Mind and Qualia

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ABSTRACT

This paper is about consciousness. It takes explicitely into account the fact that consciousness, the unified mental pattern that brings together the object and the self, emerges in living matter. Consideration of the autopoietic properties of the brain as a living system leads to the possibility that consciousness emerges from the splitting of the brain's computational and quantum representational skills. This latter process takes into account the creation of qualia. In a nonlocal quantum universe the separation between mind and matter is reexamined in the light of neuroplasticity. The argument is developed on the basis of three axioms whose validity is recognized to different degrees.

Keywords: Church-Turing Thesis, Autopoiesis, Explanatory gap, Neuroplasticity, Qualia.

1. Introduction

I take the following statements to be self evident: (1) that every mental process has a physical grounding and is consistent with the natural sciences, (2) that the world is given but once, and (3) that consciousness emerges in living matter and therefore that no consciousness can be expected to emerge in 'dead physical systems' (DPS) defined as those systems whose operation can be understood in terms of the operations of its parts: a machine (Lucas 1961; Penrose 1994). I therefore posit that no knowledge is possible outside specific biochemical properties of neural tissue. Materialism does not imply determinism. Materialism implies that the origin of the mind/world is in matter, living matter: a brain where quantum effects will reshuffle the deck (Schwartz 2004).
The declared aim of this paper is to understand how the physical neural processes going on in the brain give rise to the sum of feelings that we call Mind; understanding this link is important because the mind is the repository of all that we know and can ever expect to know (Wilson 1999).

The accent is on the possibility to show the limitations of computationalism in all its forms when it comes to the implementation of cognitive processes: reference will therefore be made to computer terminology whenever this will be necessary. In particular the question of the 'universality' of the different computational forms (T-comp, natural, hypercomp) will be discussed with reference to the brain; the splitting of the brain skills in computational and representational ones will be considered in order to allow for both its operational autonomy in terms of self-referentiality and the mutually affecting relationship between itself and the environment: the autopoietic brain (Maturana and Varela 1972; Mogi 2003).

Belief in the intrinsic unity of knowledge rests ultimately on the hypothesis that every mental process has a physical grounding and is consistent with the natural sciences: knowledge is always with reference to an observer (the brain creates the mind), thus a physical theory can only have absolute universal validity in a 'kantian' sense. Accordingly we can be compelled to recognize the existence of facts, that do not consist in the truth of propositions expressible in a human language, without being able to state or comprehend them (Nagel 1974). This is what qualia are for, the objectivity of cognition as obtained from the subjectivity of the feelings of what happens (Damasio 2000). The world is indeed given but once, the represented one and specifically ours: this means that although there exists a world out there, its cognition, its "reality" is given by the interaction with the observer. The brain creates the world and is contained in it, this is why, as it has been observed by Schroendiger, the self never appears in our scientific vision of the world: the self is the same as the totality of our vision of the world and therefore cannot be contained in it as a part. The only knowledge that we have of the world is through bodily self awareness and the phenomenal properties of represented objects or qualia: mental life can be understood in terms of first-person present-tense subjective experience. This raises the question whether it makes sense to ask what my experiences are *really* like as opposed as to how they appear to me. In this sense the mind and the world coincide as creations of the brain and in consequence whether there is at all an explanatory gap (Levine 1983) is an open question.

2. A conjecture for consciousness

Computation refers to a generic notion of mechanical rationality: namely a relationship between mathematical objects associating an input value to each output. Because computability is a strictly mathematical concept not bound to any particular type of computing device, from the very beginning the need was felt to define what a machine (in the Turing sense) could compute as against a sentient being.

Turing himself states: "…digital computers […] are intended to carry out any operation which could be done by a human computer", and further "…digital computers […] can mimic any discrete-state machine. They are universal machines" (Turing 1950).

In fact the Turing Machine concept defines what, mathematically, we mean by an algorithmic (or effective or recursive or mechanical) procedure or every function that would naturally be regarded as computable. This is what the original Church-Turing Thesis (CTT) is about, a statement on computation as a mathematical process: for any algorithm there is an equivalent Turing machine that can compute it.

