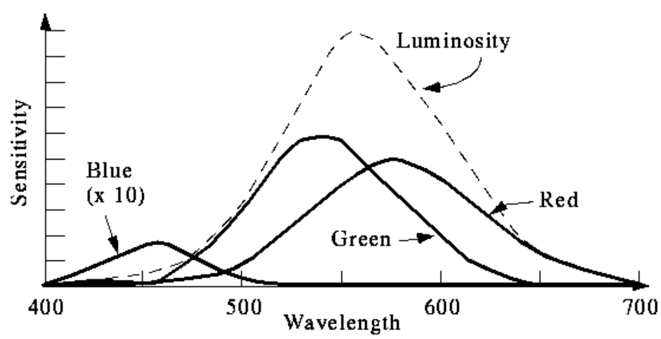

Figure 7. Human eye sensibility

This might seem like a good explanation for at least how yellow acquires its quality. But let's push a little harder. Let's tackle the problem from an evolutionary point of view.

Consciousness has two very different aspects. First of all, it is a natural phenomenon that has to do with the very way in which reality is. Secondly, our specific consciousness acquired its qualia through an evolutionary process. In the same way that our physical body has its form because it helped us in the process of evolution, so does our particular set of qualia have acquired their quality through an evolutionary process. We have the specific senses that we have because they proved the best for our evolutionary advantage. We also have many feelings and emotions with specific meanings that helped us in the process of evolution. Take for example hunger. Hunger feels the way it does because it has a specific meaning. As we saw throughout this paper, each quale acquires its specific quality because of its meaning. Hunger means the need for food or energy, and this very meaning creates the very way in which hunger feels. Thirst having a different meaning, the desire for water, has a different quality. And by the very way in which they feel, you know their meaning. One can take any emotion that he wants, and he will find specific meanings for all of them. So this assures us once again that we are on the right track in our attempt to find meanings for colours.

Let's ask now what could have been the evolutionary advantage of seeing yellow? If yellow acquired its quality because of an evolutionary reason, then we need to find that reason in the environment of the animal. And we do find such a reason! One very important object in the life of a creature that has a visual system is the Sun. And curios enough, the Sun has the colour yellow. Or to dispel confusion, I better say: when we look at the Sun we have the quale of yellow. Is this just a coincidence? I will argue that it is not. What we saw earlier is that yellow is a rather peculiar colour, having a distinct quality that none of the other colours have. I called that quality *intrinsic brightness*. But the Sun is just that: a bright object. We also need to realize at this point that when our visual system evolved, the Sun was the only bright object in the environment. Of course, at night there was the Moon, and occasionally fires sprung here and there, but there was one object that was always around. And that was the Sun.

Given the importance of the Sun, I don't consider a mere coincidence that we have evolved to have the quale of yellow in association with the Sun. And this further points out to the fact that the meaning that gives yellow its peculiar quality of intrinsic brightness is the meaning of "source of light" or "brightness" or something that in some way represents the Sun. If this is the case, the RGB system is not the primary reason for why yellow looks the way it looks, but is merely a system that evolved such that it could mold around the meaning that yellow had. One might ask at this point: Why should yellow have this meaning and not white? After all, white is the brightest colour that can be. The reason is that white has a totally different meaning. As we saw in the comparison with temperature, the black-and-white spectrum has the meaning of intensity. But since it proved advantageous to see the world in colours, rather than just black-and-white, the meanings that were used in the construction of the colours, went beyond the simple meaning of intensity.

Let's move on to another colour and observe another peculiarity. Since the Sun was such an important object for the animals, it needed to be clearly identified from the surroundings. The surrounding for the Sun is the sky. And here we stumble upon another apparent coincidence. The quale that we have when we look at the sky is the quale of colour blue. But blue and yellow are opposite colours. Is this a coincidence that also the Sun and the sky have these two opposite colours? I consider that not only is not a coincidence, but that the meaning of blue is "the opposite of yellow". When asked "Why is the sky blue?" a physicist will tell you a beautiful story about how the rays of light are reflected in different ways based on their wavelengths by the molecules present in the atmosphere, especially oxygen. But I consider that this answer misses completely the point. The correct answer should be: "Because this way, the Sun was best distinguished from the surroundings by the brain of the animals."

