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## Heat, Temperature and Phenomenal Concepts

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### **Abstract:**

The reduction of the concept of heat to that of molecular kinetic energy is recurrently presented as lending analogical support to the project of reduction of phenomenal concepts to physical concepts. The claimed analogy draws on the way the use of the concept of heat is attached to the experience in first person of a certain sensation. The reduction of this concept seems to prove the possibility to reduce discourse involving phenomenal concepts to a scientific description of neural activity. But is this analogy really justified? We will show that if there is an analogy, far from speaking for a reduction of phenomenal concepts, it rather stresses the necessity to integrate phenomenal reports in the scientific study of experience.

## Introduction

The so-called 'reduction of heat' is recurrently mentioned in the discussions about the relations between phenomenal concepts (or properties) and physical concepts (or properties). Once we said that the water was hot or cold, describing or expressing thereby the way it feels to us. Heat was then a phenomenal concept. The same phenomenon we describe now in terms of (mean) molecular kinetic energy (MKE). Now, 'heat' refers to a physical property. This is meant to be an example of phenomenal and physical concepts referring to the same thing, a physical property. Or else, the reduction of temperature to MKE is meant to show that something that we know by (tactile) sensing can be the same thing as something we do not know by (tactile) sensing. This claimed identity between what the phenomenal report of experience and what the physical description of the world are about takes on an analogical function. As it happened there, it could happen somewhere else: the phenomenal description of experience could (at least in principle) be reduced to a physico-physiological description of neural activity. This claim, we shall contend, rests on conceptual confusions and equivocations. This point will be addressed in the second and third part of the paper.

The epistemic function of the claimed identity between what the phenomenal concept of heat and what the physical concept of temperature refer to is not only analogical. It is also an assumption underlying certain experimental studies of the relation between phenomenal experience and neural activity. On that basis, the neural system is regarded as an instrument of detection of the properties of the world; neural activity stands for something, it has a representational content that can be determined independently of phenomenal reports. That phenomenal reports are not in principle necessary to make sense of neural activity is essential to the reductionist project. The thrust of the fourth part will be to show that and why this assumption is empirically objectionable. Let's begin with a few points about experience and phenomenal concepts that will form our standpoint.

### 1. Perspectival Experience

By "phenomenal concepts" we will refer to concepts describing, sometimes merely expressing, the ways things appear, manifest themselves, in perceptual experience: the ways things seem to us.

There is no appearing without *awareness*. With phenomenal concepts we describe or express our awareness of our perceptual

encounter with the world, how things or events look, feel, taste. If we call 'qualia' of experience what phenomenal concepts refer to, an event as painful, an animal as frightening, the honey as sweet, then qualia are directly introspectible in the sense that "one knows about one's own qualia noninferentially." (Kind, 2001: 150)<sup>1</sup>. If something happens to me without my realizing it, it is not a phenomenal experience. Should we even speak, then, of an experience?<sup>2</sup> If I suddenly realize that the dog is barking and think, looking at the clock, it must have been barking, as usual, for at least one hour, having now the experience of its barking is also having the experience of the difference between now and before, when I didn't have this experience. The case is slightly but significantly different if, driving, thoughtfully, on the highway, I suddenly realize that I missed the right exit- I suddenly have the image, I realize that I saw it. It seems only slightly different from the previous case for having this image seems very contingent, and what happened to me earlier should be the same whether I happen to have this image or not. But it is significantly different because having this image allows us to speak of the visual experience of the exit that I missed. Imagine someone saying "I realize that I have been hearing this dog for more than one hour but I do not remember hearing it". What does s/he mean? Taking the concept of experience in a Kantian

