1) On the Nature of Consciousness

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1) Abstract:

This paper presents a descriptive model of consciousness based on information theory The aim is to enumerate definitely described aspects of consciousness and present them in a coherent manner,talks about both phenomenal Consciousness (seen as attention)and access Consciousness,

Some aspects described about consciousness might seem akin to karl friston's view of defining brains as Bayesian inference machines, Wittgenstein's private language argument and Tononi's IIT usage of a complexity metric(amount of information) for measurement purposes with some subtleties of of it's own to add .

The part about choosing a method of measuring complexity seems to be something that can be looked over by a logician to get it refined for the models usage, some thought experiments with conjectures are there in that regard which might be worth looking into or to check their validity.

2) Note: The attempt here is to reach at a seemingly valid description of what Consciousness is? A mathematically rigorous definition of it ,there are some conjectures within which seem to point towards some refinements that seem possible for the model

2) Background & Premises

1) Everything/object has a description,that is , everything has a definite state (no matter what it is)

2) That definite state can be described using a shared language by using descriptive statements that refer to the everything's /object's qualities

3) Objects are of two types

   1) **Subjectively defined objects:** These are objects that don't have an inherent description,their Description depends on who is describing them ,like ,the shape of a unicorn's horn ,things whose description is dependent upon the description of them given by someone,they don't have one description of themselves,as will be seen ahead, Consciousness here is defined as a property of

an observer which is dependent on the type object's description too.

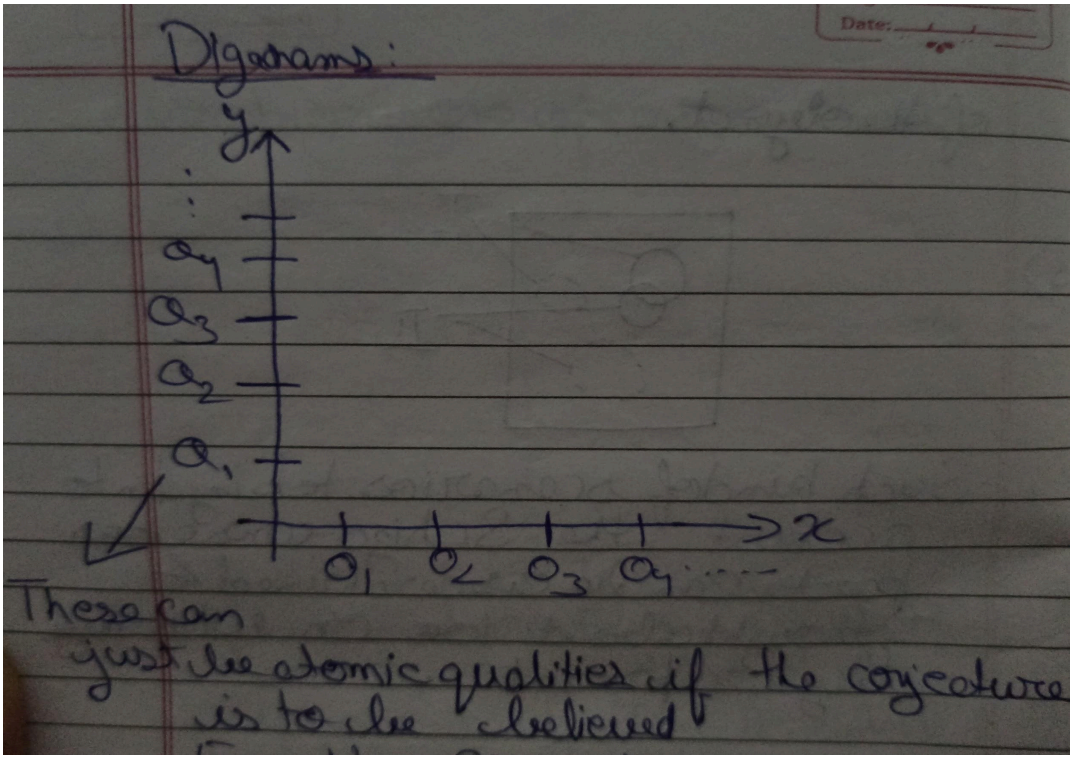
2) Objectively defined objects: Objects such as the laws of thermodynamics or an orange placed on a table, these things don't have a description that is dependent upon how someone describes it ,their description is inherent and can only be said to be inferred ,not imagined , Consciousness as defined here is a property had by the observer dependent upon description of such objects

