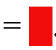
A Calculus of Qualia 9 30 2022

Abstract

The idea of this paper is to put actual qualia into equations (broadly understood) to get what might be called *qualations*. Qualations arguably have different meanings and truth behaviors than the analogous equations. For example, the term ‘ black ’ arguably has a different meaning and behavior than the term ‘  ’. This is a step in the direction of a ‘calculus of qualia’ and of expanding science to include 1st-person phenomena.

[1] Introduction

On the one hand, we can write X = red. On the other hand, we can write Y = . I believe that Y ≠ X. The purpose of this paper is to give a beginning to one path of exploring this idea. I do not assume that everyone agrees about every proposition. In fact, it might be that positions on the mind-body problems (physicalism[1], dualism, monism, idealism, etc.) can be classified by the received truth of various ‘qualations’ (defined below).

It could be argued that it is not that science cannot handle qualia, as is sometimes claimed (Dennett 2018) . Rather, science has to treat qualia somewhat differently than 3rd-person entities.

[2] Qualia + Equations = Qualations

[2.1] Names

Consider

(1) the phenomenal character engendered in a human with normal color vision by photons of wavelength 700 nm.

and

(2) 

1 I will assume in this paper that Physicalism is synonymous with Materialism.

It could be argued that (1) and (2) are *irreducibly different*, if understood in the correct language. That is the crucial point. I would further assert that the difference between (1) and (2) is not 'obvious and superficial' but rather 'not obvious and profound'.

One may try to improve (1) by something like

(3) the phenomenal character and/or the phenomenal concept engendered by photons of wavelength 700 nm in a human with normal color vision, as understood in the correct language

But the point is now that (3) is also irreducibly different than (2), and in the same way that (1) is irreducibly different than (2). It could be said that this is 'not obvious, but is self-evident'.

We note a few things.

2.A (1) and (3) only *point to* the term in (2). (More on this below.) Supposing that their terms were the same as the term in (2) is to make the classic mistake of supposing that the finger that is only *pointing to* the moon is actually the moon itself.

In (1) and (3) what we actually have are *references* to the term in (2). In (2) what we actually have is the term itself.

2.B Taking into account the differences between (1) and (3) on the one hand, and (2) on the other hand, are necessary if we are going to say that qualia are irreducibly 1-st person (which is to say, not reducible to the 3rd-person *in any way*).

2.C (2) uses a different term than (1) and (3), in our qualic language. This difference is 'non-trivial' in that it carries a non-zero amount of information.

2.D There is no expression in black-on-white (black words on a white background, on paper, a computer screen, etc.) *whatsoever* that coveys all the information in (2).

2.E The *copyright* of this paper must include actual red. Otherwise it is not a copy.

2.F Suppose we assume that the behavior (in some given sense) of the terms in (1) and (3) is the same as the behavior of the term in (2). What that shows (proves, I would say) is that *behavior* is not what we're talking about when we say 'irreducibly 1st-person'.

2.G Suppose there is a professor who writes the numeral "5" on a chalkboard, to indicate the number 5, in a classroom that has 30 students in it. Then, clearly, there is some sense in which there is just *one number 5* in the classroom. This mathematical object is known by intuition, its relation to other mathematical objects, and how it models physical objects. Thus in this sense the number 5 is independent of any particular person who apprehends the number.

But suppose the professor has colored chalk and writes the term in (2) on the chalkboard. Then, clearly, there is *some* sense in which there are then *31 different reds* in the classroom (30 students + 1 professor).

Resuming, one might try to capture (2) by something like

(4) in two-valued semantics define the term $t = t(x, y)$, where x is 1st-person and y is 3rd-person.

But this doesn’t work either, for the same reasons that (1) and (3) don’t work: it doesn’t specify the information contained in (2). We will consider (2) a *qualation* even though it’s only one term. (1), (3), and (4) are not qualations.

[2.2] Qualations

One may write

(5) blue light + red light = magenta light

(6) blue paint + red paint = purple paint

and yet

(7)  +  =  ∩ 

where, in (7), the two terms on the left hand side are apprehended by two different subjective states, but the two terms on the right hand side are apprehended together by one subjective state. Setting aside the issue of the operators for the moment, there are two qualia on the left hand side: first blue and second red, (or, depending on how they are apprehended, first red and second blue), but only one quale on the right hand side: blue-and-red. This is developed further below.

The upshot is that (7) is different from (5) and it is different from (6). I conclude that (7) cannot be reduced to (or even stated by) either (5) or (6).

We have

(8) blue = red

versus

(9)  = 

Here (8) is not a qualation, but (9) is a qualation even though it is false.