way, rather than Aristotelian<sup>3</sup>, we will say that there is no experience without *awareness* of an objectified something being experienced. In that sense, phenomenal experience is epistemic. But what about what happens to me before the moment where I realise that what I have been hearing in the background as I was working, and, as I realize it as the same time, has been unnerving me increasingly, was the barking of the neighbour's dog? If I realize, at  $t_2$ , that I was hearing something, at  $t_1$ , it must be that I was aware, at  $t_1$ , of something perceptual happening to me; I realize, at  $t_2$ , that I have been having a 'hearing experience'. If the concept of experience implies awareness, it shouldn't however require reflective awareness, not at least as actual. But insofar as this awareness is intentional, it must allow the counterfactual statement to the effect that if I had been asked whether I could hear something I would have realized it. There is something similar to this non-reflective awareness with the periphery of the visual field. The visual field is not restricted to what is in focus. Being able to move around, to notice suddenly that something happens on the side, a shape moving or the light changing, implies awareness of something, even though not actually reflectively. But of what? The question is pressing, but it is not so much anymore about the awareness attached to phenomenal experience, that is, its being epistemic, as about the something this awareness is of, that is,

about the representational character of phenomenal experience.

Compared to what is in focus the periphery of the visual field is certainly ill-defined. But how much, or to what extent is it ill-defined?

“... all round the periphery of your vision is an undoubtedly sensed region which is outside your ability to recognize.” (Wright, 2005: 74)

Can it then be ill-defined to the extent of being un-defined? So that there would be no *representational* content? Let's postpone the 'representational' issue for a short moment and just admit for now that there is no phenomenal experience without perceptual appearing.

There is no perceptual appearing without a *perceiver* to whom it appears. One's cognitive relation with the world originates in a physical encounter with the world, which involves one's body, particular, historical and situated. Phenomenal reports describing or expressing our experience of the world, that is, an interaction, are situated with respect to the condition of the interaction: how water feels to me, how honey tastes to me. A way of thinking about phenomenal reports being situated is to bring in the image of perspective. We may say that phenomenal language pertains to a perceptual perspective, on an object or an event, my tasting the honey, my feeling the water, relative to the conditions in which this perceptual event occurs. The notion of perspective is often used in support of the

idea that a phenomenal fact or property and a physical fact or property could be one and the same even though it may be known, from different perspectives, under different descriptions (Lycan 2003). It is true that some objects or events can receive phenomenal and physical descriptions; but, as we will see, that does not provide any *a priori* support to the reductionist project.

The idea of perspective is not the idea of an enclosure, a separation from the world. Perception, even though perspectival, is a direct access to the world. That there is something with which we interact, that perception is perspectival, implies that there is something that is being interacted with, something there is a perspective on. We can think of the experience of warmth when putting one's hands in a cup of water as a perceptual perspective on water. That doesn't mean that we can conceive of water in general independently of the general possibility of perceptual perspectives on it. Being able to refer to water implies being able to learn the word and that relies on certain possibilities of experience. But as to any particular 'instance' of water, it doesn't need my experiencing it to be there.

Qualia are directly introspectible, but phenomenal experience is a direct access to the world, that is, 'phenomenal', as we'll use it, doesn't stand in contrast with representational<sup>4</sup>. In perceptual

experience, if certain things or states of things are perceived, apprehended in a certain way, insofar as a representation is characterized not only by what, but also by how it represents then the content of perceptual experience is representational. The water is represented as warm, the dentist visit as painful, a strip-search as humiliating. The representational conception of phenomenal experience denies that there are aspects of experience, ways we see and feel the world, that cannot be interpreted as ways the world is represented (Drestke 2003), or that phenomenal experience has “‘phenomenal’ or ‘qualitative’ character that is not captured simply by saying what their representational content, if any, is” (Shoemaker, 1994: 292) and which would be discovered thanks to a ‘sidelong glance’ at something like a private sensation (Wittgenstein, PI: §274). That is, it is a claim for the transparency of phenomenal experience (Tye 2002).

