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PHENOMENAL HOLISM AND QUALIA CATEGORIES

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***Abstract*:** Scientists have attempted to find consciousness and, more specifically, qualia in the physical world ever since philosophers such as Thomas Nagel (1974) or Frank Jackson (1986) have commented upon the elusive experiential properties of such mental states that are characterized by a specific "what's it like". One of the proposals to minimize the metaphysical and epistemological tension that arises once the existence of such phenomena is acknowledged originates in the influential paper "What is it like to be a bat?" (Nagel, 1974): the development of an objective phenomenology. Current research programmes follow this idea and aim to understand consciousness using mathematical-empirical models. However, these endeavors seem to be missing the point when studying consciousness because they do not provide any evidence about how qualia correspond to neural states. I argue against a proposal to account for the missing link between physical structures and qualia, namely the use of category theory (Tsuchiya et al., 2016). Instead, I conjecture that the endeavor is futile because it relies on the assumption that qualia can be described structurally from an epistemological point of view. I support my conjecture arguing that phenomenal holism has not been ruled out.

1. Introduction

Scientists have attempted to identify consciousness and, more specifically, qualia in the physical world ever since philosophers such as Thomas Nagel (Nagel, 1974) or Frank Jackson (Jackson, 1986) have commented

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upon the elusive experiential properties of such mental states that are characterized by a specific "what's it like". One of the proposals to minimize the metaphysical and epistemological tension that arises once the existence of such phenomena is acknowledged originates in Nagel's influential paper "What is it like to be a bat?" (Nagel, 1974): the development of an objective phenomenology. While the author did not expand on what he meant by such a project, it seems that recently his idea reemerged in the context of scientists who want to use mathematical concepts in order to explain consciousness. (Fekete & Edelman 2011; Oizumi et al., 2014; Tononi et al., 2016; Kleiner, 2020). Maybe the most influential research programme among these is The Integrated Information Theory.

The Integrated Information Theory (IIT), first proposed by Giulio Tononi (Tononi, 2004), tries to account for the phenomenological cross-experiential properties of consciousness in order to find physical correlates for consciousness. It aims to minimize the range of possible mechanisms that could implement consciousness by looking at certain axioms related to the general characteristics of qualia and by excluding every physical thing that cannot be conceived so as to account for all of them. The last version of the theory identifies five axioms that can be briefly summarized as follows:

1. **The axiom of intrinsic existence**: consciousness has an intrinsically real and actual existence.
2. **The axiom of composition**: consciousness is structured; one can discriminate between different qualia at a given time.
3. **The axiom of information**: consciousness has a specific existence that is different than any other of its iterations.
4. **The axiom of integration**: consciousness is unified and it cannot be reduced to any non-independent parts.
5. **The axiom of exclusion**: consciousness is definite in terms of content and speed of being perceived. (Tononi, 2015)

From these, theorists derive five postulates that, taken together, describe the properties that a physical system should meet in order to be conscious. I will not mention them here, as they are not necessarily

relevant for our discussion. I will go further and describe a similar approach, the attempt to find the neural correlates of consciousness.

Searching for the neural correlates of consciousness (NCC) is an endeavor that aims to look at the minimum conditions that should be met at a physical-neuronal level so that consciousness could accompany a given mental state (Northoff, 2014; Crick & Koch, 2003). NCC typically looks at perceptions or intransitive conscious states like wakefulness or sleep as it is more difficult to account for the contents of conscious states, namely for qualia, especially if you cannot define, isolate and differentiate between them properly in an experimental setting. It is similar to IIT as its main goal is also trying to connect the physical level with the phenomenal level,[2] our qualia states. The only difference is that NCC starts from the physical level of analysis, namely the neuronal events, while IIT starts from the phenomenological level of analysis, namely the way it is for us to undergo certain experiences.