One might call

(10) red = 

a ‘mixed’ qualation. It contains a reference to red and an actual red. But (I claim) it is false too.

A qualation contains qualia, and not only references to qualia. None of these three are qualations:

(11) the term in (2)

(12) let’s suppose *X* is a qualation

It could be that tomorrow we discovered that the correlates to consciousness (on Dualism) are radically different than what we think they are today. But the qualations (2), (7), and (9) *would have exactly the same meaning*. They would be the same qualation. One could ask what is the set of 3rd-person physical configurations and processes that make such-and-such a qualation true?

(13) red = hexadecimal #FF0000, and the information can be sent from one computer to another

The same exact consideration applies to (13). If (13) were to elicit a red quale in the operator on a sending computer, the operator on the receiving computer might be color-blind and see the quale as black. Thus the *qualic* information has not been transmitted. (13) is not a qualation. #FF0000 is just another name.

[2.3] Names and Referents

It should be remembered that anything we say about qualations with color qualia could just as well be said of qualations containing any qualia whatsoever (with the possible exception of time and existence, see below). It’s just more convenient in our case to write qualations in terms of colors.

We’ll use the following notation. We suppose that red names a quale of red (i.e. redness). We’ll suppose that ˈredˈ names the English word red. We can iterate this. Thus ˈˈredˈˈ names ˈredˈ. We can take this further. Just as ˈredˈ names red, we could use the notation that ˌredˌ is what is named by red. This can be iterated too, so that ˌˌredˌˌ is what is named by ˌredˌ and so on.

Then ˌˈredˈˌ is what is named by ˈredˈ. This is red. In contrast, ˈˌredˌˈ is the name of what is named by red. This seems to be red too, but ˌredˌ is underdetermined. There is more to the calculus here.

Now, for equations we have

(14) ˈredˈ ≠ red

as the former is the name of the latter.

Also

(15) ˌredˌ ≠ red

as the former is what is named by the latter.

However, for qualations we have

(16) ˈˈ = 

and

(17) ˌˌ = 

The difference between (14) and (15) on the one hand and (16) and (17) on the other hand is pivotal.

Therefore, for example,

(18) ‚' ${\color{red}\blacksquare}$ '‚ = ${\color{red}\blacksquare}$

and

(19) '‚ ${\color{red}\blacksquare}$ ‚' = ${\color{red}\blacksquare}$

We can have a mixed qualation in that contains both 3rd-person information and 1st-person information:

(20) ‚red‚ = ${\color{red}\blacksquare}$

These following four qualations are different from each other (without making further assumptions):

(21) A. ${\color{red}\blacksquare}$ = ${\color{blue}\blacksquare}$ B. ‚${\color{red}\blacksquare}$‚ ‚=‚ ‚${\color{blue}\blacksquare}$‚ C. ‚${\color{red}\blacksquare}$ = ${\color{blue}\blacksquare}$‚ D. ‚${\color{red}\blacksquare}$ ‚=‚ ${\color{blue}\blacksquare}$‚

Here, A. is a qualation. B. is a qualation involving what is named by the left-hand-side, what is named by the equals sign, and what is named by the right-hand-side. C. a qualation of what is named by just the one quale. D. is the qualation that is what is named by: the left-hand-side, what is named by the equals sign, and the right-hand-side.

[2.4] Subtraction

Evidently

(22) red – red = Ø

because anything minus itself is the empty set, but

(23) ${\color{red}\blacksquare}$ – ${\color{red}\blacksquare}$ = ${\color{red}\blacksquare}$ + ${\color{red}\blacksquare}$

because there are two instances of ${\color{red}\blacksquare}$ on the left and two instances of ${\color{red}\blacksquare}$ on the right.

In our nomenclature we'll say that red is a reference, and ' red ' is a reference to red, but ${\color{red}\blacksquare}$ is not a reference (it is intrinsic), and ' ${\color{red}\blacksquare}$ ' is not a reference, or at least it is not a reference to anything *else*.

[2.5] Multiplication

We could develop a notion of multiplication. One way to understand a qualation

(24) ${\color{red}\blacksquare}$ × ${\color{blue}\blacksquare}$

is to suppose 1. there are as many red qualia as there are blue qualia, and 2.

(25) ${\color{red}\blacksquare} \times {\color{blue}\blacksquare} = {\color{blue}\blacksquare} \times {\color{red}\blacksquare}$

Then we may suppose the multiplication in (24) has either definition 1. the unordered set S_1, below (with an expanded notion of 'set' so as to accommodate qualia), or else 2. an ordered set, or else 3. an un-selected one of S_1's elements, or else 4. a selected one of S_1 elements, and various permutations of these definitions.

