

## NEUROPHENOMENOLOGY A Methodological Remedy for the Hard Problem

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**Abstract:** This paper starts with one of Chalmers' basic points: first-hand experience is an irreducible field of phenomena. I claim there is no 'theoretical fix' or 'extra ingredient' in nature that can possibly bridge this gap. Instead, the field of conscious phenomena requires a rigorous *method* and an explicit pragmatics for its exploration and analysis. My proposed approach, inspired by the style of inquiry of phenomenology, I have called neurophenomenology. It seeks articulations by *mutual constraints* between phenomena present in experience and the correlative field of phenomena established by the cognitive sciences. It needs to expand into a widening research community in which the method is cultivated further.

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This paper responds to the issues raised by D.J. Chalmers (1995) by offering a *research direction* which is quite radical in the way in which some basic methodological principles are linked to the scientific studies of consciousness. Neuro-phenomenology is the name I am using here to designate a quest to marry modern cognitive science and a *disciplined approach* to human experience, thus placing myself in the lineage of the continental tradition of phenomenology.<sup>1</sup> My claim is that the so-called hard problem that animates these Special Issues of the *Journal of Consciousness Studies* can only be addressed productively by gathering a research community armed with new pragmatic tools enabling them to develop a science of consciousness. I will claim that no piecemeal empirical correlates, nor purely theoretical principles, will really help us at this stage. We need to turn to a systematic exploration of the only link between mind and consciousness that seems both obvious and natural: the *structure of human experience itself*.

In what follows I open my proposal by briefly examining the current debate about consciousness in the light of Chalmers' hard problem. Next, I outline the (neuro)phenomenological strategy. I conclude by discussing some of the main difficulties and consequences of this strategy.

### I: A Cartography of Approaches

#### *The riddle of experience*

Chalmers opens up the discussion of the 'hard problem' by focusing on *the* problem that seems central: the *experience* associated with cognitive or mental events.

Sometimes terms such as 'phenomenal consciousness' and 'qualia' are also used here, but I find it more natural to speak of 'conscious experience' or simple 'experience' (Chalmers, 1995, p. 201).

After describing case studies of some popular functionalist explanations, Chalmers moves to qualify the remaining challenge as some necessary 'extra ingredient'. The choice of the term is already revealing, for Chalmers seems to assume from the outset that

<sup>1</sup> The use of 'neuro' should be taken here as a *nom de guerre*. It is chosen in explicit contrast to the current usage of 'neurophilosophy', which identifies philosophy with anglo-american philosophy of mind. Further, 'neuro' refers here to the entire array of scientific correlates which are relevant in cognitive science. But to speak of a neuro-psycho-evolutionary-phenomenology would be unduly cumbersome.

the only avenue is to find theoretical principles that will bridge the gap between cognition and experience. As I will detail below, it seems that another fundamental alternative is to change the entire framework within which the issue is discussed. In any case '[t]he moral of all this is that *you can't explain conscious experience on the cheap*' (p. 208; his italics). I entirely agree but hasten to add that the price we need to pay is heavier than most people are willing to concede. Again the central difficulty is that experience is 'not an explanatory posit, but an explanandum in its own right, and so it is not a candidate for [reductive] elimination' (p. 209). What is needed, he concludes, is a form of non-reductive explanation. Here again, I concur with Chalmers, but one of my tasks will be to detail how different our options are from this point onwards.

Let me begin my re-focusing the question of experience in the current boom in the scientific study of consciousness. As we all know, the number of books, articles and meetings on the subject has increased exponentially over the last few years. Why this current outburst after all the years of silence, during which consciousness was an impolite topic even within cognitive science?

To be sure, after the peak of dominance of behaviourism there had to be a conservative phase before cognitive science felt that it had some ground under its feet. More important perhaps was the style of the dominant philosophy of mind in the USA (with numerous followers in Europe), which is intrinsically suspicious of subjective experience. Within this framework, significant developments in cognitive science have been accomplished almost exclusively within a cognitivist-computationalist or a connectionist perspective. Connectionism in particular made possible a revolutionary idea of transitions and bridges between levels of explanation, better understood as a philosophy of emergence: how local rules can give rise to global properties or objects in a reciprocal causality. This gave new meaning to the traditional mind/body interface, which in the form of cognitive processes as computationalist or connectionists schemes, made an array of specific cognitive phenomena (vision, motion and associative memory are prime examples) solvable (if not solved) in principle. These developments, at the same time, created the very background for the 'hard problem', since they made consciousness appear as devoid of any causal relevance. This is well illustrated in Ray Jackendoff's pioneering book, in which the 'phenomenological mind' (i.e. consciousness *qua* experience) is seen as projection from a 'computational mind' (i.e. cognitive mechanisms) where all causality takes place. Thus the only conclusion he can come to is that consciousness 'is not good for anything' (1987, p. 26).

Further, in parallel developments, new techniques for large-scale analysis of brain activity and neuropsychology have for the first time allowed us to ask direct experimental questions concerning complex cognition correlates in action, such as mental imagery and emotions (see for example Posner and Raichle, 1992; Mazoyer, Roland and Fox, 1995). The experiments involving such non-invasive on-line measurements are particularly interesting since they have led researchers to confront such questions as: Can a subject's report be taken at face value? What are verbal reports expressions of? These are basically experiential questions that already imply a significant revision of the manner in which accounts of human experience have to be approached in empirical research.

One day the intellectual history of the peculiar twists and turns of this problem space will be reviewed thoroughly. But it has a *déjà-vu* aura to it, reminding us of many swings of the pendulum, between rejecting and total fascination with the scientific discussions of conscious experience. This can hardly be otherwise, since any science of cognition and mind must, sooner or later, come to grips with the basic condition that we have no idea what the mental or the cognitive could possibly be apart from our own experience of it.

As John Searle has aptly remarked in his own contribution to the boom, if there is a research phase favouring strictly materialist theories of mind:

[the philosopher] encounters difficulties. It always seems that he is leaving something out . . . [and] underlying the technical objections is a much deeper objection . . . [that] can be put quite simply: The theory in question has left out the mind; it has left out some essential feature of the mind, such as 'consciousness' or 'qualia' or semantic content . . . [Thus] if we were to think of the philosophy of mind as a single individual we would say of that person that he is a compulsive neurotic, and his neurosis takes the form of repeating the same pattern of behavior over and over (Searle, 1992, pp. 30–1).

I agree with the diagnosis as much as I disagree with Searle's proposed cure (more on that later). Clearly we need some radical measures to compensate for this compulsive behaviour. That is precisely what I intend to do here, with a proposal that will probably seem radical for some; but nothing short of it will break the vicious circle and bypass the attempts to fix it with yet another abstract, theoretical model.