Of course the argument is rather circular and the mention of a "human computer" further raises the problem of the relation to actual physical systems. Turing seems to expect that what would "naturally be regarded as computable" could also, at least in principle, be computed in nature. This is precisely the central problem in AI research: whether actual physical systems (presumably including human brains) – subject as they are to precise physical laws – are able to perform more than, less than or precisely the same logical and mathematical operations as Turing machines (Penrose 1989). Posing the problem in these terms of course fails to acknowledge that the brain is a dissipative system (Vitiello 2004) and further that since there are more functions than TM, there are functions that are not T-comp belonging to a non countable infinite set.

However by establishing a link between the human mind as the representational phenomenology of the neural activity of the brain and the brain itself, it is possible to give an operational definition of the mind before comparing it to a UTM. It is possible to adapt the formulation of the original CTT to encompass all physical systems:

> *"It is possible to build a universal computer: a machine that can be programmed to perform any computation that any other physical object can perform".* (Deutsch 1985)

Having thus lost sight of the original CTT and wanting to stress the 'physicality' and the 'universality' of the system it is a small step to:

> *"There exists a universal physical system (UPS) whose evolution includes any physically possible system".*

This formulation has the further advantage to bring the whole debate back within Physics whereby the physical system can be chosen as 'universal' for reasons which are rooted in the experience of the physical world rather than for purely logical ones (Licata 2007). This claim of 'universality' is of course different from what can be said of TM, both in natural computation and hypercomputation it is well known that different solutions will require the computing devices to be ad hoc adapted to the problems under consideration.

At this point it is interesting to note that so far, however, the physical version of the CTT only extends the concept of computability to all physical systems

considered as computing devices; nothing is said about the nature of the physical systems. It seems tacitly assumed that what they can do is some sort of *"unconscious computation"* where they apply the "rules of the game" (the syntax = the program) without knowing the meaning of what they are doing (semantics). What of the brain? The brain is itself a physical system and as such can perform 'computations' with two important differences: the brain (or rather ourselves as embodiement of the brain, because in this context there is always an observer behind each *"computing"* physical system) is aware of being computing and somehow it knows the meaning of what it is doing thanks to its representational skills or qualia: the richness of knowledge! The brain can therefore simulate the evolution of the object physical system using its computational skills, and simulate itself in the act of carrying out the measurement because it knows that it is doing just that!

In order to account for this particular brain skill, it is necessary to put forward a new Conjecture for consciousness in the following form:

"There exists a UPS whose evolution includes any physically possible system, including itself".

The element of *'reflexivity'* implied by the sentence *'including itself'* introduces the potentiality for consciousness because such a UPS would have a cognition of its own workings.

I argue that the brain is such a UPS and then it becomes clear that comparing living systems to DPS is restrictive because only computational skills can be compared. Even hypercomputation in all its varieties will fail to produce a viable universal computing mechanism showing 'living matter consciousness'. Unless a high degree of integration will be present in a computing model open both onto the environment (dissipation) and onto itself (reflexivity) and therefore able to compress its own evolution, even super-Turing conscious cognitive activities like those emerging from a dynamic cooperation between traditional computational modules show a type of emergence purely computational failing to show a real emergence of semantic domains. No other UPS (if any!) will ever be able to achieve consciousness in spite of ever growing computational power. Because the software is always "closed" relative to a specific hardware, a UPS can compress its knowledge but cannot simulate its own evolution in the act of knowing because it does not know the meaning of what it is doing.

3. The conscious brain

Because the material structure (the hardware) molds and constrains the computing mechanism (the software) (Chalmers 1996), only biological systems will ever be able of consciousness: their 'hardware' (the brain) is ever evolving making possible 'software adaptivity' (learning) leading in turn to neuroplasticity in a recursive way (Damasio 2003). This takes into account how the brain