Definition 1 might go something like

(26) $S_1 = \{$ (empty set), $({\color{red}\blacksquare}, {\color{blue}\blacksquare})$, $({\color{red}\blacksquare}, {\color{red}\blacksquare}, {\color{blue}\blacksquare}, {\color{blue}\blacksquare})$, $({\color{red}\blacksquare}, {\color{red}\blacksquare}, {\color{red}\blacksquare}, {\color{blue}\blacksquare}, {\color{blue}\blacksquare}, {\color{blue}\blacksquare})$, … $\}$

We might define

(27) $S_2 = {\color{green}\blacksquare} \times ({\color{SteelBlue}\blacksquare} + {\color{red}\blacksquare})$

as something like

(28) $S_3 = \{$ (empty set), $({\color{green}\blacksquare}, ({\color{SteelBlue}\blacksquare} + {\color{red}\blacksquare}))$, $({\color{green}\blacksquare}, {\color{green}\blacksquare}, ({\color{SteelBlue}\blacksquare} + {\color{red}\blacksquare}), ({\color{SteelBlue}\blacksquare} + {\color{red}\blacksquare}))$, $({\color{green}\blacksquare}, {\color{green}\blacksquare}, {\color{green}\blacksquare}, ({\color{SteelBlue}\blacksquare} + {\color{red}\blacksquare}), ({\color{SteelBlue}\blacksquare} + {\color{red}\blacksquare}), ({\color{SteelBlue}\blacksquare} + {\color{red}\blacksquare}))$, … $\}$

And of course there might be other definitions of multiplication.

(29) $2 \times {\color{red}\blacksquare}$

could be specified to be 1. undefined, 2. itself, 3. the number 2 times ${\color{red}\blacksquare}$, 4. the numeral 2 times ${\color{red}\blacksquare}$, 5. ${\color{red}\blacksquare} + {\color{red}\blacksquare}$, 6. a red numeral 2, ${\color{red}2}$, etc. These definitions generalize to all 1st-person entities.

[2.6] Variables

Let x be a variable that ranges over the relevant references, and [x] be a variable that ranges over instances of the quale. [x] is not a quale itself, but we will *pretend* (in this nomenclature) it is an instance of a quale. A qualation that uses these pretend variables might actually be an equation, and therefore might actually have solutions that the corresponding actual qualation would not have (see section 4).[2]

Then

(30) $x \neq {\color{red}\blacksquare}$

but

(31) $[x] = {\color{red}\blacksquare}$

could be true.

2 Physicalists must be particularly careful here.

[2.7] Functions with Qualia

Write R for a variable that ranges over the possible [R]'s, and [R] for a quale of red itself. We will pretend [R] is a quale, for the sake of discussion, but [R] is not 'actually' a quale of redness. Let G be a variable that ranges over greens, [G] be an instance of green, B be a variable that ranges over brains, [B] be an 'actual' brain, and [B_2] be another actual brain. For a function f_i both domain and range can be specified.

For example

(32) f_1: (B, [B]) –> ([B_2])

is a function from a domain variable B ranging over brains, and an actual brain [B], and has range actual brain [B_2]. Dualists have it that functions like f_1 cannot solve (or even state) Hard Problems (see section 4).

(33) f_2: (R, [R], B, [B]) –> (B) where R is a variable that ranges over the possible [R], and [R] is a red quale. f_2 cannot solve a Hard Problem either.

A Physicalist would want to have something like

(34) f_3: (R, ${\color{red}\blacksquare}$, B, [B]) –> (B, [B_2])

which could be said to be a *mixed qualamap* because it is a map and not all the terms are qualia. The Dualist would have answers to the Hard Problems be something like

(35) f_4: (R, ${\color{red}\blacksquare}$, B, [B]) –> (B, ${\color{red}\blacksquare}$)

Indeed the Dualist's notion of spectrum inversion (Byrne 2020) is that

(36) f_5: (R, ${\color{red}\blacksquare}$, B, [B]) –> (R, ${\color{red}\blacksquare}$, [$B_2$])

cannot be experimentally distinguished from the mixed qualamap

(37) f_6: (R, ${\color{red}\blacksquare}$, B, [B]) –> (R, ${\color{green}\blacksquare}$, [$B_2$])

But clearly there are many ranges to try for a good model of answers to the hard problems (see section

4). One could define a *qualimorphism*

(38) Q(${\color{red}\blacksquare}$) –> (${\color{green}\blacksquare}$)

One could define two identity qualimorphisms

(39) Q_1(${\color{red}\blacksquare}$) –> (${\color{red}\blacksquare}$), Q_2(${\color{green}\blacksquare}$) –> (${\color{green}\blacksquare}$)

Qualimorphisms can be combined in certain ways. It is crucial that qualimorphisms are different than morphisms among just *pointers to* qualia.