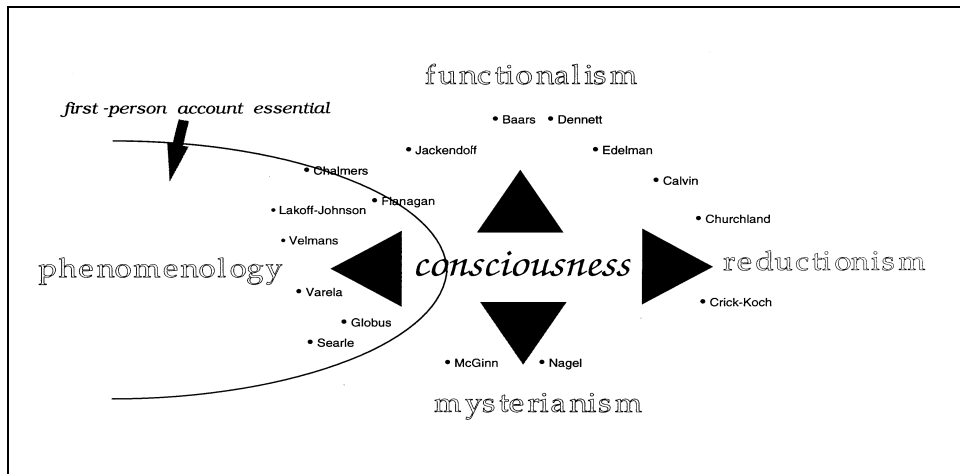


Figure 1

#### A four-way sketch

In order to appreciate my position the reader should now turn to the sketch in Figure 1 outlining four axes that seem to capture the essential orientations in the current boom of discussion on consciousness. It is not intended to be an all-encompassing chart of the various viewpoints, but an occasion to place myself in context with modern authors that have published extensive arguments (generally in book form) over the past few years.<sup>2</sup>

In the far right orientation, I have put the very vocal trend best represented by P.S. Churchland, but including F. Crick and C. Koch, and close to the spontaneous philosophy of many other of my colleagues in neuroscience, and appropriately labelled as neuro-reductionism or eliminativism. As is well-known, this view seeks to solve the

<sup>2</sup> Note that this is a chart of naturalistic approaches, that is, positions that each in their own way provide a workable link to current research on cognitive science. This excludes at least two streams of popular discussion: on the one hand views that take a traditional dualistic stance (*à la* J.C. Eccles); on the other hand calls for new foundations from the quantum mechanics proponents. I find both these views extreme and unnecessary, and concentrate on those that are based on current neuroscience and cognitive science in some explicit manner.

hard problem by eliminating the pole of experience in favour of some form of neurobiological account which will do the job of generating it (Churchland and Sejnowski, 1992). Or as Crick puts it with characteristic bluntness: 'You're nothing but a pack of neurons' (1994, p. 2).

At the centre north I have collected a variety of positions that can be labelled as functionalist, and identified by Chalmers as being the most popular ecology of ideas active today (1995, pp. 204–9). Functionalism has been drastically preferred in cognitive science over the last 20 years, followed by the strategy to replace the link between cognition and consciousness (the most immediate one in western philosophical tradition) by the link between cognition and its corresponding functional or intentional states. In the best of cases the problem of consciousness is assimilated with that of 'qualia' for some particular features of mental states. Thus the notion of experience becomes forcefully assimilated with that of cognitive behaviour, propositional attitude, or functional role.

These views include a number of well-developed proposals including, R. Jackendoff's (1987) 'Projective Mechanism', B. Baars' (1988) 'Global Workspace', D. Dennett's (1991) 'Multiple Drafts', W. Calvin's (1990) 'Darwinian Machines', or G. Edelman's (1989) 'Neural Darwinism'. The basic move in these proposals is quite similar. First start from the modular items of cognitive capacities (i.e. the 'soft' problems). Second, construct a theoretical framework to put them together so that their unity amounts to an account of experience. The strategy to bridge this emergent unity and experience itself varies, but it is left typically vague since the entire approach relies almost entirely on a third-person or externalist approach to obtain data and to validate the theory. This position seems the most popular one in the current boom literature, and it represents an important segment of researchers in cognitive science. This popularity rests on the acceptance of the reality of experience and mental life while keeping the methods and ideas within the known framework of empirical science.

At the centre south we have the mirror image of functionalism. Mysterians such as T. Nagel (1986) and C. McGinn (1991) seek to conclude by principled arguments that the hard problem is unsolvable, based on intrinsic limitations of the means through which our knowledge of the mental is acquired.

Finally, to the left, I have put the sector that interests me the most, and which can be roughly described as giving an *explicit* and central role to first-person accounts and to the irreducible nature of experience, while at the same time refusing either a dualistic concession or a pessimistic surrender to the question, as is the case for the mysterians. This is in line with Chalmers' identification of where the hard problem lies. As are the other orientations in my sketch, the group gathered here is a motley one, with odd bedfellows such as G. Lakoff and M. Johnson's (1987) approach to cognitive semantics, J. Searle's (1992) ideas on ontological irreducibility, G. Globus' (1995) 'post-modern' brain, and at the edge, O. Flanagan's (1992) 'reflective equilibrium', and Chalmers' (1996) own proposal as fully developed in his recent book.

What is interesting about this diverse group, within which I place myself, is that even though we share a concern for first-hand experience as basic fact to incorporate in the future of the discipline, the differences are patent in the manner in which experience is taken into account. The phenomenological approach is grounded on a peculiar move to explore experience which is at the centre of my proposal. This sufficiently clarifies, I hope, the context for my ideas within the current scene. Now we may move to the heart of the matter, the nature of the circulation between a first person and an external account of human experience, which describes the phenomenological position in fertile dialogue with cognitive science.

## II: A Phenomenological Approach

### *Irreducibility: the basic ground*

The phenomenological approach starts from the *irreducible* nature of conscious experience. Lived experience is where we start from and where all must link back to, like a guiding thread. Most modern authors are disinclined to focus on the distinction between mental life in some general sense and experience, or manifest some suspicion about its status.

From a phenomenological standpoint conscious experience is quite at variance with that of mental content as it figures in the anglo-american philosophy of mind. The tension between these two orientations appears in a rather dramatic fashion in Dennett's (1991) book, where he concludes with little effort (15 lines in a 550 page book) that phenomenology has failed. He remarks:

Like other attempts to strip away interpretation and reveal the basic facts of consciousness to rigorous observation, such as the Impressionistic movements in the arts [*sic*] and the Introspectionist psychologists of Wundt, Titchener and others, Phenomenology has failed to find a single settled method that everyone could agree upon (p. 44).