But now imagine I am looking at an image on a screen, and it looks blurred. Suddenly I realize I am sitting too far, I need glasses. I put them on, the image becomes distinct. How could the difference I am able to make between the two situations be a difference in representational content alone since the image I look at on the screen is the same whether I wear my glasses or not? It must be that “[t]here are some phenomenal properties that really are attributable to experiences

themselves.” (Bach, 1997: 467) It may have to be so, if ‘representational content’ were to refer to what is represented independently of how it is represented. But the representational content is constituted not only by what is represented but also how it is represented. The blurriness one experiences without one’s glasses is not here a property of the object represented, but neither is it a property that should be ascribed to the experience itself. It is a property the object is represented as having. The photograph of a block of ice (sharply defined object) taken with an out-of focus camera is blurry while the photograph of a cloud taken with a well focused camera is not, even though they may look quite the same. Only the former is blurry for only in that case the property ‘fuzzy edges’ the object is represented as having is not a property of the object being represented, namely, the sharply defined block of ice. An image shows an object in a blurry way when the object doesn’t look the same as we know it looks when seen in what we know as being the ‘normal conditions’ – and the ‘not the same’ would have to be specified in terms of a descriptive contrast between fuzzy vs. sharp edges.

The same understanding of what it is for phenomenal experience to be representational can be applied to the experience of the periphery of the visual field. What is represented in the periphery of the visual field is not represented in the same way as it is

represented when it is in focus; the phenomenal experience is different and the difference can be accounted for in terms of representational content. In fact, in the periphery the representational content is most often limited to shapes, lights and movements. But to speak of the representational content of the experience of the periphery of the visual field doesn't require that we be able to identify what is represented in the same way as we would do if it was represented in focus.

'Phenomenal' does not stand in contrast with 'representational' but it does contrast with 'physical' or 'scientific'<sup>5</sup>. A scientific description of water is free from perceptual dependencies. It is a description abstracted from experience; hence, not perceptually perspectival. Not being situated with respect to perception doesn't preclude being situated in another way, though, for instance with respect to instrumental tools and practices, and then being instrumentally perspectival<sup>6</sup>. The idea of perceptual perspective introduced here does not contrast with an 'absolute conception of the world'. The determination of the properties a scientific description assigns to objects abstracts from experience by appealing to experimental procedures and instrumental outcomes. But the conditions of possibility of this assignment are still rooted in experience in the sense that our having such a sensation, for instance,

as the sensation of heat is a condition of possibility, at least historical, of the development of thermometry.

Speaking of the qualia of experience and phenomenal language as pertaining to a certain way for things to appear, to a perspective, doesn't commit oneself to mental private 'objects'. Inner processes stand in need of external criteria. We learn to speak of our anxieties, pains, joys, "in the light of publicly observable symptoms" (Quine, 1985: 5-6). But the acquisition of phenomenal language only begins with such general 'symptoms'. It develops, to a certain extent<sup>7</sup>, idiosyncratically for it pertains to the grammar of phenomenal concepts, 'Are *you* cold?', that we can disagree on their conditions of application<sup>8</sup>. That doesn't commit us to any sort of anti-materialism. But contrary to what Quine claims, it is another matter to speak of *reduction* of phenomenal language to neuro-physical language; or *identification* of what is referred to by the former with what is referred to by the latter. The main reason for that is that, as pointed to by Quine for beliefs, for phenomenal experience too the external manifestations "vary drastically and unsystematically with the content ... to be ascribed".

## 2. Reduction and Phenomenal Concepts

A reduction is primarily a relation between two forms of description, two languages. The general scheme of a reduction involves two vocabulary sets, and the possibility, in certain specified conditions to replace one language by the other. Ideally, where the reduction applies, the description of a phenomenon P given in the reduced language can be deduced *a priori* from the reducing language. But in practice, things are quite different. First, sometimes the replacement amounts to the elimination of the reduced descriptive terms. Second, when the new language (Tf) can be regarded as a more general descriptive instrument supplying the description provided in the first language (Tc), it is in particular conditions of application of (Tf).<sup>9</sup> Third, in the most delicate cases, among which, in spite of its popularity lies the case of the thermodynamics/statistical mechanics reduction relation (Hooker, 1981: 47-48), the passage from Tf to Tc requires the introduction of an analog Tc' such that, in certain conditions (limiting assumptions and boundary conditions)<sup>10</sup>, Tf entails Tc' and Tc' is analog to Tc<sup>11</sup>. That the deduction of Tc' (from Tf) is a reduction of Tc (to Tf) must then be warranted by correspondence rules, or 'term-connecting assertions', relating their respective vocabulary. The restricted, idealist, conditions of the deduction and the appeal to correspondence rules make it difficult to simply equate reduction with identification. Conceiving of

these rules as statements of identity presents important epistemological advantages (ibid.: 202-203). But whether it is always legitimate is a difficult question hinging on how the conditions for identity are to be specified.