modifies its semantic domain showing different levels of logic-informational aperture.
As a living system the brain is an autopoietic system and therefore it *exists in two operational domains, namely: the domain of its composition that is where its autopiesis exists and in fact operates as a closed network of molecular productions, and the domain or medium where it arises and exists as a totality in recursive interactions* (Maturana, 1997).
Autopoiesis is a way of defining living systems but, although there is only one way of being autopoietic, there are more than one way to be 'alive' in the sense of being sustainable like, for instance, conscious thought. Life and cognition are two faces of the same coin.
Therefore by arguing that the brain is a UPS whose evolution includes any physically possible system including itself we must admit that the brain splits into its computational skills (responsible for the manipulation of symbols: the computation in all its forms, T-comp, super-Turing, etc) and representional skills described as some kind of non-symbolic computation "beyond-Turing" in terms of qualia. In this way it is possible to allow for both its total operational autonomy in terms of self-referentiality (reflexivity) (Schwartz 2004; Stapp 2004) and the mutually affecting relationship between itself and its environment (Maturana, Varela 1972, Mogi 2003).
Comparing UPS to human brains - (Fodor 2000) and (Pinker 1997, 2005) - is falling short of one dimension: the representational one (Churchland 1985).We can expect the closing of the explanatory gap - the convergence between the objective physical processes and the subjective first-person conscious experience – when inside the autopoietic mechanism of a living system, the neural physical processes are as it were having a subjective representation: the physical account of a subjective first-person experience.
Furthermore by postulating the coincidence of the world (the observed) and the mind (the observer) as creations of the brain, the raising of our cognition out of a quantum background is introduced in a natural way: because science is about what we can know, quantum theory involves not just what is "out there" (the world) but also what is "in here" (the mind). Bell has shown that the universe is nonlocal and that at the bottom nature must be governed by quantum rules: in a nonlocal universe the separation between mind and world meets its ultimate challenge. In fact the problem arises, as I have shown, when the observing system is the same as the system being observed – when, that is, the mind is observing the brain. Nonlocality suggests that nature may not separate ethereal mind from substantive stuff.....It is here, when the mind contemplate itself and also the brain, that these issues come to a head. In the case of a human being who is observing his own thoughts, the fiction of the dynamic separation of mind and matter needs to be reexamined. Neuroplasticity can be the answer.