This passage is revealing: Dennett mixes apples and oranges by putting impressionism and introspectionism in the same bag; he confuses introspectionism with phenomenology which it is most definitely not (*vide infra*); and he finally draws his conclusion from the absence of some idyllic universal agreement that would validate the whole. Well, we do not demand 'that everyone could agree' upon, say, Darwinism, to make it a remarkably useful research programme. And certainly *some* people do agree on the established possibility of disciplined examination of human experience. In a book that is in many other respects so *savant* and insightful, this display of ignorance concerning phenomenology is a symptom that says a lot about what's amiss in this field.

The main point that must be brought to the fore is clearly made by Searle:

. . . much of the bankruptcy of most work in the philosophy of mind . . . over the past fifty years . . . has come from a persistent failure to recognize and come to terms with the fact that the ontology of the mental is an irreducibly first-person ontology . . . There is, in short, no way for us to picture subjectivity as part of our world view because, so to speak, the subjectivity in question is the picturing (Searle, 1992, pp. 95, 98).

But in Searle's defence of the irreducibility of consciousness there is an inability to come to any conclusion about how to solve the epistemological issue concerning the study of consciousness. Searle wants us to accept that 'the irreducibility of consciousness is merely a consequence of the pragmatics of our definitional practices' (p. 122), and therefore, although the irreducibility of consciousness is a 'straightforward argument' it 'has no deep consequences' (p. 118). In fact,

The very fact of subjectivity, which we were trying to observe, makes such an observation impossible. Why? Because where conscious subjectivity is concerned, there is no distinction between the observer and the thing observed . . . Any introspection I have of my own conscious state is itself that conscious state' (p. 97).

The mental does not have any obvious manner to investigate itself, and we are left with a clear logical conclusion, but in a pragmatic and methodological limbo.

This is not unlike the limbo in Jackendoff's views, who in his own way also claims the irreducibility of consciousness but is tellingly silent when it comes to method. He does

claim that insights into experience act as constraints for a computational theory of mind, but follows with no methodological recommendations except 'the hope that the disagreements about phenomenology can be settled in an atmosphere of mutual trust' (Jackendoff, 1987, p. 275). Mutual trust indeed! What is needed is a strict *method* and that is where both the difficulty and the revolutionary potential of the topic lie.

*Method: moving ahead*

We need to examine, beyond the spook of subjectivity, the concrete possibilities of a disciplined examination of experience that is at the very core of the phenomenological inspiration. To repeat: it is the re-discovery of the primacy of human experience and its direct, lived quality that is phenomenology's foundational project. This is the sense in which Edmund Husserl inaugurated this thinking in the West, and established a long tradition that is well and alive today not only in Europe but world-wide. In fact, between 1910 and 1912, while Husserl was at the peak of his creative formulation of phenomenology, in the United States William James was following very parallel lines in his pragmatic approach to cognitive life. And to complete the planetary 'synchronicity' of this turn, a very innovative philosophical renewal appeared in Japan, the so-called Kyoto School, initiated by Nishida Kitaro and then followed by Nishitani Keiji and others. Husserl and James knew and read each other, and the members of the Kyoto school read widely in western phenomenology and spent extensive periods of training in Germany. Thus I believe we should consider these *anni mirabiles* for phenomenology, akin to the years 1848–52 for the birth of modern evolutionary biology.

It is fair to say that phenomenology is, more than anything else, a *style of thinking*, which Husserl started in the West, but it is not exhausted by his personal options and style (Lyotard, 1954). I do not want to engage in an account of the diversity and complexity of western phenomenology (see e.g. Spiegelberg, 1962). The contributions of individuals such as Eugen Fink, Edith Stein, Roman Ingarden, and Maurice Merleau-Ponty to cite only a few have attested to a continuing development of phenomenology. More recently various links with modern cognitive science have been explored (see for instance Dreyfus, 1982; Varela *et al.*, 1991; Klein and Wescott, 1994; Petitot, 1995; Petitot *et al.*, 1996; Thompson and Varela, 1996). I mention this explicitly because it has been my observation that most people not familiar with the phenomenological movement automatically assume that phenomenology is some sort of Husserlian scholasticism, a trade better left to dusty continental philosophers who can read German.

At best cognitive scientists might have read the collection edited by Dreyfus (1982), which presents Husserl as some form of proto-computationalist, and they assume that this bit of history is all there is to know about phenomenology. This has become an oft-quoted interpretation, but critics have made clear that Dreyfus' cognitive reading of Husserl is seriously flawed. This is not the occasion to expand on this issue, but it is essential to flag a caveat here lest the reader with a scientific background thinks it has been settled once and for all.<sup>3</sup>

My position cannot be ascribed to any particular school or sub-lineage but represents my own synthesis of phenomenology in the light of modern cognitive science and other traditions focusing on human experience. Phenomenology can also be described as a *special type of reflection* or attitude about our capacity for being conscious. All reflection reveals a variety of mental contents (mental acts) and their correlated orientation or

<sup>3</sup> For a critique of Dreyfus' take on Husserl see Langsdorf (1985) and also the objections of R. McIntyre (1986). For a recent account of this controversy through a contrast between Fodor and Husserl see J.M. Roy (1995).

intended contents. Natural or naive attitude assumes a number of received claims about both the nature of the experiencer and its intended objects. The Archimedean point of phenomenology is to suspend such habitual claims and to catalyse a fresh examination. Whence Husserl's famous dictum: 'Back to the things themselves!';<sup>4</sup> which for him meant — the opposite of a third-person objectification — a return to the world as it is experienced in its felt immediacy. It was Husserl's hope, and still the basic inspiration behind phenomenological research, that a true science of experience would be gradually established which could not only stand on equal footing to the natural sciences, but in fact would give them a needed ground, for all knowledge necessarily emerges from our lived experience.

On the one hand experience is suffused with spontaneous pre-understanding, so that it might seem that all 'theory' about it is quite superfluous. But on the other hand this pre-understanding must itself be examined since it is not clear what kind of a knowledge it stands for. Experience demands a specific examination in order to free it from its status as habitual belief. As Merleau-Ponty puts it:

To return to the things themselves is to return to that world which precedes knowledge, of which knowledge always *speaks* and in relation to which every scientific schematization is an abstract and derivative sign language, as the discipline of geography would be in relation to a forest, a prairie, a river in the countryside we new beforehand (M. Merleau-Ponty, 1945, p. ix).