All we can properly ask of a reducing theory, says Churchland (1985), is to have the resources to conjure up a set of properties whose nomological powers/roles/features are systematic analogs of the powers/roles/features of the set of properties postulated by the old theory. And if such a correspondence is achieved, the best explanation for this would be the identity of the properties that are referred to by the paired items. How would an analogy of 'powers/roles/features' be established? With concepts that have broadly functional or causal roles, the idea would be to show that the new description allows these roles to get filled. For instance, that when the MKE rises the same effects occur as those coming along with a rise of the temperature.

Unfortunately, it is largely recognized among the participants of the debate that phenomenal or mental concepts are not functional. They are recognitional, and as such "lack any conceptual connections with concepts of other kinds, whether physical, functional or intentional." (Carruthers, 2004: 155) - which doesn't mean that we don't have to learn, on the basis of external criteria, the conditions of

application of the concept. That, however, does not, according to Carruthers, rule out a reductive explanation of experience. For the facts or properties characterized purely recognitionally, from a first person perspective, “also admit of third-personal characterization”. (p.167)

The words used in phenomenal reports are sometimes used also to ascribe a phenomenal experience to someone else. But the ‘drastic and unsystematic’ variability of criteria of ascription of mental state, the fact that identification of a state “depends heavily on symptoms *reported* by the patient” (Quine, 1985 it. added), makes it very hard to see ascriptional language as anything like explanatory or functional. The ascriptional use is not autonomous with respect to the recognitional one. Patricia Churchland (1986: 303) claims that our folk psychology with its phenomenal language is a proto-scientific theory, just as folk physics once was; with no reason why it would not become a mature science as well. But if an ascriptional use of phenomenal or mental concepts were to develop into something like an autonomous functional-psychological language, the question would remain of the relation between recognitional and ascriptional uses. If the ascriptional, in order to become functional, becomes independent of the recognitional, on what basis would one assert that the same word in the two languages refer to the same ‘thing’? Without a systematic

connection between recognitional and functional languages, the reduction of the ascriptional to the functional-psychological is not an answer to the question of the reduction of the recognitional.

### 3. Sensation of Heat and Temperature

A classical objection to the mere possibility of establishing the identity between what phenomenal and neural descriptions are about appeals to the notion of 'direct epistemic access'. What phenomenal concepts refer to is known directly, by introspection. The properties of neural activity are not known directly, by introspection; they are known through inter-subjective investigations and measurements in terms that do not involve perceptual experience. The counter-objection seems easy though: the notion of 'being known directly' sets an intensional context where a mere difference of description can account for the difference in truth value of the ascription of 'being known directly'. It is not necessary for something to be known to have a certain property to have it. However, there is an anti-physicalist premise, as Loar puts it (1990: 83), which even the physicalist should accept: phenomenal and physical-functional descriptions are cognitively independent. Loar adds that this cognitive independence doesn't imply the distinctness of

what these descriptions are about. (p.87) But what could be '*in concreto*' the conditions of an assertion of identity?

Well, just look at the 'reduction of heat', says the reductionist.

We have already there such a case:

(1) Warmth is identical with the mean level of the objects' microscopically embodied energies<sup>12</sup>. (Churchland, 1985: 18)

And as an argument against the epistemic access difference objection:

(2) Temperature is known by me directly, by tactile sensing, whereas the mean molecular velocity is not; however, who could deny that for a body to have a certain temperature and to have a certain mean molecular velocity is one and the same thing? (p.20)

Don't we have, here, a case where a phenomenal description, of the feeling of heat, turns out to refer to the same thing as a physical description?