Note:Classification of statements:Statements about an object can be classified as being axiomatics (statements that describe the object and statements that are true about the object because they are a resultant of the axiomatics)

4) The statements which can be used to describe can be generalized to the form O(x)_Q(y) where {x,y} belong to natural numbers and thus the O(1),O(2),O(3).... can refer to objects and Q(1),Q(2)...can be used to label qualities that can be had by any object and O(x)_Q(y) can be read as object x has quality y ,O refers to the object and Q refers to the qualities,one might see a type of language that is capable of giving

descriptive statements only where Is and Qs are the words it has

5) **Now ,a lattice can be curated here such that the Os are placed on the horizontal axis (x-axis) and the Qs can be placed on the vertical axis (y-axis) as seen in the image below**



(Disregard the statements written in english here)

6) **The lattice here will have quality that all possible statements (where true or false) that can ever be made to describe an object will be representable by some lattice point in the above lattice ,the statements that are known to be true can be labelled with a green dot at their respective lattice point and those that are false can be labelled by the colour red, others can be left white**

Note :A conjecture to be mentioned here
What can be done here is that it can be noticed that there will be some qualities Q(a) ,Q(b) and Q(c) on the vertical axis such that saying an object O(x) has qualities Q(a) and Q(b) is the same as saying that the object has Q(c) ,in such a case letting Q(c) be on y axis and seems redundant and so a newer lattice is created such that such Q(c) (which are made redundant by other qualities or might be said that , qualities that are composed of two or more other qualities) type qualities are not on the y-axis since the non composite ones seem to enough for Descriptive purposes of any object

Conjecture: There are such qualities which can not be seen as being composed of other

qualities, which make up the composite qualities (a measure of complexity of a given set of statements is defined here as the number of non composite qualities that compose the qualities mentioned in those statements)

Let Q be a composable quality (it can be seen as composite of two or more non composable qualities) then it can represented as follows

Q= Q(a1)+Q(a2)+....+Q(a(some natural number))

Here the Q(a) are the non composable qualities composing Q and = is read as composed of and + is read as and .

Note: One can also start by naming all fathomable qualities of an object (like thinking of all qualities,the ones which are made by adding something to a quality and subtracting something from it),after that take out all the composables and what is left are only non composables

7)The brain is modelled here as an inference machine (like karl friston's modelling) which can make inferences (beliefs :a statement inferred to be true by the inference machine/brain) and hold on to them for an interval of time while also having a

certain set of rules (called here as brain codes) that directs how those inferences or beliefs evolve over time.

Belief state : In the above x-y lattice,all statements will be labelled with a truth value of true,false or a measure of probability of being true by anything that can be ascertainable to be a brain(in case of humans it will be represented by the state of the paragraph defining the neural network),the state of truth values at any given point of time is called the belief state of the brain at that point of time curated by the brain code and evolved by it.
Note: As it will be seen as the paper progresses ,that the brain codes are of different types based on the subtleties of the code which map directly to different types of disorders of consciousness and attention.

8)There are many kinds of measures of complexity (amount of information) like Shannon entropy, kolmogorov complexity, bit code length and length of a code in different coding languages such java , python etc which measure complexities of many different types and one other is that of a measure of complexity of what was learnt by a neural network when trained for a certain while,the complexity of what was learnt might be ascertainable from the

change of parameters of the neural network before and after the learning process

Note: A background in basics of information theory, complexity theory might be needed here