These approaches have arguably made significant contributions to our understanding of either one of the levels, or the other (for example Haun & Tononi, 2019). Nevertheless, it seems that neither have made any definitive progress in accounting for the connection between neuronal events and qualia. This inter-level relationship is still not clear because both IIT and NCC lack an a priori account of causality in their models between the two levels and about how each level, especially the phenomenal one, can be best described in more systematic terms. Following a distinction made by Tsuchiya et al. (Tsuchiya et al., 2016), it seems that the main limit of these approaches is precisely this one: they lack the theoretical foundations that would allow for more research in the areas of either reducing one level to another, or of finding interactions between the two levels in question. Tsuchiya et al., more specifically,

[2] I use the word "level" and the distinction between different levels corresponding to the implementational part of a system, namely the physical substrate, and the representational part, which I take to be in this particular case the phenomenal component, similarly with the terminology introduced by Marr (Marr, 1982). I find it a helpful tool to make sure no confusion arises between the analysis of different dimensions.

reason that the theories do not include structural characterizations of phenomenal consciousness. Without this sort of characterization, it would be, according to them, impossible to describe and operationalize empirically how a certain quale is instantiated in a physical structure, as opposed to other qualia. So, is "quale" a genuinely non-referring term?[3]

The solution Tsuchiya et al. provide is to apply the structure typical to the physical level at the phenomenological level of analysis. They argue that this can be done by identifying quale instances and their relationships with one another in terms of degrees of similarities, and conversely dissimilarities, so that these relationships can be, in turn, understood as part of a structure out of which we can define certain qualia based on the relationships that are postulated between them and all the other qualia. The proposal once again makes use of mathematics, and, more specifically, category theory (Tsuchiya et al., 2016, 2021; Tsuchiya & Saigo, 2021). The resulting mappings between either intransitive levels of consciousness, or transitive phenomenal contents, would help in bringing us closer to mapping conscious mental states structurally to neural states.

In this text, I argue against this proposal. It seeks to account for the missing link between physical structures and qualia by imposing a structure upon these kinds of phenomenal contents, by appeal to category theory. Firstly, I argue that this endeavor is not achievable, nor that it is completely compatible with IIT axioms. Secondly, I argue that the project seems futile as it relies on the assumption that qualia can be pragmatically described structurally from an epistemological point of view. In doing so, I would briefly mention how proponents would apply category theory to the study of consciousness, I would discuss their assumptions and argue against one of the premises of their model by introducing a counterargument based on a phenomenal holism thesis. The problem of compositionality that arises, I would contend, renders the whole endeavor moot.

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[3] For a discussion on negative existential claims and empty names, see Dumitru, M., and Kroon, F. (2008). What to say when there is nothing to talk about. *Crítica (México, DF), 40*(120), 97-109.

2. Structural Qualia

Tsuchiya et al. (Tsuchiya et al, 2016) are empirically inclined to argue that a quale is a representational property of a given experience. This is easily explainable since, by establishing an identity theory between content that is represented mentally and an external experience that is highly influenced by numerous factors, one essentially can hold true that the nature of the apparent metaphysical content, namely that of the properties associated with the experience, supervenes on the actual physical properties of the entities which make the experience possible in the first place. This kind of externalism, it seems, is the first premise that guarantees the development of a phenomenology objective enough as to account for qualia with the tools that science has gathered up to this point in time.

The second premise, which I will discuss more, seems to be at least partially derived from the first one. By saying that qualia can be characterized intentionally by making use of the state of affairs in the external, physical world, and by acknowledging the fact that this physical world is essentially a structured one, one can argue that qualia, in a similar manner, can be characterized structurally. The reasoning is valid, and the premises seem to be true as far as our intuitions hold. In fact, as we have previously seen, one of the axioms of Information Integration Theory is the one related to the compositionality of qualia (Tononi, 2015). This, however, is more related to the fact that we can identify different qualia instances at a given time and derive from them the idea that our overall conscious state is made up of these individual instances subsumed. It seems that there might be another way to look at the idea of a structure which would face certain epistemological limits. But, first, let us understand the way in which category theory would actually account for qualia or, better said, to analyze what kind of a structure is imposed on qualia.