I insist on bringing to the fore this basic principle of the phenomenological approach since it is often quickly translated into an empirical quest for mental correlates. We need to return repeatedly to this issue since it is only by appreciating its depth that phenomenological bridges can claim to keep a meaningful link to lived experience and to be a remedy for the hard problem.

Phenomenology grounds its movement towards a fresh look at experience in a specific gesture of reflection or *phenomenological reduction* (PhR).<sup>5</sup> I need now to unfold the bare bones of this attitude or gesture through which is the habitual way we have to relate to our lived-world changes. This does not require us to consider a different world but rather to consider this present one *otherwise*. As we said before this gesture changes a naive or unexamined experience into a reflexive or second-order one. Phenomenology correctly insists in this shift from the natural to the phenomenological attitude, since only then the world and my experience appears as open and in need of exploration. The meaning and pragmatics of PhR have taken several variants from this common trunk. It is not my intention to recapitulate them here.<sup>6</sup>

The conscious gesture that is at the base of PhR can be analysed into four intertwined moments or aspects:

*(1) Attitude: reduction*

The attitude of reduction is the necessary starting point. It can also be defined by its similarities to doubt: a sudden, transient suspension of beliefs about what is being

<sup>4</sup> 'Zurück zu den Sachen selbst!', *Logische Untersuchungen*, Vol. II, Part 1, p. 6.

<sup>5</sup> The reader should resist the temptation to assimilate this usage of the word 'reduction' to that of 'theoretical reduction' as it appears for instance in the neuroreductionist framework and well articulated in the writings of P.S. Churchland. The two meanings run completely counter to one another; it is therefore convenient to append a qualifier.

<sup>6</sup> For a recent discussion about the varieties of reduction see: R. Bernet (1994), pp. 5–36. Husserl's own first articulation can be found in his breakthrough lectures of 1907 (Husserl, 1962).

examined, a putting in abeyance our habitual discourse about something, a bracketing of the pre-set structuring that constitutes the ubiquitous background of everyday life. Reduction is self-induced (it is an active gesture), and it does seek to be resolved (dissipating our doubts) since it is here as a source of experience. It is a common mistake to assume that suspending our habitual thinking means stopping the stream of thoughts, which is not possible. The point is to turn the direction of the movement of thinking from its habitual content-oriented direction backwards towards the arising of thoughts themselves. This is no more nor less than the very human capacity for *reflexivity*, and the life-blood of reduction. To engage in reduction is to cultivate a systematic capacity for reflection on the spot thus opening new possibilities within our habitual mind stream. For instance, right now the reader is very likely making some internal remarks concerning what reduction is, what it reminds her of, and so on. To mobilize an attitude of reduction would begin by noticing those automatic thought-patterns, let them flow away, and turn reflection towards their source.

*(2) Intimacy: intuition*

The result of reduction is that a field of experience appears both less encumbered and more vividly present as if without the habitual fog separating experiencer and world. As William James saw, the immediacy of experience thus appears surrounded by a diversity of horizons to which we can turn our interest. This gain in intimacy with the phenomenon is crucial, for it is the basis of the criteria of truth in phenomenological analysis, the nature of its evidence. If intimacy or immediacy is the beginning of this process, it continues by a cultivation of imaginary *variations*, considering in the virtual space of mind multiple possibilities of the phenomenon as it appears. These ideal variations are familiar to us from mathematics, but here they are put into the service of whatever becomes the focus of our analysis: perception of three-dimensional form, the structure of 'nowness', the manifestations of empathy, and so on. It is through these multiple variations that a new stage of understanding arises, an 'Aha!' experience which adds new evidence that carries a force of conviction. This moving intimacy with our experience corresponds well to what is traditionally referred to as intuition, and represents, along with reflection, the two main human capacities that are mobilized and cultivated in PhR.

*(3) Description: invariants*

To stop at reduction followed by imaginary variations would be to condemn this method to private ascertainment. The next component is as crucial as the preceding ones: the gain in intuitive evidence must be inscribed or translated into communicable items, usually through language or other symbolic inscriptions (think of sketches or formulae). The materialities of these descriptions however are also a constitutive part of the PhR and shape our experience as much as the intuition that forms them. In other words we are not merely talking about an 'encoding' into a public record, but rather of an 'embodiment' that incarnates and shapes what we experience. I like to refer to these public descriptions as *invariants*, since it is through 'variations' that one finds broad conditions under which an observation can be communicable. This is not so different from what mathematicians have done for centuries: the novelty is to apply it to the contents of consciousness.

*(4) Training: stability*

As with any discipline, sustained training and steady learning are key. A casual inspection of consciousness is a far cry from the disciplined cultivation of PhR. This point is particularly relevant here, for the attitude of reduction is notoriously fragile. If one does



not cultivate the *skill* to stabilize and deepen one's capacity for attentive bracketing and intuition, as well as the skill for illuminating descriptions, no systematic study can mature. This last aspect of the PhR is perhaps the greatest obstacle for the constitution of a research programme since it implies a disciplined commitment from a community of researchers (more on this below).

<b>Phenomenological Reduction</b>	+
<i>aspects of method</i>	<i>characteristics of resulting examination</i>
Attitude	bracketing, suspending beliefs
Intuition	intimacy, immediate evidence
Invariants	inscriptions, intersubjectivity
Training	stability, pragmatics

#### *Avoiding some standard traps*

In previous presentations of these ideas I have found a number of misunderstandings and misleading conclusions recurring. Let me anticipate a few of these common traps and address them immediately.

- *Phenomenological analysis is not just introspectionism.*

As many have remarked, introspection presupposes that we have access to our experience in the same manner that we have access to an 'inner' visual field, as the etymology of the word suggests, by inspection. Such an internal examination is a normal cognitive ability of reflective doubling, a gesture in which we engage regularly. It assumes a certain referential 'I' who does the self-observation, a narrative network that shapes what we identify as a subject.

In pre-phenomenology days (i.e. without reduction) introspection elicited a wave of interest in psychology starting with the work of W.Wundt, followed by others such as E.Titchener in USA and the Würzburg school. Despite an initial enthusiasm the research programme advanced by introspectionism did not take root. Among other problems, reports from different laboratories could not reach a common ground of validation. A classic case was the issue of whether visual imagery played a role in problem solving or not. The method employed began with reflection but gave explicit direction as to what to look for or what kind of distinctions to make, much as we are used to seeing done in modern experimental psychology. Inevitably the reports became more and more influenced by the theoretical underpinnings of the studies, and in fact rapidly degenerated into arguments about authority. The historical account of Lyons (1986) is written as an obituary for introspection. But this would be a premature conclusion, as Howe (1991) reminds us.