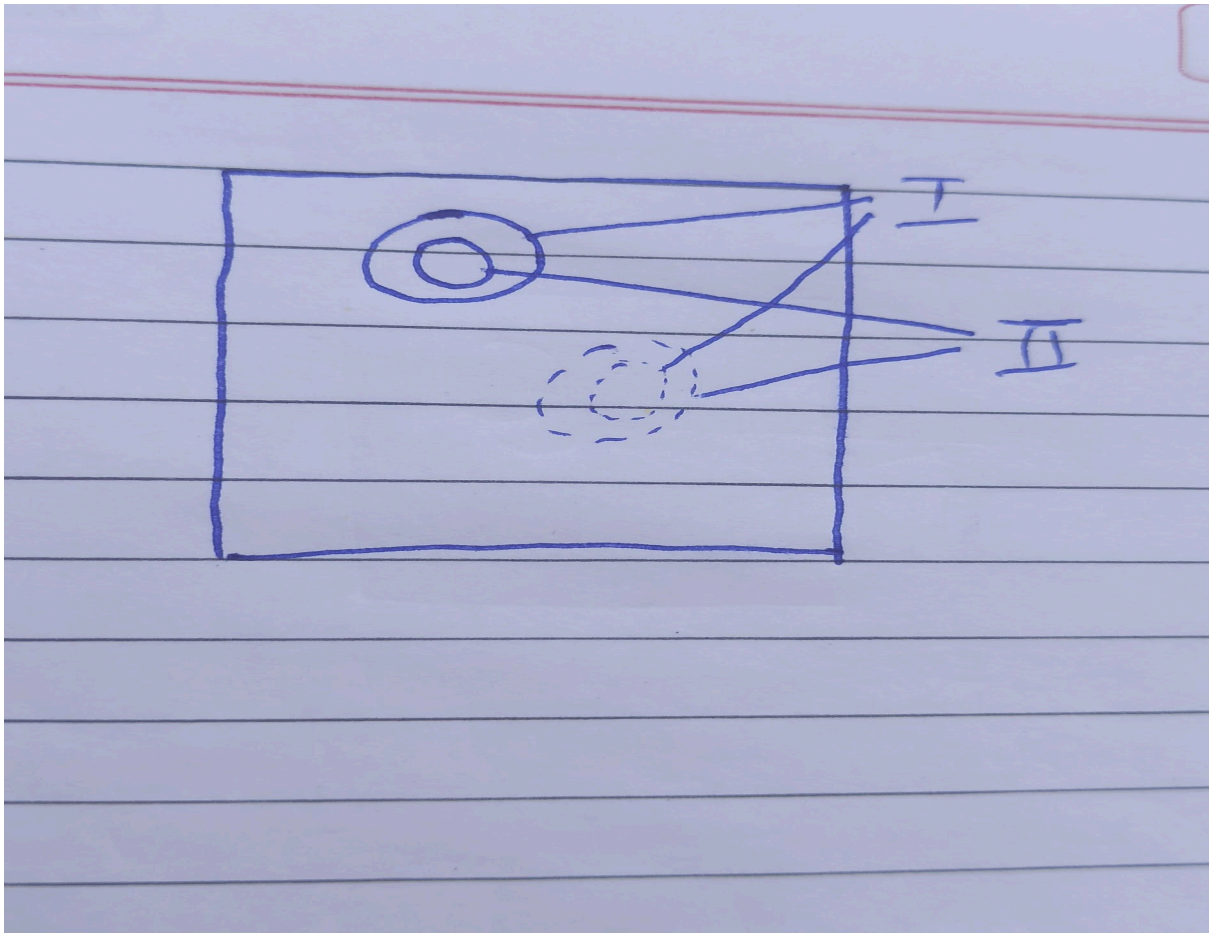
9)Qualia, subjective experience is treated as a language here (Wittgenstein's private language argument).The private sensations are the symbols used in it to label objects & qualities.Here ,the languages also get classified into shareable (English, python) and unshareable(Qualia of different people)
Note: Shared languages are what allow one gauge other's Qualia
Conjecture: In Qualia ,the number of private sensations experienced which represent an object can be said to be a measure of the complexity of the description of the object in qualia, number of sensations might also be treated as a measure of complexity

10) What constitutes as being one object is subjective in nature here, that is , what constitutes as being one object can be defined differently by different persons

3) The white paper metaphor

Image a white paper,on it is written the true description of an object with an objective description (in a language that is shareable, like English) in a definite manner ,could have been translated from another language or the object and it's qualities could have been given names which are written on the paper

Now the belief state of an observer whose Consciousness about the object is to be gauged can be represented on this paper,just loop the statements that are ascertained to be true by the observer at any point of time in a circle and all those that are labelled false by the observer in a dotted circle as in the image below,where the circles for two different observers I and II are drawn for a given point in time and
labelled by the Roman numerals for 1 and 2 ,here they will be written as I and II second respectively whenever they are referenced



The part of the description within the continuous circle is called the part of the description of the object a person is conscious of .