Let's consider (1). If 'being warm' is a phenomenal concept, it must be that being warm is feeling warm. There is no warmth, in the phenomenal sense, without the feeling of warmth, just as there is no pain without the feeling of pain. If you ask whether the water is warm enough to swim I will 'try' it, with my foot, then the leg; it may feel different, and different today from yesterday when I was so tired, even

though for you it feels the same. The mean molecular velocity is a physical property whose determination has nothing to do with feelings and sensations. It has the value it has independently of my feeling anything. But then, how can it have the same conditions of application as something like 'being warm', which is completely, and necessarily, dependent on my feeling?

There is an equivocation of 'being warm', as there is one of 'heat', 'heat' as a physical quantity and 'sensation of heat'. "The reductive account of heat", writes Searle, "carves off the subjective sensations and defines heat as the kinetic energy of molecules movements." (Searle, 1998: 26) But Searle is twice wrong. The reduction doesn't carve off the subjective sensations because it relates physical concepts. What was reduced to kinetic energy was a thermodynamical variable which can be measured by using a thermometer. What was reduced is not a subjective quality, not even some admixture of subjective qualities and physical properties, but a previously objectified physical determination. Moreover, the elaboration of an objective, physical concept of heat didn't eliminate the phenomenal concept. When one speaks of a heat wave, by contrast to a cold wave (which contrast between heat and cold doesn't exist in thermodynamics), the property that is referred to is phenomenal; the

air is hot in the sense that it feels hot. It is only contingent that the temperature of the air during a heat wave is about 100F. In the same way 'being warm' can function either as a phenomenal or a physical description. Imagine a couple of biologists considering a test-tube of living cells that must be kept above a certain temperature. Asking 'Do you think it is warm enough?' is not asking about someone's feeling. It is asking about the temperature, whether s/he thinks it is high enough. Here anybody can simply find *the* answer by using a thermometer.

Of course the reductionist will insist that the words we use to express our experience, as happened with the word 'heat', could be released from their subjective qualitative connotations and reduced to an objective description. But, again, the reduction of the concept of heat, or more precisely, the reduction of temperature, was the reduction of an objective large-scale property to an objective microscopic property, not the reduction of a phenomenal description. We still have, on the one hand, the phenomenal concept of heat, ('heat wave' meaning most people suffer from feeling hot), and on the other, the physical concept that has been reduced to another physical concept (the heat of a system meaning its energy). The reduction doesn't relate phenomenal and physical concepts.

Still, when the temperature varies the sensation I have varies, and in a predictable way. I can even sometimes say what the temperature of the objects I touch is. There must be a correlation, and we want to make sense of it. Is it because of this correlation that Putnam (1992: 93) speaks of “heat (temperature)” as a secondary property, even though objective? Because it is a property that we can have a sensation of, the sensation of heat? As Churchland says we have a tactile sensing of the temperature?

But within science, the conception of temperature and the ascription of a certain temperature are completely independent of any sensation anyone could have. And the heat (temperature) is the same thing as the MKE. So there is no more reason to call temperature a secondary property than there would be to call velocity, length or duration, secondary properties. If length and duration are not secondary properties, velocity is not either, nor heat (temperature). Isn't speaking of “heat (temperature)” as a secondary property still being under the spell of a conceptual confusion?

In the present state of science, the relation between the physical concept of heat and the mean molecular velocity is such that their respective determinations are interdependent. But an object with a given temperature can feel different to different persons, or different to

the same person depending on whether she is feverish, drunk, touches it with the hand or the jaw. And one can suddenly feel hot or cold in connection with for example an emotive change of state. But if it is contingent that in presence of heat (the scientific concept) we have the sensation of heat, what about the correlation? According to Kripke (1980: 132), given a certain sensation, sensation-of-heat, we identified a certain phenomenon as the property of heat because it is *able* to produce this sensation. When we have the kind of sensation we call 'sensation-of-heat' (sensation $h$ ), we are not having the sensation of something, sensing a physical property, as if it were an object lying somewhere waiting to be stroked. What we feel is the water, the hot plate, the air, the cat. The correlation would result from this object's having a property 'able to produce' the sensation.