This manner of mobilizing reflexive capacities still falls into the natural attitude for a phenomenologist, for it rides on the wave of previous elaborations and assumptions. Phenomenology does share with introspectionism an interest in the reflective doubling as a key move of its approach to phenomena. But the two attitudes part company. In PhR the skill to be mobilized is called bracketing for good reasons, since it seeks precisely the opposite effect of an uncritical introspection: it cuts short our quick and fast elaborations

and beliefs, in particular locating and putting in abeyance what we think we 'should' find, or some 'expected' description. Thus PhR is not a 'seeing inside', but a tolerance concerning the suspension of conclusions that allows a new aspect or insight into the phenomenon to unfold. In consequence this move does not sustain the basic subject-object duality but opens into a field of phenomena where it becomes less and less obvious how to distinguish between subject and object (this is what Husserl called the 'fundamental correlation').

It is important to re-open the debate concerning the key differences between introspectionism (which did not lead to a fruitful succession), and phenomenology (with its uninterrupted history). Searle, for instance, who claims that first-person experiences are irreducible, makes no reference to this complex intellectual and historical issue, and rapidly concludes that introspection is merely another mental state. Hence it cannot claim to have a privileged access to experience, and the irreducibility of experience 'has no deep consequences' (1992, p. 118). This dismissal of introspectionism and (by default) of phenomenology does not take Searle very far. Despite his disclaimer about introspection, that is precisely what he does in the chapter called 'The structure of consciousness: An introduction', containing twelve attributes that appear to him as fundamental. On what basis? By doing a suddenly valid introspection? How does he validate these observations? Why not an alternative list of attributes?

- *Intuition is not some fluffy stuff*

Many people react to the mention of intuition with suspicion. In this context, intuitive capacity does not refer to some elusive, will-o'-the-wisp inspiration. It is, on the contrary a basic human ability which operates constantly in daily life, and that has been widely discussed in studies of creativity. Think about mathematics: ultimately the weight of a proof is its convincing nature, the immediacy of the evidence which is imposed on us, beyond the logical chains of symbolic reasoning. This is the nature of intuitive evidence: born not of argument but from the establishment of a clarity that is fully convincing. We take this capacity for granted but do little to cultivate it in a systematic manner. Obviously there is no contradiction here between reasoning and inference: intuition without reasoning is blind, but ideas without intuition are empty.

- *There is life beyond the objective/subjective duality*

One of the originalities of the phenomenological attitude is that it does not seek to oppose the subjective to the objective, but to move beyond the split into their fundamental correlation. PhR takes us quickly into the evidence that consciousness is inseparably linked to what goes beyond itself (it is 'transcendental' in the Husserlian language). Consciousness is not some private, internal event having, in the end, an existence of the same kind as the external, non-conscious world.

To begin with, phenomenological investigation is not my 'private trip' since is destined for others through intersubjective validation. In this sense what one is up to in phenomenological attitude is not radically different from other modes of inquiry. As Hut and Shepard point out in their contribution here:

An analogy with Euclidean geometry may be helpful: once we specify the lengths of the two sides of the triangle, and the magnitude of the enclosed angle, the lengths of the third side is fixed and so are the magnitudes of the remaining two angles. Why is this? Wherein reside the magical power of space? How can space enforce the 'laws' of geometry, laws that physical objects obey as well, to a very high accuracy? (Hut and Shepard, 1996, p. 317.)

We are similarly convinced by empirical and intuitive evidence that our human experience, mine as well as yours, follow some fundamental structural principle which, like space, enforces the nature of what is given to us as contents of that experience.

Through PhR, consciousness appears as a foundation which sheds light on how derived notions such as objective and subjective can arise in the first place. Hence consciousness in this style of examination is drastically different from that of anglo-american empiricism. We are not concerned with a private inspection but with a realm of phenomena where subjective and objective, as well as subject and others emerge naturally from the method applied and its context. This is a point that reductionists and functionalist often miss. Experience is clearly a personal event, but that does not mean it is *private*, in the sense of some kind of isolated subject that is parachuted down onto a pre-given objective world. It is one of the most impressive discoveries of the phenomenological movement to have quickly realized that an investigation of the structure of human experience inevitably induces a shift to considering the several levels on which my consciousness is inextricably linked to those of others and the phenomenal world in an empathic mesh.<sup>7</sup>

Consequently, the usual opposition of first-person vs. third-person accounts is misleading. It makes us forget that so-called third-person, objective accounts are done by a community of concrete people who are embodied in their social and natural world as much as first-person accounts. As B.C. Smith aptly asks: ‘Who’s on third?’ (Smith, 1996). The line of separation — between rigour and lack of it — is not to be drawn between first and third person accounts, but determined rather by whether there is a clear methodological ground leading to a communal validation and shared knowledge.

- *Better pragmatics are needed*

On the whole, my claim is that neurophenomenology is a natural solution that can allow us to move beyond the hard problem in the study of consciousness. It has little to do with some theoretical or conceptual ‘extra ingredient’, to use Chalmers’ expression. Instead, it acknowledges a realm of *practical* ignorance that can be remedied. It is also clear that — like all solutions in science which radically reframe an outstanding problem rather than trying to solve it within its original setting — it has a revolutionary potential, a point to which I shall turn at the end of this article. In other words, instead of finding ‘extra ingredients’ to account for how consciousness emerges from matter and brain, my proposal reframes the question to that of finding meaningful bridges between two irreducible phenomenal domains. In this specific sense neurophenomenology is a potential solution to the hard problem by casting in an entirely different light on what ‘hard’ means.

I am painfully aware that what I have said here and what is available in published form about reduction is limited.<sup>8</sup> This is both a symptom and a cause of the relative paucity of

<sup>7</sup> E. Stein and A. Schutz were two of the most active explorers of empathy (*Einfhlung*) in the early days of phenomenology. For an excellent recent discussion on the development on transcendence, empathy, and intersubjectivity in Husserlian phenomenology see Depraz (1996). Abrams (1996) offers a poetic evocation of the same issues with an environmentalist eye. This phenomenological discovery of empathy can be illustrated for our purposes here with various parallel empirical studies, that is, some of its natural correlates from scientific studies rather than PhR itself. As studies on the natural history of mind continue to progress, it is becoming clear that like many other supposedly higher human functions, solidarity and empathy are present in all higher mammals and certainly in primates. As de Waal (1996) convincingly argues in his recent essay, monkeys display the whole spectrum of moral inclinations, and from an early age they can put themselves in the place of another individual even unrelated by blood. Thus from our early evolutionary roots the sense of self is more adequately seen as a holographic point which cannot be separated from the distributed, multiple others which are our inescapable human ecology.