3. Consciousness and Category Theory

Category theory is a mathematical framework that allows for formalizing and comparing the relationships between objects originating in the same

categories, but also the relationships between objects that do not share any categorial origin. These are calculated based on the degree of analogousness in terms of the relationships that each object has in their original category. I would not go deeper into the mathematical proofs and formalities; I would just mention the relevant aspects related to the framework, intuitively. If a relationship is found in terms of similarity, or analogousness, then there is a functor that can preserve the structure of any of the categories based on the other category. This brief description of the theory already suggests that if we were to apply the model to the study of consciousness, we would be able to settle if a quale instance that one person has is similar to the one of another person, solely based on the relationships that each has in terms of similarities with their own similar qualia, which we take generally to be, at least for this case, accessible to introspection. Similarly, it seems that these qualia objects, if we take them as such, could be also mapped with the objects of other categories, for example the ones corresponding to the neural underpinnings based solely on the configurations each of these categories has between their objects. This is essentially the goal, to aid current theories of consciousness such as IIT or NCC to account for the connection between phenomenal states, on one hand, and physical states, on the other hand. But, before going on to explain how finding a functor across these categories would actually work, one has to check whether the domains in question can be thought as categories in the first place.

There are two ways in which we can apply the category framework to the study of consciousness. On one hand, we can consider the states that fall under the scope of intransitive consciousness, namely those found in wakefulness, sleep, or coma, as objects, under the category of, say, degrees of consciousness. On the other hand, we can apply it to the quale instances as part of the category of transitively conscious states. The latter approach is the one that I find has more explanatory power for the development of the mapping between different domains as previously discussed, which is why I will focus mainly on it while only briefly describing the idea of levels of consciousness as categories.

4. Conditions for a Category of Qualia

According to Tsuchiya et al. (2021), the conditions that a collection of objects has to meet in order for it to be called a category are the following:

> 'Definition: For a collection of objects to be considered as a category, they must satisfy the following five axioms.
> 1. An arrow has its "source" object called domain and "target" object called codomain.
> 2. For every object, there is a self-referential arrow called identity.
> 3. A pair of arrows is composable if the domain of one arrow equals the codomain of another.
> 4. Identities do not change other arrows by composition.
> 5. Composition is associative.' (Tsuchiya et al., 2021)

The authors illustrate how we can conceptualize an arrow *f* between two objects representing two different degrees of consciousness so that every condition is met if the meaning of the arrow is understood as "higher or equal". Essentially, what they do is associate numbers with the said degrees of intransitive consciousness, and to prove that the function *f* meets the conditions for composition, associativity, and unit, for the numbers assigned to the wakefulness levels in the domain and the codomain. There is not much that can be argued against here, as there is no difficulty in imagining that these kinds of states are part of a continuum ranging from 0, when the individual might be dead or in a vegetative state, to an upper limit that would be ultimately a fully wakeful state. What could be mentioned, however, is that the assignment of values would be difficult without referring to the physical conditions in which the agent finds himself. This would go against the initial idea to determine the relationships solely inside a category and then apply them to the category of neural states by using a natural transformation. Additionally, the upper limit of this continuum might not be easy to settle, especially if we consider the states of different species about which we do not have generally the intuitive anthropocentric assumption that their states are similar to ours, more specifically that they are as wakeful as we are. This

would be influenced as well by the cases in which the experience of being awake would feel different from an individual to the other not only in terms of the intensity. This brings us to the second interpretation, that of the category of transitive consciousness consisting of qualia objects.

Tsuchiya et al. (Tsuchiya et al., 2016) talk of a different function in this case, that can be understood as "similar" and that can be mapped between three objects representing three instances in which an individual sees the color red in three different objects. They go on to argue that these representational contents of qualia can be understood to be part of a category as well, mainly relying on the function's nature, that is understood isomorphically to correspond to the one of equivalence in mathematics. It seems that for the sorts of things that its objects are, namely quale instances, the function does not work as clear-cut or as objectively as they picture once we think how it would be applied in real life, in an environment that is not controlled. For this, we can also remember the fourth Information Integration Theory axiom that states that consciousness is unified and irreducible (Tononi, 2015). If we think of the contextual qualia that might influence the particular perceived quale content which we compare with others in terms of similarities, then it would seem that compositionality would be a problem that would not allow us to compare quale instances independently of context. In order to explain this, I would develop the example given by the authors with the three red objects: the sunset, the crayon, and the wine.