Definition of consciousness:

Consciousness about an object (can only be had for an objectively defined object) had by an object is the fraction of complexity fathomed about the object by the observer out of the total complexity of the object for which the consciousness is supposed to be measured about (which is defined subjectively,but

the definition for all of them remains the same as those will also objects).

Mathematically rigorous definition:

Consciousness about an object at anytime had by an observer about an object is the ratio of complexity of the object's description labelled true by the observer and the complexity of the object's description

i.e. Consciousness(C)=

$$\frac{\text{Complexity of beliefs labelled true(CTB)}}{\text{Complexity of the object's description (COD)}}, V$$

This not just a scalar quantity ,one has to mention a component (represented by V) that signifies the parts of the object's description (the part inside the continuous circle) that the consciousness is about The metrics of measuring complexity might be chosen suitably for the type of the object

Now ,the consciousness about the object had by the observers I and II has been described here ,it can be ascertained from the paper that I has more consciousness than II about the object being

described in the white paper ,the exact amount can be measured from the formula given

Here ,two other quantities can also be described Schizo-consciousness (S) and Unconsciousness (U) in the same manner as Consciousness (C) such that for a given object at anytime

C+U+S=1

4) Brain codes

Title: Brain Codes and the Evolution of Consciousness, Schizo-Consciousness, and Unconsciousness

1. Concept Overview
This model treats the brain as a belief-processing machine. It starts with an initial set of beliefs and modifies them over time based on stimuli and internal brain code—an algorithmic function that updates beliefs.
Different brain codes lead to different evolutionary trajectories of:
Consciousness (C): True beliefs about an object.
Schizo-Consciousness (SC): False beliefs.

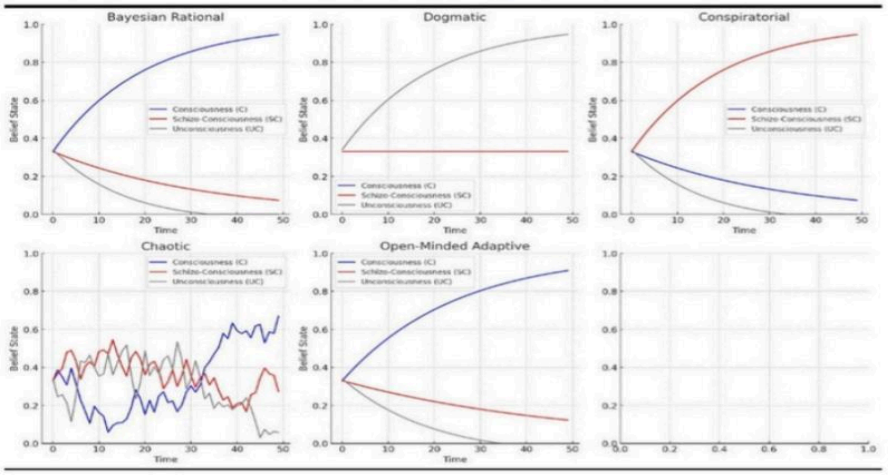
Unconsciousness (UC): Unknown or unassigned beliefs.But they might be labelled by probability metrics .
The relationship is dynamic and influenced both by the stimuli and the nature of the code.