Can these hypotheses be tested? I would suggest two tests for them. One is that each extraterrestrial will see their home star yellow and their sky blue. This doesn't mean that we will see them like that. If we were to go on their home planet, we would see their star and sky as having various colours. But this is because our visual system and our brain evolved in a different environment. But each native species will see their star yellow and their sky blue. If they would have more than one main star, they will probably see colours that we cannot even imagine. Their colours will have specific meanings that will help them distinguish between the two or more different stars. But since we didn't need to make such a distinction, we didn't evolve to have those meanings in our colours. For us it was enough to have a colour that has the meaning "source of light" that we can see when we looked at the Sun. Unfortunately, this hypothesis cannot be tested at the present moment. It might even be the case that we will explain consciousness before we will encounter aliens. And by that time we will anyway know for sure that each alien are seeing their home star yellow and their sky blue.

The second test is the phenomenon of Haidinger's Brush that we will later explore.

Before getting there, let's try to find the meaning of colour red. We will adopt a similar approach as for yellow. Since the particular sets of qualia that we have were acquired through an evolutionary process, we need to have a look in the environment and see where could the colour red come from. One of the most important things in the life of an animal is the acquisition of food. In order for the animal to be most efficient in this attempt, he needed to quickly make sense of the environment. Food had to be easily identifiable. Ideally, it would have been good if all food looked the same. In practice this is not the case. But nevertheless, there is a recurrent feature of how food looks. And that is: red! Most of the fruits are indeed red, especially when they are ready to be eaten. We have to be once again careful here. Fruits are not red. They have no colours whatsoever. Red is only in the consciousness of the animal.

So whatever light was coming from the fruits, the brain of the animals evolved such as to give the meaning of red, to see colour red. So now that we identified how red got to come about, we are in the position to find a meaning for it. Could it mean "food"? Not necessarily. I would go for a more profound meaning, and that is: Red has the meaning of "important". The animal not only needed to know that that is food, but it needed to know that that is important for his survival. Another reason for why I consider that "important" should be the actual meaning, and not "food", is because "important" is a more abstract meaning, that can be used in a more general way in other qualia as well. Is something similar to "intensity". As we have seen, the meaning of "intensity" appears in many different qualia and in each qualia domain it takes a different form.

Is this the real source from which red acquired its quality? Let's argue that indeed it is. Fruits are not simply found in the environment all by themselves, but they are found in trees. One important characteristic of trees is that leaves are coloured green. But red and green are opposite colours. We are in the same situation as for the Sun-sky pair. This time the pair is fruits-leaves. Is this a coincidence that leaves have the opposite colour of red? No. The reason, the same as for the Sun, was that fruits needed to be easily identifiable. So the brains of the animals evolved to see the leaves as having colour green. In this case, green has the meaning "the opposite of red". One might ask at this moment: Why fruits red and leaves green and not the other way around? Wouldn't it be the same situation? The answer is no, and this is for the reason that animals were interested in the fruits. What needed to draw the attention of the animals, were the fruits. The fruits were those important, not the leaves. So only the fruits could have acquired colour red, because that is the colour that has the meaning of "important".

Can this explanation for the meaning of red be tested? I will propose here two experiments that might be able to see at least some correlations. One way to test this is to have a look at some MRI scans. Since the meaning of "important" is also an abstract idea and not only part of red itself, the subjects of the experiment can be asked to think about important persons or events in their life and then identify the neuronal correlate (NCC) of the idea of "important". Then the subjects will be asked to see colour red and register the corresponding NCC. It might turn out that some similarities will be seen for the two NCCs.

The second experiment will be to ask the subjects to have a look at a screen on which various coloured objects are displayed for only a brief moment of time. Then the persons will be asked to tell the objects that they remembered. The colours would probably be needed to be adjusted such that they have the same luminance, such that this parameter would not influence the answer of the subjects. If the objects that are mostly remembered turn out to be those that are coloured red, it might be an indication that indeed colour red looks the way it looks because it has the meaning of "important". This experiment should also take into account the cultural background of the subjects. It might be that for different cultures, some objects or some colours are more likely to be chosen. But if even after the cultural background has been eliminated and the most often remembered objects would still be the red ones, this would indicate more strongly that indeed colour red might have this meaning.

Haidinger's Brush

Let's argue a little more for the meaning of yellow. Since we cannot find an alien right now that can provides us with an answer about what colour it sees its own star, maybe we can find an answer here on Earth. Let's have a look at the phenomenon of Haidinger's Brush and see if we can see something remarkable.

Figure 8. Haidinger's Brush with its yellow and blue colours.