But wait. Is the claim that objects have a physical property able to produce (Searle speaks of 'cause') a certain kind of sensation empirical? The scientists developed experimental practices, in thermometry and thermodynamics, and achieved the conceptions of heat and temperature with no consideration for our sensations; these concepts have been defined in total independence of phenomenal concepts. 'Being able to produce' or 'cause' a sensation has no place whatsoever in the scientific conception of heat. Is it then a grammatical

point? Imagine people eating together and one of them putting on his sweater; we usually do not expect any further explanation than 'he is cold'. And to the question 'Why are you so cold?', an answer referring to the temperature would sound empty, since we are all submitted to the same without being cold; the question is 'why are *you* so cold', understated 'when *we* are not', and calls for something personal, like 'I am very sensitive to cold' or 'I feel feverish'.

We do have an ordinary knowledge of a loose correlation, but no 'process' of production or causation is needed to account for it. Science provides us with descriptions of how things change in terms of variation of physical parameters. We became able to describe the change of state of water in terms of the variation of a certain parameter, the temperature T, strictly correlated to the change of the state of the water. Long before we had this concept, we could already give a description of 'the change of state of water', C: in terms of phenomenal difference, for instance, a difference in how it looks or feels. A phenomenal difference was hence already correlated to the change of state of the water, but too loosely to the taste of scientists. If a certain kind of sensation S is loosely correlated to C, and T strictly correlated to C, S had to be correlated to T, and it can only be a loose correlation. This loose correlation makes it possible for us to become able to *infer*,

sometimes, the value of the temperature on the basis of our sensation, like someone can guess the mass of a box by carrying it. But being able to infer the value of the temperature from a phenomenal experience has nothing to do with 'experiencing' or knowing "directly, by tactile sensing". The concept of temperature is autonomous with respect to experience, exactly in the same way as the MKE is. And if one is able to infer the value of the former, one can become able to infer the value of the latter as well. There is no epistemic access contrast. And rather than a case of reduction of the phenomenal to the physical, what we have is a case of *articulation* between phenomenal and physical concepts.

The reduction of thermodynamics to statistical mechanics provides no analogical support to the project of reduction of phenomenal to neuro-physical descriptions. The analogical argument fails. And we keep wondering how, if one admits the recognitional character of phenomenal concepts, and the 'cognitive independence' of phenomenal and physico-functional concepts, the identity of what phenomenal and physico-functional concepts are about can be established. Certainly the best thing to do is to consider the experimental work devoted to this project.

#### 4. Experimental Studies

How could one show the identity of what a phenomenal report and a neural description are about? Admittedly, a phenomenal experience is intentional, is about something. As we saw, this aboutness is not only a 'what', the water, but a 'how', as warm for instance. If one thinks about neural pattern as being characterized, identified, by merely physico-physiological parameters, the only relation one can establish seems to be a mere co-existence, co-occurrence, of a certain experience with a certain phenomenal content and a certain neural pattern. What the reductionist wants is an identity of the phenomenal state identified by its aboutness with a neural state, and a neural language that has enough descriptive power so as to make the phenomenal report merely optional for the description of our perceptual relation with the world. For that, the aboutness of the phenomenal state has to be, in one way or the other, also a characteristic of the neural.

That makes for a fundamental difference between a neural system and the physical systems we considered up to now as having, say, a temperature. A neural system will be said to have, besides its physical (like firing rate) or physiological properties, representational properties, in the sense of being about something or having a representational content. This is philosophically daring. Not that a physical object have a representational content, but that it have it on its

own, by itself. Not as the result of an intentional ascription, like a sign representing a bicycle path, or a painting representing a lake, but as the result of a natural process. An important question is then how the scientific experimenters find out what this representational content is. And whether there is room in it not only for the 'what' but also for the 'how' of experiential aboutness.