Stimuli: Any events whose description influences the evolution of the belief state via being an input for the brain code

The brain codes themselves are influenced by evolutionary, genetic and environmental factors , different types of brain codes can represent different types of brain conditions and disorders related to consciousness and attention (attention is defined as being akin to the phenomenological experience here)

Examples can be :

Brain Codes: The brain can be said to be any object that has the capabilities to have beliefs,a code that defines how those beliefs will change as time progresses based on events that act as inputs to the code which also be called stimuli.In this manner various types of brain codes can be defined which start from a different initial state of belief s and change as time progresses based upon the code which is being run by the stimuli and this results in different evolutions of c, sc , uc over time



Consciousness
Schizoconsciousness
Unconsciousness

The above graphs(only exemplary in nature)describe some types of brain codes,codes working in a Bayesian rational manner might be seen to show trajectories where Consciousness about an object increases and Schizo-consciousness and unconsciousness decreases overtime,the conspiratorial one(might

also be akin to a schizophreniac's) is showing increase of Schizo-consciousness overtime and decrease of consciousness
Dogmatic ones are those which don't change their beliefs which will atleast keep a certain level of Schizo-consciousness overtime

5) A subtlety to notice (another description of consciousness)

It is known that a definition of consciousness has not been curated to this day and so there seems to be some subjectivity when talks are done on the topic
Some thoughts about what Consciousness is have been noted to say that it is just the amount of information contained within the brain (whether true or false doesn't matter)

An another definition of consciousness is being curated here for such a perspective

Remember the O(x)_Q(y) lattice, well it can be said that all statements on it are not represented by any brain (as they will just be infinite) but only certain statements have been given a truth value of true or false or a probability metric by the brain code

For the perspective shared here it can be said that the amount of consciousness had by the observer at any point of time is the complexity of all the statements on the x-y lattice that have been labelled with a probability or a truth value by the brain . Here it seems to end dependency upon the object

Also this might also result in addition of the subjectively defined objects's complexity into the definition of consciousness

Footnotes:

Consciousness is being said to be a property that can only be had by a system which capable of making an inference (i.e. said to have a certain belief state)

The first view about consciousness proposed here seems to be in conjunction with Darwinian theories of evolution, Consciousness evolved in the humans as it did because it was beneficial for survival,the brain codes got more and more attentuated for becoming Conscious overtime on a species level ,individuals with Consciousness disorders just happen to have brain codes that lead them have belief states that represent those disorders like schizophrenia and ADHD

There can be some types of consciousness based on the first definition given and the type of object the consciousness is about like phenomenological consciousness (Consciousness had about the surroundings at a given moment, attention)and knowledge (Consciousness gained via ideation and abstraction,like the knowledge of laws of thermodynamics, there seems to be a need to describe a Complexity metric for these)

An example of the model in work (for phenomenological consciousness)

Let's say there is a strip of black and white squares, firstly two black ,then a white and then a black one again

Case 1) A person who has seen the strip from different angles will make the right assumptions about the order of the squares and if asked within the time it was stored by the access Consciousness,he will be able to describe it and his consciousness in such a case about the object will be 1
Case 2) Let's say the person is not allowed to see it from different angles and it's placed such that the last black square's image is formed on the blind

spot of the eye. In this case the brain might make the wrong assumption of thinking it to be white, resulting in increased Schizo-consciousness

It seems ascertainable that all the squares carry the same amount of information so
Consciousness= ¾ for the first three squares
Schizo-consciousness= ¼ (about the last square)

But what if he knows that the square is on the blind spot and knows about it's functioning
In that case this person's brain has a different brain code which will ascertain that the last square's state is not known
In such a
Consciousness=¾ about the strip because of the last square
Unconsciousness=¼ about the strip because of the last square
It seems the model is apt enough to talk about such phenomenological experiences but what about consciousness gained through ideation and abstraction, knowledge of physics principles etc.

Note: part about the White paper depicting unconsciousness will have a probability argument applied to the statements in it,they are not just unlabelled true or false statements,they have an evolution of probability applied to them,their

evolution overtime can give insights into how a brain is evolving overtime.
The paper provides a lot of discussion , which might seem bothersome,but it seems some method of measuring complexity for any set of statements is needed .