This phenomenon is our ability to see polarized light. It is a rather weak effect, not seen by many people. It presents 2 colours, yellow and blue, arranged at 90° to each other. The blue axis corresponds to the direction of the electrical vector of the electromagnetic radiation that hits our eyes. By seeing the orientation of the blue axis we can thus know the polarization of light without using any apparatus beyond our own eyes. There are various explanations put forward about how we are able to see this pattern. The most common has to do with the ability of the xanthophyll pigment in the macula to absorb polarized light. And because of the circular geometry of this pigment's arrangement in the eye, the specific pattern and colours of the Haidinger's Brush are obtained. However, none of the proposed models are able to fully account for the look of Haidinger's Brush.

I will therefore allow myself the liberty to bring a new explanation in terms of the ideas presented in this paper. First of all, I will allow for the shape to be realized entirely by the geometry of the eye. But for colours, I will suggest that they are not accountable for by anything in the structure of the eye. What the eye is doing is just sending signals to the brain, letting the brain know that there is an interaction in the eye that has the geometry corresponding to the polarization of the light. So the brain has 2 pieces of information to deal with, corresponding to the two geometrical axes.

Now it needs to represent this information somehow. Since it is part of the visual system, it will have to use qualia of colours to represent it. The question arises about what colours to use to represent it. Since the information coming from the polarized light is isolated from the information that we usually receive from the normal light, it forms a totally independent system of qualia. So we are dealing with 2 systems here. First, there is the normal visual system that contains the normal set of information, which is then used by the brain to create 7 different main colours (let's say the 7 colours of the rainbow: red, orange, yellow, green, blue, indigo, violet). And then there is a different system, that contains only 2 pieces of information. The question is: If you were to have a visual system that contains only two colours, what would those two colours be? I would suggest that those colours would be yellow and blue. And here is why. One of the colours needs to mean "source of light", because that would be the colour that would let you know that you are actually seeing a colour. And that colour is yellow. The other colour needs to be the colour that is opposite of the first one, such that the 2 colours contrast maximally and so they contain the maximum meaning that can be contained in such a situation. So the second colour should be blue. Those are exactly the colours that we are seeing in the Haidinger's Brush.

If it will turn out that indeed the colours in the Haidinger's Brush cannot be accounted by the structure of the eye but they are actually created by the brain, then this will be an important argument in the favour of the idea that yellow means "source of light", and more generally it will be an argument in the favour that all qualia are meaning[4].

Conclusions

We are drawing to an end now. We just presented a rather controversial view in this paper. Can this be a valid explanation for why colours look the way they look? Shouldn't a real explanation involve mathematical equations? How would colours be explained in a future science in which consciousness will be explained? I will only give a short justification for why this explanation will likely hold even when we will have a theory of consciousness. Let's take the simple case of feeling thirsty and drinking water in order to end thirst. We then ask: *Why did I drink water?* I think the answer is straightforward and that is: *Because I was thirsty*. I don't consider to be anything more to the answer than this simple explanation. I don't think that there is any need to explain the reason for drinking water in any sophisticated mathematical terms. I think that this is the most fundamental explanation that can be given to the question of why I drank water. When

[4] The expression "The meaning of qualia" (i.e. the meaning of red) is employed here in a rather loosely way. Since what I argue for is that qualia IS meaning, the expression "the meaning of qualia" is incorrect. It is only used for the ease of expression. A more proper expression would be "the content of qualia" or "the content of meaning", since meaning is synonymous with qualia.

it comes to consciousness, it might well be that some explanations can simply be given in plain words, that being the most fundamental level possible. So is not unreasonable to search for an explanation in plain words for why some qualia feel the way they do.

What a theory of consciousness will probably do is to provide an explanation of what meaning is, how it arises in the world, and how it can have different contents. But this would be probably the only explanation that can be given to consciousness from a 3rd person perspective. Other explanations, as for example the relations between various meanings, will only have to come from the 1st person perspective: *I drank water because I was thirsty*. It would still be possible to give a 3rd person account for the relations between meanings, but this will not tell us how that specific meaning feels like.

This 3rd person account might come from brain scans. As we suggested for colour red, a scan might reveal that what happens when we see a specific colour also happens when we think about something in a rational way, this suggesting what the meaning of a particular colour is. This also might point out what reason actually is and what its powers are. It appears that reason has access to meanings that are embedded in sensibility qualia. How is it possible for reason to manipulate these meanings? What is it about free will that through the power of reason can have access to meanings hidden deep inside sensibility qualia? The questions are indeed fascinating, but we will stop here. For the present moment, it is enough to know that there is meaning inside all qualia. Future developments will reveal us more about the nature of consciousness.