5. Contextual Qualia

We do not have a single qualia instance at a given time. What might trick us into believing this, is that we seem to be able to change the introspectable access and discriminate in certain cases between such quale that compose an overall conscious state at a given time. For example, when we focus on the redness of a sunset, we also perceive what might be in the background: the shape of the sun, the light, the warmth, the other colors, maybe the blueness of the sky that contrasts the other chromatic properties of the landscape. The same applies to the redness of

the crayon: we might perceive its size, its shape, its texture, and what is near it, for example if it is in a pencil case along with other pencils and crayons that have different or similar colors. In the case of the red wine, we might feel additional quale based on our previous experiences related to how its consumption made us feel, the taste it had, but also how the brightness of the room was.

This is compatible with both representationalism and externalism. It is also what the axiom of integration and combination, taken together, argue: consciousness is structured as long as we can identify and discriminate between different qualia, but, at the same time, we cannot explain a conscious state purely as the sum of all discriminated qualia that we have access to: integrated into one, the nature of the content changes. We do not have a single quale associated with a single experience, but we have a couple of them, all integrated, unified into one representation, and all influencing each other up to some extent, by virtue of being part of our conscious global state, at a given time. There is no doubt that we can pinpoint the redness of each of these objects, but it seems that this cannot be done without subtracting the influence of the other chromatic properties that we perceive in the vicinity of the objects or even the other cross-modal quale that might affect the way in which we perceive the redness. This brings us to the phenomenal holism thesis.

6. Phenomenal Holism

There are two approaches that can be broadly taken when we are talking about the idea of unity of consciousness, along with the idea of a structure. On one side, we can consider that the global conscious state, that we have at a certain moment in time, is made up of independent units. On the other side, we can argue that it is made up of interdependent units. If we take the axioms of composition and integration as granted, then one of these views should logically follow. This has to do with the type of structure that is imposed on qualia. The first point of view can be considered as a thesis of atomism, while the second one can be

understood as a thesis of holism about conscious states. Tim Baynes summarizes this as follows:

> "Theorists who adopt an atomistic orientation assume that the phenomenal field is composed of 'atoms of consciousness' — states that are independently conscious. Holists, by contrast, hold that the components of the phenomenal field are conscious only as the components of that field. Holists deny that there are any independent conscious states that need to be bound together to form a phenomenal field. Holists can allow that the phenomenal field can be formally decomposed into discrete experiences, but they will deny that these elements are independent atoms or units of consciousness." (Bayne, 2010)

The proponents of *category theory* for mapping qualia structurally seem to endorse the atomistic view, because they do not talk about any context or any variation across experiences perceived in terms of quale instances. They implicitly assume that seeing redness when looking at a sunset and seeing redness when looking at a pencil, both can be compared in terms of degrees of similarities, without acknowledging the other possible factors which might influence the particular experience of looking at these particular objects in separate contexts, or at separate times. By taking into account the possibility of having some other factors as part of the global conscious state, which may affect the way in which we see redness, one adopts a holist or a context-dependence view.

Visual illusions are a good example for illustrating how one could argue for the holistic approach, as opposed to the atomistic one. We are familiar with how certain visual configurations of colors and shapes can trick us into having certain global representations, unreachable by division into smaller parts, like pieces of a puzzle, and by experiencing each on its own. The exact sum of all the micro-representations that we could derive from a macro-representation, would not be equivalent to the macro-representation itself. This can be explained in virtue of how each piece of puzzle gains a novel information once associated with other pieces, namely the way in which all relate to each other, so as to give birth to the bigger image. Going back to our example, it is conceivable to say the redness of the crayon is similar to the redness of the sunset, not only

because of their individual contents, but also based on what other quale we have or have had while perceiving them, in the context of a global conscious state. Based on the color configuration of the background, we are typically tricked to say that the same color instantiated in two places is different, as a result of the other perceptions that accompany it.