Another example:

Let's say someone curates a set containing n colors and tells someone about some of them(b) ,now colours don't seem like a quality which can be defined to others by referring to other qualities that can be said to composing those qualities (so colours are non composable and b/n becomes the consciousness in this case

Now look at the scenario where a person has a box of coloured origami papers ,but the one who is looking at them is colour blind,he sees green as green and brown as green too ,so in this case a wrong qualia sensation (referring to a false statement in shared languages is there) which will result in schizoconsciousness increase

On consciousness disorders

There are many disorders of consciousness like ;

- **ADHD(Attention deficit hyperactivity disorder)**

A person who has a lack of consciousness about space around him , the person's brain code is such that it doesn't even apply a truth value to placement of objects around him

- **Schizophrenia**

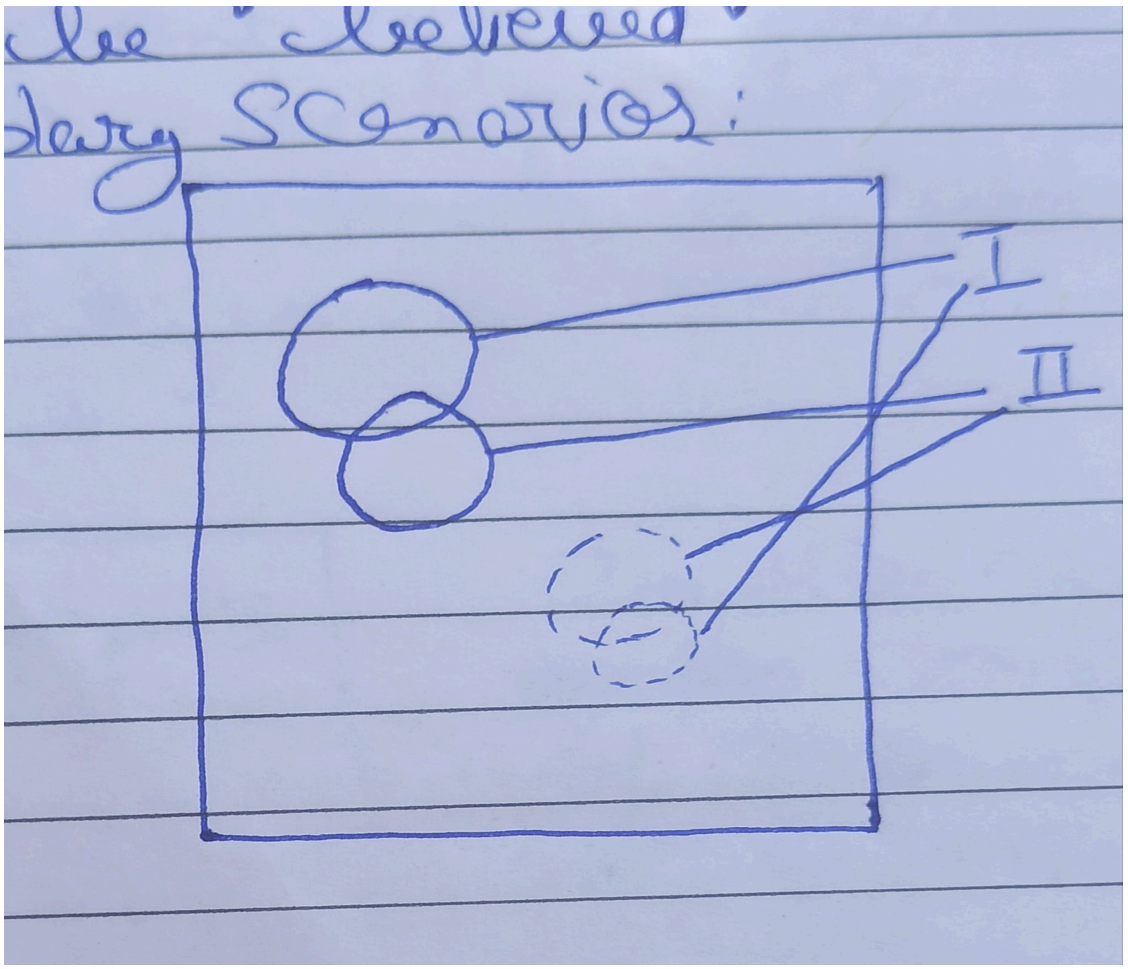
The person with this just has a belief state where the statements are labelled wrongly by the brain code

Like maintaining some false beliefs about past events or hallucinating objects in front of him at present

There can be many other types of disorders or states a person's consciousness is in which can be mapped directly to a certain type of brain codes leading to that state of consciousness,all such disorders can be said to stem from an increase in S and U about objects and a decrease in C

Synaesthesia can be seen as mislabeling of stimuli gotten from the environment by private sensations. (subjective qualia experiences)

☆ Enumerating cases of consciousness comparisons.