An analog of

(40) f_5: (R, [R], G, [G]) –> ([G])

is

(41) f_6: (red, , green,) –> ()

[2.8] Solving Qualations

We can write and solve qualations, for example

(42) X = , + ' red = ' +   = ,' ' + , blue , , ,

allows the well-defined problems

(43) Solve for X
(44) Solve for
(45) Solve for
(46) Solve for the operator ,   ,

Consider

(47) , x + [x] - ' + + ' , = [x] + +

(48) solve for x
(49) solve for [x]
(50) solve for red
(51) solve for
(52) solve for

Here, (51) and (52) are easy. Whatever else may be going on in the qualation, we have

(53) =

and

(54) =

[x] is underdetermined in this particular qualation, but in general, in this nomenclature,

(55) [x] = [x]

anyway, and for (48)

(56) x = homework

and for (50)

(57) red = homework

[2.9] Spectrum Inversion

(58)  ≠ 

Is true. But a sufficiently color-blind person would experience (58) as

(59)  ≠ 

which is false. Nevertheless, while (59) is indeed false, it could be argued that if the color-blind person experienced (58) the way we do, then it would be true to them, too. (Perhaps their brain could be imperceptibly modified so that they can indeed experience redness on the left and greenness on the right.) And if we experienced the qualia in (59) in the qualation (58) then we would find it to be false, too. So qualations are well-defined in this sense.

It's possible to conceive of keeping a brain/process unchanged but associating to it different qualia as its subjective experience (spectrum-inversion).

It's also possible to conceive of keeping a quale unchanged but associating to it different brains/processes as its 'physical substrate' (on Dualism). This could be called physiology-inversion. [refs.]

If one could vary both the 1st-person (qualic) information and the 3rd-person (physical) information then there is some kind of group of symmetries, $G_1 \times G_2$, where G_1 acts on the relevant qualia and G_2 acts on the relevant sets/processes of the physical. For example, a first guess is that G_1 = the identity, I, and G_2 = the Poincare group.

[3] Incompleteness

Godel's incompleteness theorems are well known. He drew a famous disjunct from the incompleteness theorems in his 1951 Gibbs lecture:

> either … the human mind (even within the realm of pure mathematics) infinitely surpasses the power of any finite machine, or else there exist absolutely unsolvable diophantine problems. (Godel 1995)

This doesn't apply to the logic of qualia. Neither his conception of 'finite machine' nor 'diophantine problems' contain qualia. In fact, his notions might themselves be situated within a logic of qualia. It is critical that in these logics we are *not* talking about just the *structure* of the propositions. Statements and proofs in qualia calculus involve actual qualia. But a new theory of truth must be developed too.

[4] Hard Problems

A hard problem is a qualation. Thus

(60) why is my red *red*?

is not a hard problem, but

(61) why is my red ?

is a hard problem. I would contend that there are solutions to (60) that are nevertheless *not* solutions to (61).

I cannot tell if you are a zombie. But, given (61), I can tell that *I* am not a zombie. The upshot is that 'is *he* a zombie?' is an ill-posed question. It's irrelevant whether *Mary* sees new colors when she exits the black-and-white room and steps into a the colorful world. The relevant question is whether *I* see new colors. In the case of qualations these are not the same questions.

Hard problems might eventually be able to be solved this way: on Dualism, record the neural processes R that correlate to experiencing red qualia. Then record the neural processes W that correlate to having the subjective experience of answering a *why* or *how* question. Then, in some judicious way, induce the processes of R and W together (if possible), and a (1st-person) answer to the relevant hard problem should be forthcoming. The answer to a hard problem (in addition to the question) is a qualation. There is a different hard problem for each quale. (61) makes it clear that an actual answer to a hard problem must contain an instance of the actual quale that is in the question.

[5] Notes

[5.1] Time

The basic idea would be that McTaggart's A-series (McTaggart 1908) is qualic.

[5.2] Existence

Theorem: Let w be a possible world contained in world W. Then

(62) If  is in w, then  is in W

Proof: The proof is (62) itself.

[6] Conclusion

The beginning of a 'calculus of qualia' has been given and seen to be non-trivial. Several applications were given.

Acknowledgments

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References

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