We deal with a different level of complexity if we take into account cross-modal perceptual interferences. One famous example is the "McGurk" effect (McGurk & MacDonald, 1976) which proves an interdependency between visual and auditory stimuli. Another example can be the "parchment skin illusion" (Jousmäki & Hari, 1998), which has found an interdependency between auditory and tactile stimuli. This kind of illusions can arise based on the idiosyncratic ways in which our species integrates different perceptions, but this does not prove our argument wrong: that the qualia arising from these perceptions, can be intuitively thought to be dependent on the global conscious state that they are part of.

This view creates a problem for the approach of category theory, because it seems that the identity of a given quale instance is not stable or context-independent. In fact, using the mathematical terminology, it seems that the identity changes once composed with another representational content. To take a more familiar example, it seems that certain moods affect the way in which we perceive certain external things. With the example of the red color it might not be as easy to notice if and how our quale of redness changes when we are sad or in a negative mood, when we are happy or in a positive mood, but if we think of listening to Beethoven's Moonlight Sonata, then it might be more intuitive to say that the representation of our experience would be substantially different, depending on the mood we were in when the experience happened.

Based on all previous considerations, I would formulate the phenomenal holism thesis in a similar way to how it was previously articulated (Dainton, 2010):

> (**PHT**) Two phenomenal contents perceived in a single state of consciousness are impacted in a significant way as a result of being perceived in a single state of consciousness.

It can be understood in a narrow form, if we look solely at the how a local quale and a global conscious state are influenced bidirectionally. If we look further, we can understand the impact in a broader sense: essentially every local quale is affected by all the other local quale because these are all affecting the perceived global state. Thus, it seems that if we accept this thesis as opposed to the atomistic one, the fourth condition, the one related to how identities should not change other arrows by composition, would not be met. My argument can be summarized as follows: supposing qualia can only be understood structurally from a holistic point of view, namely one that does not minimize the dependence effect across different perceived instances and contexts, then it would not make sense to think of qualia as classical objects in category theory because they would not have a stable identity once they are composed in different configurations. Moreover, even if we were to classify them as such by adopting a special enriched category as it has been proposed (Tsuchiya et al., 2021), the similarities between quale instances taken outside of their original contexts, would not suffice to create an objective framework, since the postulated relationships would entirely correspond to similarities perceived only for the quale instances in question. They would also incorporate the contextual influences, so the model would need an additional component, subtracted from every similarity degree reported, a component related to the interferences caused by our different conscious global states.

These do not seem to be something that can be accounted for, considering the fact that we only perceive conscious unities made up of some components that are always discriminated in relation to the global state of affairs. In other words, it seems that if we take the IIT axioms for granted, and in addition accept the phenomenal holism thesis, then we would not be epistemologically equipped to argue that the redness of a sunset and the redness of a pencil are similar, purely based on their local or atomical properties, without taking into account the interdependency between them and the other perceived qualia "atoms" that each could be said to shape each other, up to some extent. Any attempt of finding equivalence between quale instances, which is at the core of using category theory to map the qualia relationship, and to correlate them with

the relationships between physical events, would include a degree of error - not because of the subjectivity of the one who perceives and reports the qualia similarities, but because of their inability to recognize whether a quale is in itself similar with another one, or if it is similar by association with the global conscious state that one finds oneself in.

7. Epistemological Constraints

Another way of stating the phenomenal holism thesis, following the distinction made by Pitt (Pitt, 2018) between ante and post-hoc compositionality, is to say that qualia are not ante-hoc compositional: their phenomenology in context cannot be composed of the phenomenologies its representations have out of context, which is why their identities in context, or in composition, cannot be composed by summing the identities that create the context, as they would appear outside or in no context. Everything needs to be put into a context, every quale depends on the other ones that are perceived at a given time. The authors' proposal for a functor that aims to make a correspondence between objects based on perceived similarities, has to account, as I previously mentioned, for why the quale are said to be similar, but this task is difficult. We do not know how much the redness of a sunset is similar to the redness of a crayon, or a wine, without taking into account the environmental factors that might generate a setting capable of influencing the way in which we perceive the same redness instance, differently, in two different spatial-temporal contexts. This inability is similar to the one we have when we are exposed to an illusion, when we are informed about the nature of the illusion and about the fact that we have been tricked, and when we cannot escape the way in which we perceive the particular illusion, even if we do not know that it is not in the same way that it appears to us.