In the image above it can be seen that the circles representing the conscious part of description of the object for observers I & II intersect but one doesn't overlap another.

In such a case one can not be said to have more consciousness than the other. Only the complexity of consciousness be compared to be more or less because they are just conscious different parts of the same object
In such a manner different types of scenarios involving can be imagined and judged as to what

they tell about the state of consciousness of an individual or a number of individuals.

The need for refinement

- **This model seems to have a need for curating a generalized method of measuring complexity/ a method for measuring complexity related to knowledge (as described here as Consciousness gained via ideation and abstraction)**

What the descriptive model points to:

Yeah, it's a descriptive model,but that in itself is a need well known which has been mentioned in the discourses about consciousness and it is pointing to a possibility too,just when can it be said that an event has happened which can be said to be the origin of an inference,that specifies what to look for in experimentation,also those inferences are made in form of qualia sensations(they depict the quality of the object to the observer)and shared language can have words referring to those sensations ,all qualia sensations correspond to a statement but not all shared language statements might correspond to qualia sensations (like the statement telling the temperature of sun’s surface,no one seems to have a qualia sensation for that , only for the statements representing the fact in shared language symbols)

Just when can it be said that an inference has been made?(This is what discriminates between systems that can have consciousness and systems that can't.

Conjecture:

It can be said that sometimes some qualities Q’(can be composable or non composable from two or more distinct elements) are had by an object as a result of having certain other qualities

And when such a law (that some set of non composable qualities result in Q’ being had by the object) is noticed it can be represented in the O_Q language that was curated above in the following form :

Q(a1)+Q(a2)+Q(a3)+.....+Q(a(some natural number))

=>

Q(b1)+Q(b2)+Q(b3)....+Q(b(some natural number))

Where the Q(a) represent the non composable qualities Q’ is a result of and Q(b) are the non composable qualities composing Q’ and the sign => is read as “result in ”.

Qualia elements:

Our qualia(Wittgenstein's private language) can also be seen as a language that applies symbols to qualities of objects and some qualities are non composable which will directly correspond to a specific qualia element
(symbols of non composable qualities in qualia)

In case of phenomenological Consciousness:

It can be said that number of non composable qualities and object is made of is the complexity of the object
It is dependent upon the interpretation of stimuli by the brain

In case of abstract Consciousness:

Abstract Consciousness is had when a law is is used to make inferences about the interpretations of the stimuli by the brain (brain reasons based on laws ,can be represented in the way described above)

Now the complexity of statements inferred by the brain on application of that law (if the law that the brain applies is one which results in true statements) can be

measured by multiplying the complexity of resultant quality Q’ (number of non composable qualities it is composed of) and the number of objects the law is applied upon (as all those objects got the the quality Q’)

This model doesn't yet seems to have a concrete method of measuring complexity, though some conjectures are there and there some more hinted at below,just some AI generated examples

6. Complexity and Measurement

A critical component is measuring complexity of descriptions. Options include:

- Binary encodings: Statements are written in binary, with bit-length reflecting complexity.
- Code length: Using programming languages like Python or Java, the number of characters required to generate the object's description can serve as a measure.
- Entropy-based metrics: Information-theoretic tools like Shannon entropy or Kolmogorov complexity

may provide formal grounds for estimating complexity objectively.

This section requires refinement and empirical validation but serves as an essential component of the formal model.