<sup>8</sup> But see the early attempts of Don Ihde (1977) to remedy this situation.

recent work on phenomenological approaches to mind. The reader cannot be blamed for not having more than a passing whiff of what I mean by emphasizing the gesture of reduction, the core of the methodological remedy I am offering here. It is remarkable that this capacity for becoming aware has been paid so little attention as a human pragmatics. It is as if the ability for rhythmic movement had led to no development of dance training. A phenomenologically-inspired reflection requires strategies for its development as cognitive practitioners have known for some time (Vermersch, 1994), and as attested in the mindfulness tradition of various Buddhist schools (Varela *et al.*, 1991). My only comment when faced with this relative poverty of pragmatical elaboration is that it represents an urgent call for research to fill up this gaping hole. My own contribution concerning the practice of reduction and its training will be presented in a forthcoming joint work (Depraz *et al.*, 1996).

In the West we have not had a rich pantheon of individuals gifted for phenomenological expertise (with notable exceptions, such as Husserl or James) rendering their investigations public to an attentive community. In consequence this avenue of inquiry may appear foreign to many readers. But my contention is precisely that this absence is at the root of the opacity of consciousness for science today. What is needed are precisely the *connecting structures* provided by PhR since they are both immediately pertinent for experience (by their very nature) and at the same time sufficiently intersubjective to serve as constructive counterparts for external analysis.

### III: A Neurophenomenological Circulation

#### *Case studies*

In this Section I wish to sketch a few domains of experience and mental life in order to illustrate more concretely what a neurophenomenological circulation might mean in practice. Needless to say, these case studies do not constitute a proof of what I am proposing, nor do they preclude the detailed examination of other examples more interesting to the reader. Moreover, in recent years there has been a number of different studies where, while remaining well-grounded in the scientific tradition of cognitive neuroscience, the part played by the lived experience is progressively more important to the extent that it begins to enter inescapably into the picture apart from any interest in first-person accounts (Picton and Stuss, 1994). Clearly, as more sophisticated methods of brain imaging are becoming available, we shall need subjects whose competence in making phenomenological discriminations and descriptions is accrued. This is an important philosophical issue but it is also a pragmatic, empirical need. The following are illustrative cases touching both on large and more local issues.

#### *1. Large issues*

**Attention** can be understood as one of the basic mechanisms for consciousness (Posner, 1994). In recent years studies of electrical recordings and more specifically of functional brain imaging have led to the identification of networks and pathways that provide a useful background for distinguishing conscious from non-conscious cognitive events. Three such attentional networks can be distinguished involving orienting to sensory stimulation, activating patterns from memory, and maintaining an alert state. These results indicate that attentional mechanisms are a distinct set of processes in the brain which are neither located in a few neurons, nor merely the ensemble of the brain in operation. At the same time it is clear that the experiential distinctions between these forms of attention require detailed structural investigation of the varieties of ways in

which attention is manifest in experience. A systematic study of the structures and strategies of attention is still a largely unfulfilled task. But how is one to investigate the neural mechanisms relevant to consciousness unless such experiential counterparts can be sufficiently discriminated, recognized and trained?

**Present-time consciousness.** Temporality is inseparable from all experience, and at various horizons of duration from present nowness to an entire life-span. One level of study is precisely the experience of immediate time, the structure of nowness as such or in James' (1912) happy phrase 'the specious present'. This has been a traditional theme in phenomenological studies, describing a basic three part structure of the present with its constitutive threads into past and future horizons, the so-called pretentions and retentions (Husserl, 1966; MacInerny, 1991). In fact, these structural invariants are not compatible with the point-continuum representation of linear time we have inherited from physics. But they do link naturally to a body of conclusions in cognitive neuroscience that there is a minimal time required for the emergence of neural events that correlate to a cognitive event (Dennett and Kinsbourne, 1992). This non-compressible time framework can be analysed as a manifestation of the long-range neuronal integration in the brain linked to a widespread synchrony (Singer, 1993; Varela, 1995). This link illuminates the nature of phenomenological invariants via a dynamical reconstruction which underlies them, as well as giving to the process of synchrony a tangible experiential content. I have developed this case of neuro-phenomenological circulation more in detail elsewhere (Varela, 1996).

**Body image and voluntary motion.** The nature of will as expressed in the initiation of a voluntary action is inseparable from consciousness and its examination. Recent studies give an important role to neural correlates which precede and prepare voluntary action, and the role of imagination in the constitution of a voluntary act (Libet, 1985; Jeannerod, 1994). Yet voluntary action is preeminently a lived experience which has been well discussed in the phenomenology literature — most specifically in the role of embodiment as lived body (*corps propre*, Merleau-Ponty, 1945), and further in the close relation between lived body and its world (*Leibhaftigkeit*). Pain, for instance, is an interesting 'qualia' which reveals this dimension of embodiment most vividly, and its phenomenological study yields surprising insights both in body-image and its relation to neurophysiological correlates (Leder, 1991). Here again, a phenomenological analysis of voluntary action and embodiment is essential but only partially developed so far.

## 2. Local issues

**Perceptual filling-in** as used in visual science involves the spontaneous completing of a percept so that the appearance (i.e. a visual contour) is distinct from the physical correlate (i.e. discontinuous borders, as in the case of the popular illusory contours). These questions can be studied even at the cellular level, and raise more questions concerning experiential distinction of the appearances. In fact the neuronal data on filling-in seem to correlate well with what PhR had concluded some time ago: there is an important difference between 'seeing as', visual appearance, and 'seeing what', a visual judgment (Pessoa *et al.*, 1996). This is the opposite conclusion from Dennett (1991) for whom consciousness is 'all tell and no show'. These are issues that can only be solved with the concerted convergence of external and first hand accounts.

**Fringe and centre.** Interestingly for us here a number of studies have gone back to consider some traditional phenomenological issues such as the two-part structure of the

field of consciousness between a centre and a fringe. This mostly has come from the influence of William James, but carried into modern laboratory protocols. In these studies the crucial experience to explore and target for refinement is the feeling of ‘rightness’, here standing as a summary of cognitive integration representing the degree of harmony between conscious content and its parallel unconscious background (Mangan, 1993).

**Emotion.** Recent years have seen significant advances in the understanding of the brain correlates of emotions; the separation between reasoning and emotions is rapidly disappearing (Damasio, 1994; Davidson and Sutton, 1994). Evidence points to the importance of specific structures such as the amygdala, the lateralization of the process, and on the role of arousal in emotional memory. Yet these studies are entirely based on verbal protocols, and the questions of the competence for emotional distinction and the patterns of relations between mood, emotion and reasons need to be addressed explicitly at this stage of research.