The only escape, it seems, if we want to apply category theory to the study of consciousness, would be to either think of global conscious states as categories composed of local quale objects, or to choose global conscious states themselves as objects part of a wider category of

intransitive conscious states. The first option would not have any utility in providing the missing link between the phenomenal level and the physical level because of our current state of methodology that needs a universal structure similar to the one of the neural mechanisms, rather than a fragmented, context-dependent structural characterization. The second one, it seems, would be hardly feasible. Instead of taking the redness of a sunset as an object, one could take it, along with the other qualia influencing the perception of the redness of the sunset, as an object that is not decomposable, or easy to individuate. By trying to account for all the factors, however, we would be getting at the global conscious state, since every perceived factor would be caused or influenced by another factor. It would be difficult to weigh in all the representational influences that have shaped a given quale, without regressing to the totality of the representations that we have access to at that given time. This would be another epistemological limit, especially if we accept the fact that we do not have access to all our qualia.

Surely, one could argue that as long as we can find similarities between different qualia, seeing the redness of a sunset and seeing the redness of a pencil or a wine, then there should be something common between them, which is context independent. Nobody denies that qualia cannot be stripped out of their interdependencies so that a pure content could remain. However, this pure content could not be taken as the basis for applying category theory, as this would not capture the reality of how qualia are presented to us. It would not run counter to the problem exposed, as we can identify certain elements as similar even though they are partly influenced by different factors and contexts, but we still could not point out how much the difference is related to the way the quale is perceived in itself, and how much the quale perceived is dependent on or influenced by other factors. We would not have the capacity to approximate this common ground between, for instance, seeing redness in different spatial-temporal settings.

Other than arguing against the phenomenal holism thesis, which as I have presented seems to be consistent with certain intuitions and perceptions that we typically have, the proponents of category theory could reason that category theory helps us in precisely identifying the

common element of a content across contexts. In order to explain this, let us suppose that the problem of compositionality does not exist, and accept the fact that qualia can be understood as objects of a category. We would go on to define the objects, purely on relational terms, but in order to understood how it would pragmatically happen, we seem to have to continue the explanation of the tools provided by the category theory.

A natural transformation, in category theory, is a relationship between functors of different categories that enable each one of them to be translated by making use of the relationships of the objects of the other one. This concept brings us to the Yoneda Lemma, from which we can derive in an intuitive form the following sentence: an object A of a category X is equivalent with an object B of a category Y, if the relationships that A has inside category X are equivalent with the relationships that B has in category Y. In other words, if we apply this idea derived from the Yoneda Lemma to our discussion, my sunset redness can be equivalent with another person's sunset redness if my sunset redness can be described *in such way*[4] that would form a certain relational configuration with the other qualia I have, that is similar to the configuration that the redness of the other person creates, once it is compared with the other qualia the other person has. Provided that the context in which the sunset redness was perceived by the two individuals was the same, then it would be fair to assume that their contents are equivalent.

It does not matter what the representation is, it matters only how the representation relates to the other representations or local qualia and, in turn, to the global conscious state. If one sees the three objects as having different shades of green, then it seems that the similarity-based relationships between these qualia instances would be equivalent with the ones that another individual might have, even though they would perceive the different shades of the objects as red. In other words, all the relationship configurations of a quale with the other qualia, being the

[4] As Quine points out: "what makes a sentence an observation sentence is not what sort of event or situation it describes, but how it describes it" (Quine and Ullian, 2007:39).