Consciousness can be had by brains not sharing a language as what they are conscious of can be judged using a shared language a gauge

Complexity Metrics Based on Language

The complexity of an object's description (\(COD \)), true beliefs (\(CTB \)), false beliefs (\(CFB \)), and unknown statements (\(CUS \)) can be measured using different languages or encoding systems. Here are some examples:

1. Binary Language

- **Complexity Measure**: Number of bits required to encode the description.
- **Example**:
- If the description "red, sweet, smooth" is encoded in binary, the complexity is the total number of bits used.
- Suppose "red" = 3 bits, "sweet" = 4 bits, "smooth" = 5 bits.
- Then, \(COD = 3 + 4 + 5 = 12 \) bits.

2. Programming Languages (e.g., Python, Java)

- **Complexity Measure**: Number of lines of code or tokens required to represent the description.
- **Example**:
- In Python, the description "red, sweet, smooth" might be represented as:

```python
color = "red"
taste = "sweet"
texture = "smooth"
```

- Here, \(COD = 3 \) lines of code.

There seems to be room for refinement on measuring methods of complexity , maybe inspirations can be drawn from other sources,such as theories like Integrated information theory (which makes use of amount of information as a metric),or maybe some other refinements that suit the needs here best can be found in the future.
Maybe amount of memory required to store the amount of information might be a metric worth using too

Note: The words red sweet smooth are used as reffering to the objective qualities of the objects, like some wavelength of light can be termed red and they don't refer the subjective experience the person is having,here they are treated as symbols that represent the quality to the person

Footnotes:

Final words:

The model presents the O_Q graph (which amounts to placing of all thinkable predicates on the y axis) and the white paper metaphor with a distinction between phenomenological (based on inference of stimuli by the brain) and abstract Consciousness(based on reasoning based those “stimuli resulting in the subjective experience”)

It also seems to makes a concrete distinction between objects with Consciousness and others by sharing looking the a origination of an inference (it will be recorded in a private language (qualia) at first in any organism on birth)

It has provided a method to compare Consciousness of individuals for finding out who has more consciousness than others or do they equate

A concrete measure of complexity (amount of information held by the system that can be said to have Consciousness(is making inferences) seems to be a need when comparing Consciousness of individuals when they don't share Consciousness(reffering to the vector component here)about the same objectively and definitely described object but workarounds are there it seems and possibilities of a refinements too .The conjecture of non composable composable qualities that can make up the y axis of the O_Q graph seems is

probably wrong,(the motive is to present what is the problem here concretely by mentioning it) ,the O_Q graph still seems to have capability of being able to represent the inference state of the inference machines (brains) (before doing that refinement of taking out the composable qualities,is it possible to do that refinement or does it have the capability of representing all qualities after that is debatable)

In any case a measure of consciousness will depend on the amount of information held by the conscious system,that much seems ascertainable from here

It also seems to give a rigid classification of psychiatric conditions and disorders based on variations and subtleties of brain codes (the inference machines)and seems to in conjunction with Darwinian theories of evolution.

On the Conjecture:

The O_Q before (before being given the refinement) will have all the Qs on the y axis such that they correspond to every single thinkable predicates in logic theory which take the objects on the x axis as inputs,now let's say a person has been person told some set of true statements and the y axis has every single thinkable quality /predicate (they need to have distinct meanings)that can be thought of

Now the truth of value of some of the intersection points will be ascertained by the observer (just of the ones the statements told them ,not of the ones that can be reasoned from them or they are reasoned from)
The number of qualities or predicates for which the truth value was ascertained in such a way is called the complexity of that set of statements

A note: Some qualities that can be had by objects are smbolized in qualia sensations but not all , some are only symbolized in shared languages and so when talking such qualities,the syntactic complexity of symbols of those qualities might be required (eg.one can be said to have no sensation for the sun’s core temperature but we still symbolize it with measures of temperature scales in Kelvin or celsius)

Inspirations/References for this paper:

1) Wittgenstein's private language argument and discourses in his “Philosophical Investigations”

2) Tononi's usage of a Completexity metric “ in Integrated information theory ”,this is just an inspiration as it seems a measure of information content in a system said to be conscious will be crucial to any such model defining consciousness

3)Karl friston's modelling of brains as Bayesian inference machines (Free energy principle model)