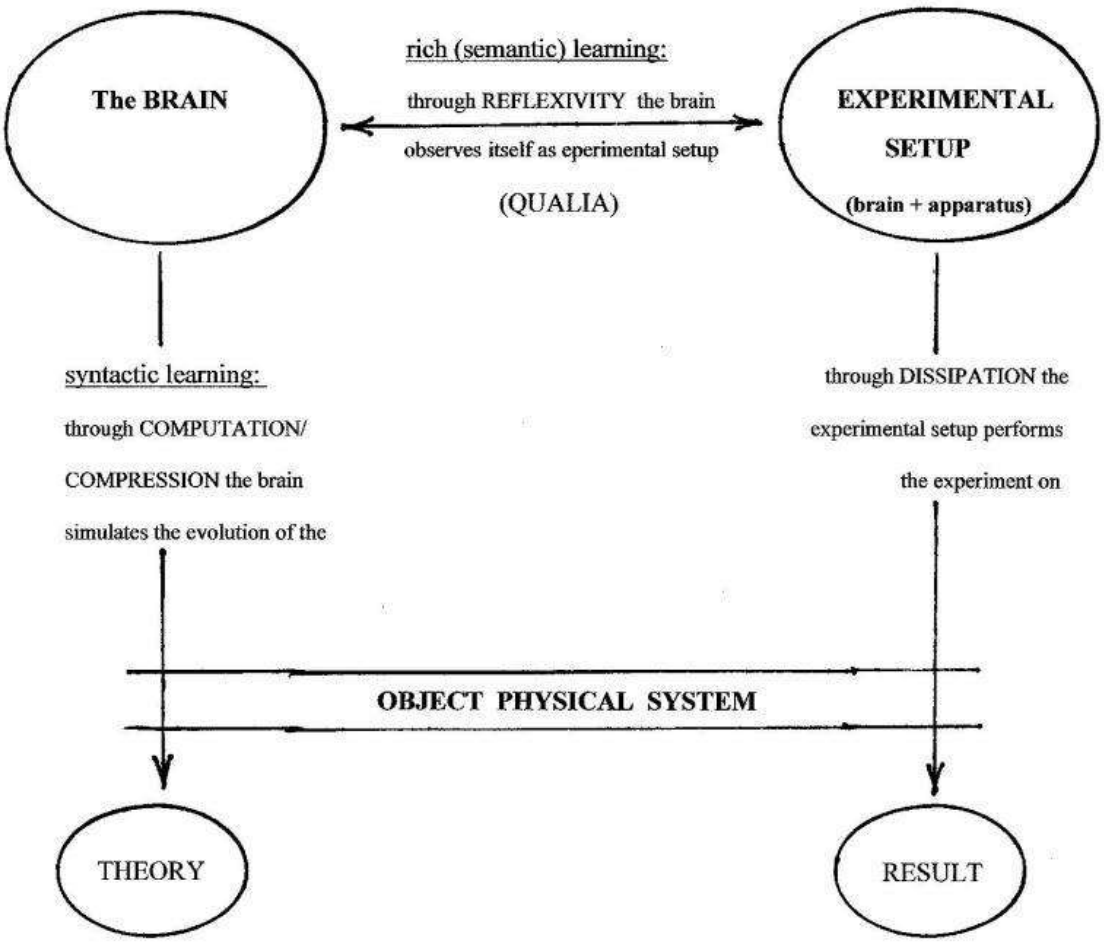

Fig.1 - The brain can simulate the evolution of the object physical system using its computational skills, and simulate itself in the act of carrying out the measurement because it knows that it is doing just that! (page....)

According to Schwartz (Schwartz 2004; Schwartz, Begley 2002) the quantum states of the brain split into a vast host of classically conceived possibilities leading to a huge *smear* for which it will be necessary to appeal to quantum rules (von Neumann 1955) in order to connect the physically described world to the stream of consciousness of the observer with an important difference: that qualia will, as it were, merge the objectivity (ontology) of the physical world with the subjectivity (epistemology) of what we can know about the physical world.
Qualia are representational mental states of neural activity that are embodiment of the relations generated through either external or internal interactions. Both are sets of states of neural activity that can be said to represent the interactions. A nervous system that is capable of treating its internally generated states of activity as different from externally generated states, that is of distinguishing their origin, is capable of abstract thinking and such a nervous system can interact with the

representations of its interactions, and hence of the organism, in an endless recursive manner.
Qualia are the source of objective cognition in a 'kantian' sense . In fact, what J.R. Lucas (Lucas 1961) had stated in 'simple' words - consciousness is knowing to know, and knowing that you know that you know and so on in a recursive way - we can express in a more detailed way by saying that consciousness is in its most general sense a cognition of one's internal states in terms of qualia. It is possible to say that the object, its mental representation and knowing to have that representation (the feeling of what happens) (Damasio 2000) are subjectively instantiated through reflexivity by the brain performing a metacomputation: i.e. on top of the computation (the observation) the brain is making a phenomenological 'measurement' of the its neural activity. It is having a metacognition of its internal state (Mogi 2003): the mind is the experiential representation of the neural activity of the brain.
The mind is the brain's quale in the act of knowing: it is at this level that the subjective experience of qualia is transposed to a level that engenders the sustainability of conscious thought (semantic learning).
Sustained thought is something of which we are aware. We are aware of a remembered past, of a lived present and of a planned future: sustained thought is conscious thought. I think that it will be easier to tackle a concrete notion, e.g. conscious thought, rather than an abstract property like consciousness to sort out what we are talking about.
In the first place it would be natural to put consciousness in the same category as other fundamental subject matters like time, space, matter, life, etc. When we talk about such abstract concepts, we do it by making reference to something measurable: seconds, miles, grams, DNA; in the case of consciouness it could be reasonable to make reference to sustained thought as defined above.
Sustained thought is a notion crossing over generations handing down the acquired knowledge that makes progress possible in the form of meme: technical, cultural, artistic, moral, social and so on.
Sustained thought is thought that is 'alive' in an autopoietic sense: it reflects on itself and interacts with the world and, in so doing, it molds the brain without constraints.

4. Conclusions

In this paper I discussed the splitting of the brain's skills at different levels: first I discussed the computational vs representational skills.
This splitting is reflected in the autopoietic nature of the brain allowing for both its total operational autonomy in terms of self referentiality and the mutually affecting relationship between itself and its environment: it results in fact in the

splitting between its sinctactic (the rules of the game) and semantic properties or qualia that make objective cognition possible in a 'kantian' sense.
The third level of splitting happens when the quantum nature of qualia is reduced to a metacognition of the brain's internal state: the mind is the experiential representation of the neural activity of the brain. The mind is the brain's quale in the act of knowing: it is at this level that the subjective experience of qualia engenders the sustainability of conscious thought.
In fact, because the world is given but once, the function of the qualia is to merge the objectivity (ontology) of the physical world with the subjectivity (epistemology) of what we can know about the physical world: thus by closing the explanatory gap it is possible for the mind to change the brain (neuroplasticity). Semantic learning, as it were, can be conceived as a "conscious mental field" (Libet 2004) whereby our neural connections are ever evolving contrary to what happens in DPS where the hardware molds and constrains the software.

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