The evocation of these study cases tries to provide a concrete background to discuss further the central concern of the neurophenomenological programme I am presenting here. On the one hand we have a process of emergence with well defined neurobiological attributes. On the other, a phenomenological description which links directly to our lived experience. To make further progress we need cutting edge techniques and analyses from the scientific side, and very consistent development of phenomenological investigation for the purposes of the research itself.

Do I expect the list of structural invariants relevant to human experience to grow *ad infinitum*? Certainly not. I surmise that the horizon of fundamental topics can be expected to converge towards a corpus of well-integrated knowledge. When and how fast this happens will of course depend on the pace at which a community of researchers committed to this mode of inquiry is constituted and creates further standards of evidence.

### *The working hypothesis*

This brings me back to my initial point: only a balanced and disciplined account of both the external and experiential side of an issue can make us move one step closer to bridging the biological mind–experiential mind gap. Let me now be more explicit about my basic working hypothesis for a ‘circulation’ between external and phenomenological analysis:

#### **The Working Hypothesis of Neurophenomenology**

Phenomenological accounts of the structure of experience  
and their counterparts in cognitive science  
relate to each other through reciprocal constraints.

The key point here is that by emphasizing a co-determination of both accounts one can explore the bridges, challenges, insights and contradictions between them. This means that both domains of phenomena have equal status in demanding a full attention and respect for their specificity. It is quite easy to see how scientific accounts illuminate mental experience, but the reciprocal direction, from experience towards science, is what is typically ignored. What do phenomenological accounts provide? At least two main aspects of the larger picture. First, without them the firsthand quality of experience vanishes, or it becomes a mysterious riddle. Second, structural accounts provide constraints on empirical observations.

The study of experience is not a convenient stop on our way to a real explanation, but an active participant in its own right. Clearly in this research programme, like in all others worthy of their name, a certain body of evidence is slowly accumulated, while other aspects are more obscure and difficult to seize. The case studies mentioned above obviously need substantially more development, but I hope it is clear how they begin to provide a 'stereoscopic' perspective on the various large and local issues where experience and cognitive science become active partners.

This demand for a disciplined circulation is both a more precise and a more demanding standard than the 'reflective equilibrium' proposed by Flanagan (1992) or the 'conscious projection' put forth by Velmans (1996). Although there is a similarity in intention to what I am proposing here, they propose no explicit or new methodological grounds for carrying out these intentions. It is surely an improvement on Searle, who insists on the fact that he takes a naturalistic attitude and that 'obviously' consciousness is an emergence. And yet this naturalism does no work in his book: there is not a single line about explicit mechanisms, and thus his naturalism remains barren. At the very least, the hypothesis presented here provides an explicit avenue to conduct research in cognitive science as if both brain physiology and mental experience mattered. Thus, for example, a large-scale integration mechanism in the brain such as neural synchrony in the gamma band should be validated *also* on the basis of its ability to provide insight into first-person accounts of mental contents such as duration. The empirical questions must be guided by first-person evidence. This double constraint would not apply to descriptions that are not directly relevant to the level of experience, for instance for cellular responses or neurotransmitter diffusion.

The claim about appropriate levels of description between brain events and behaviour is, of course, not new and rather uncontroversial except for those who are extreme reductionists. The novelty of my proposal is that *disciplined first-person* accounts should be an integral element of the validation of a neurobiological proposal, and not merely coincidental or heuristic information. This is why I choose to describe the situation by the hypothesis that both accounts be mutual *constraints* on each other.

Still, is this not just a fleshed-up version of the well-known identity theory (or at least a homomorphism) between experience and cognitive neuroscientific accounts? Not really, since I am claiming that the correlates are to be established, not just as a matter of philosophical commitment or physicalist assumption, but from a methodologically sound examination of experiential invariants. Again, this is a question of pragmatics and learning of a method, not of *a priori* argumentation or theoretical completeness.

In contrast, a more conventional psycho-identity thesis works on the form of a reasoning that Pessoa *et al.* (1996) call linking propositions (following D. Teller). These are propositions of the form:

$$\Phi \text{ looks like } \Psi \Rightarrow \Phi \text{ explains } \Psi$$

where  $\Phi$  are neural-psychological terms and  $\Psi$  are phenomenal terms, and the implication operator has a conditional sense: if the empirical events 'look like' the phenomenal events, then these are explained. An excellent example is Crick's enthusiasm when discussing single neuron correlates associated with the sudden shift in experience in binocular rivalrous visual figures (Leopold and Logothetis, 1996), which he assimilates to an explanation of that form of visual consciousness. These kinds of bridges are unsatisfactory because they leave the problem untouched. We still have to contend with the nature of the arrow: how are these neural units related to the rest of the brain's activity, how do they acquire their sense, and specially what in them makes them into an

experiential event. We are back to square one with the hard problem intact. What is different in the research strategy proposed by neurophenomenology is that these bridges are not of the 'looks like' kind but they are built by mutual constraint and validated from both phenomenal domains where the phenomenal terms stands as explicit terms *directly* linked to experience by a rigorous examination (e.g. reduction, invariance and intersubjective communication).

This working hypothesis does have some points of similarity with the notion of 'structural coherence' as put forth by Chalmers, amongst his three basic principles for the structure of consciousness. Indeed 'precisely because the structural properties of experience are accessible and reportable, those properties will be directly represented in the structure of awareness' (1995, p. 213). This is quite correct from my viewpoint but it is fatally incomplete as stated at least in regards to two key issues raised here. First, this structure of experience needs a method for exploration and validation, and it is not enough to simply claim that we can work with the structure of awareness. Second, there is no ontological value on Chalmers' principle since he assumes consciousness is an added ontological term. In our case, phenomenal experience does represent an irreducible ontological level, but it retains its quality of immediacy because it plays a role in structural coherence via its intuitive contents, and thus keeps alive its direct connection to human experience, rather than pushing it into abstraction.

This makes the whole difference: one obtains an intellectually coherent account of mind and consciousness where the experiential pole enters directly into the formulation of the complete account, making direct reference to the nature of our lived experience. The 'hardness' and riddle become a research programme open for its exploration in an open-ended manner with the structure of human experience playing a central role in our scientific explanation. In all functionalistic accounts what is missing is not the coherent nature of the explanation but its alienation from human life. Only putting human life back in will erase that absence; not some 'extra ingredient' or profound 'theoretical fix'.<sup>9</sup>

By the same token it would be missing the point to expect from the neurophenomenological approach some completely new insights into empirical mechanisms. ('So what *do* you add to cognitive science with your method that we don't know already?') Surely, the PhR approach does provide interesting ideas concerning the structure of mental life (cf. the cases of temporality or filling in), but its main force is that it does so in a way that makes our experience recognizable. I am quite sure that this second order twist will be the most difficult for those researchers of a persistent functionalist inclination to appreciate.