same interpersonally, does not entail that the quale itself is the same. In fact, it seems that this principle of Similarity-Congruence is not logically strong enough as to help one deduce whether the type of the quale in question is similar or not (Pautz, 2019). This issue is inescapable even if we describe relationships between qualia by adopting an interval or a ratio level variable assignment. This has been attempted by "enriching" the category theory as to account for more flexible "relationships" in the qualia space that can be mapped in a more nuanced manner, on a continuum. The motivation is that when one maps qualia in a metric space, one fails to account for the phenomenal properties that go beyond the represented points. Tsuchiya et al. (Tsuchiya et al., 2021) introduce a monoidal category called "dissimilarity", to complete the initial framework, but this endeavor fails to address both the problem of compositionality, and the epistemological limits previously mentioned. By assigning numbers to the similarities perceived, not only the congruence would have to be approximated, as it does not seem to be an *inter-individually objective similarity* between any two qualia instances, but also the degree of variation introduced. This does not manage to render the endeavor more objective, because it would depend, maybe in a more significant manner, on the individual subjective ratings and everything else which might influence them, from the degrees of access to introspection, to the range of possible perceived limits between which an experience can be represented as similar or not with another one. Such model might, however, help us find the "noise" s coming from our global conscious experience, because it would allow for comparisons between the same agent's local qualia in different contexts, so that the variations in terms of interdependencies could be closer to being controlled. However, such an approach would be ultimately an atomistic one, because qualia would be perceived as the phenomenal building blocks that would suffer from a certain degree of dependency capable of altering their contents, a degree that can be mathematically subtracted from the parts, so that the content remains in its pure form.

8. Conclusion

I started the paper by describing the most prominent approaches for investigating the elusive phenomenon of consciousness, namely IIT and the NCC. The latter starts at the physical level and tries to infer from the neural events the phenomenal states thought to intervene upon them, while the former follows the exact opposite move. Both have to account for, as Tsuchiya et al. (Tsuchiya et al., 2016) argued, the way in which the two levels relate to each other and how one can possibly implement or cause the other, if they want to offer a more complete framework for research. Applying a structure to the phenomenal level, as the authors go on to suggest, is an idea that could aid in such an endeavor, by delimitating qualia in the same way we delimitate brain regions. It would make it possible for our current scientific tools to map the connection between the two levels.

I, then, presented one of their assumptions, namely atomism, and argued against it by defending the alternative position, namely the context-dependence or phenomenal holism thesis. This can be understood as a view which is entailed by two axioms of IIT – the axiom of integration and the axiom of unity-, which states that two representational contents perceived at the same time, by virtue of being perceived at the same time in an integrated whole, are different than what they would have been if they were perceived each on their own, and then subsumed. If we accept this view, we cannot think of qualia as categories, because they do not maintain their identity while they are being composed.

The endeavor inspired by category theory to map qualia structurally creates a problem because developing such an objective reporting of our qualia does not seem to be entirely pragmatically achievable, especially if we take into account the epistemological limits that would constrain us from identifying how much the similarity perceived between two qualia instances in two different contexts would rely on the local content itself, and how much it would be influenced by the global conscious state, the amalgamation of the phenomenal contents all being interconnected.

I want to end by saying that even though category theory does not help us in laying the foundations for a more concrete study of the nature of the supervenience arising between the two levels mentioned, this does not mean that we should all end up supporting either mysterianism, or dualism. In fact, quite the contrary: we should continue to think of ways in which we can bring consciousness closer to our scientific tools, or, better said, we should bring our scientific tools closer to consciousness[5]. We should not assume that, by default, the characteristics of the physical level could be isomorphically applied to the phenomenal level. We are most certainly slowed down by certain epistemological limits, especially in interpreting the interactions that arise between different levels of analysis that we perceive, but we are also constrained by certain views we have about science. These are the ones that we are more in power to change at present. Applying mathematics to our object of study is most certainly an asset. However, a positivist approach does not always benefit science, especially if we are talking about the study of such a mysterious and elusive, yet utterly familiar and widespread phenomenon, as consciousness.

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[5] It is not entirely clear which the best way to move forward is, when it comes to the study of consciousness – for a discussion on the way this problem weighs on experimentalists and arm chair philosophy see Chapter 8 – "Explicarea conştiinţei fenomenale. Conceptibilitate epistemică şi posibilitate metafizică", in Dumitru, M. (2019). *Lumi ale gândirii: zece eseuri logico-metafizice*. Iași: Polirom. Edited by Andrei Pleșu.

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