#### IV: In Conclusion

##### *Consciousness: hard problem or time bomb?*

Practically since its inception cognitive science has been committed to a very explicit set of key ideas and metaphors which can be called *representationalism*, for which the inside–outside distinction is the centre piece: an outside (a feature-full world) represented

<sup>9</sup> Incidentally, Chalmers' own theoretical fix (or extra ingredient) is his notion of 'double information' derived from the old Shannonian theory of signs, incorrectly known as a 'theory of information'. In a book which displays such clear intellectual acuity, I was dumbfounded to see that in the end Chalmers argues that the best choice is to revive a cybernetic tradition, largely transformed after its inception into truly informational tools by the work done in computationalist, connectionist or embodiment approaches to cognition, not once discussed by Chalmers in this context. Even assuming the position that an 'extra ingredient' is needed, I simply do not see what could possibly be derived from this move, and neither do some of the scientists that have commented on it. See for instance Koch's otherwise rather positive review (Koch, 1996).



inside through the action of complex perceptual devices. In recent years there has been a slow but sure change towards an alternative orientation, one that I have contributed to and defended for many years (see Varela, 1979; Varela *et al.*, 1991). This orientation differs from representationalism by treating mind and world as mutually overlapping, hence the qualifying terms *embodied*, situated or *enactive* cognitive science.

I cannot elaborate here the current state of embodied cognitive science, but my present proposal concerning the study of consciousness aligns itself with those larger concerns. It seems inescapable to take the trend towards embodiment one step further in the direction of a principled consideration of *embodiment as lived experience*. In our book (Varela *et al.*, 1991) we first highlighted the intrinsic circularity in cognitive science wherein the study of mental phenomena is always that of an experiencing person. We claimed that cognitive science cannot escape this circulation, and must cultivate it instead. We explicitly draw from Asian traditions, Buddhism in particular, as living manifestations of an active, disciplined phenomenology. It was not the intention of that book to dwell on Asian traditions *per se* but to use them as a distant mirror of what we needed to cultivate in our science and the western tradition.

The present proposal takes what was started in that book one step further by concentrating on the key issue of methodology. I hope I have seduced the reader into considering that we have in front of us the possibility of an open-ended quest for resonant passages between human experience and cognitive science. The price however is to take first-person accounts seriously as valid domain of phenomena. And beyond that, to build a sustained *tradition* of phenomenological examination that is almost entirely nonexistent today in our western science and culture at large.

One must take seriously the double challenge my proposal represents. First, it demands a re-learning and a mastery of the skill of phenomenological description. There is no reason why this should be any different from the acquisition of any know-how, like learning to play an instrument or to speak a new language. Anyone who engages in learning, be it in music, language or thinking, will be bringing forth a change of everyday life. This is what is listed as the fourth item in PhR: sustained, disciplined learning *does* entail transformation, and so does anything else we do in a sustained mode. This is fine if we reject the assumption (as I do) that there is some kind of well-defined standard for what should count as real or normal experience: experience appears to be inherently open-ended and pliable, and hence there is no contradiction in saying that sustained training in a method can make available aspects of experience that were not available before. The point of PhR is to overcome the habit of automatic introspection among others, and we need not carry with us a mourning for what may be lost, but an interest in what can be learned.<sup>10</sup>

The second challenge that my proposal represents is that of a call for transforming the style and values of the research community itself. Unless we accept that at this point in intellectual and scientific history some radical re-learning is necessary, we cannot hope to move forward and break the historic cycle rejection–fascination with consciousness in philosophy of mind and cognitive science. My proposal implies that every good student

<sup>10</sup> H. Dreyfus (1993) in a critical review of our book chided us for emphasizing the transformation that accompanies the learning of phenomenological observation since this itself interferes with ‘everyday experience’. This would be a mistake if one believes that one exposes a ‘deeper layer’ by acquiring some skill such as stable reduction or engaging in a practice such as mindfulness/awareness, which was not at all our claim. Even Dreyfus would have to conclude that there is no privileged vantage point to tell us what counts as ‘real’ experience. He has plainly misunderstood the main point: phenomenological reduction does not ‘uncover’ some objective ground, but it does bring forth new phenomena within the experiential realm, in an unfolding of multiple possibilities.

of cognitive science who is *also* interested in issues at the level of mental experience, must inescapably attain a level of mastery in phenomenological examination in order to work seriously with first-person accounts. But this can only happen when the entire community adjusts itself — with a corresponding change of attitude in relation to acceptable forms of argument, refereeing standards and editorial policies in major scientific journals — so that this added competence becomes an important dimension for a young researcher. To the long-standing tradition of objectivist science this sounds anathema, and it is. But this is not a betrayal of science: it is a necessary extension and complement. Science and experience constrain and modify each other as in a dance. This is where the potential for transformation lies. It is also the key for the difficulties this position has found within the scientific community. It requires us to leave behind a certain image of how science is done, and to question a style of training in science which is part of the very fabric of our cultural identity.

*In brief: what's the story?*

Let me conclude by summarizing the main points I have raised in this reaction to the 'hard' problem of consciousness based on an explicit proposal for its remedy.

*The argument:*

- In line with Chalmers' basic point, I take lived, first-hand experience is a proper *field of phenomena*, irreducible to anything else. My claim there is no theoretical fix or 'extra' ingredient in nature can possibly bridge this gap.
- Instead, this field of phenomena requires a proper, rigorous *method* and pragmatics for its exploration and analysis.
- The orientation for such method is inspired from the style of inquiry of *phenomenology* in order to constitute a widening *research community* and a research programme.
- This research programme seeks *articulations by mutual constraints* between the field of phenomena revealed by experience and the correlative field of phenomena established by the cognitive sciences. I have called this point of view *neurophenomenology*.

*The consequences:*

- With no radical expansion of the style of work in the scientific tradition and the establishment of research programme roughly along these lines, the riddle of the place of experience in science and world will continue to come back, either to be explained away or to be re-claimed as too hard, given what we know.
- The nature of 'hard' becomes reframed in two senses:
  - (1) it is hard work to train and stabilize a new methods to explore experience,
  - (2) it is hard to change the habits of science in order for it to accept that new tools are needed for the transformation of what it means to conduct research on mind and for the training of succeeding generations.

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