The neurobiological research program that seems the most promising to provide the expectations of the reductionist project with evidence is the work done on Neural Correlates of Consciousness<sup>13</sup> (NCC). Chalmers (2000) proposes of a NCC the following synthetic definition: "A neural system N is a NCC if the state of N correlates directly with states of consciousness". At first sight, the notion of correlation rather looks like a betrayal of the reductionist hopes of evidence for identity. The reductionist needs a ground for the notion of identity that the mere notion of correlate doesn't yield. A correlate, if it is something that is correlated, falls short of being identical with what it correlates with. But the notion of correlate may be misleading, downplaying the real ambition of the empirical research. In the case of visual experiences for instance, the search for NCC, writes Chalmers, is the search for "the neural states that *determine* the specific contents of

visual consciousness.” (it. added) ‘Determine’ sounds very different from merely ‘correlate’.

However, without a condition on how the content of neural activity is identified, the identification would not be enough yet to support reductionism. To see why let’s consider the experimental study that was conducted by Lutz et al (2002) with the conclusion that “synchrony patterns *correlate* with ongoing conscious states during a simple visual task.” (it. added) Several subjects are asked to press a button when they see a visual target appearing on a screen<sup>14</sup>. Before and after the task, the neural activity is recorded, as well as the phenomenal reports of the state of preparation, of attention, of how the perception of the form is experienced, with some surprise or not. The phenomenal reports lend themselves to a 4-fold classification in terms of cognitive contexts. Each category corresponds to different patterns of neural synchronisation identified by the experimenters at local and global scales; for instance they found that “local and long-range synchrony occurred at different frequencies before the stimulus depending on the degree of readiness reported by the subjects” (p.1588). An important upshot of this study concerned the variability of the neural activity of subjects submitted to identical tasks. Whereas this variability is generally “discarded by averaging techniques”, the

authors contend that apprehended in terms of cognitive contexts, based on phenomenal reports, it becomes meaningful and allows a more differentiated analysis of the neural activity. At the same time, the neural description induces more differentiated accounts of phenomenal experience.

This is an example of empirical study identifying neural correlates of phenomenal experience and ascribing content to them, in terms of 'perception of something in a certain way.' And yet, it doesn't contribute to the reductionist project, on the contrary. First, not only the identification of a correlate but also the determination of its content appeal to phenomenal report. Imagine that in order to determine the MKE we had no other option than measuring the temperature, how could we speak of a reduction? Second, this study aims to show that phenomenal reports, not only cannot be done away with, but should be integrated in the scientific study of neural activity.

The kind of experiment that the reductionist project needs should have a procedure of determination of the representational content of neural activity that doesn't appeal to the phenomenal description. And there seems to be such experimental work: for instance, the famous studies on the visual consciousness of monkeys.<sup>15</sup> A monkey M trained to react differently ( $action_H$ ,  $action_V$ ) to two

different visual situations H and V (horizontal or vertical lines). For each situation, the scientist-observers record the neural activity of different areas of M's brain. They identify both in the primary visual cortex and the inferotemporal cortex distinct neurons,  $neurons_H$  and  $neurons_V$ , as correlated to the presentation of H and V. It is known from human reports that if one is presented simultaneously with two different images, one to each eye, one will report a binocular rivalry, that is, seeing alternatively one and the other. It is supposed that it should be the same for the monkey. Presented simultaneously with H and V to each eye, M produces alternatively actionV and actionH.

What is 'the neural system' determining the content of the experience of the monkey? In the primary visual cortex, the neural activity remains mainly correlated with the image that is presented: when the two images are presented, most of the  $neurons_V$  and the  $neurons_H$  respond, whereas M produces *alternatively* actionH or actionV. The activity of these neurons doesn't seem therefore to reflect the content its phenomenal experience. By contrast, most of the neurons of the temporal cortex, identified beforehand as correlated with the presentation of a certain image I in normal situation, respond in a binocular situation only when M produces the action associated with I. They are therefore good candidates for the status of neural

correlate of the phenomenal experience of I, and would determine the content of this experience since I is primarily their own representational content. What does this 'I' stand for? Lines, butterfly, flower: what *the human observer* sees as being what M is confronted with and responds to.

In these experiments, the representational content of the neural system is specified by the correlation established by the scientist-observers between the visual situation, for example V, and the neural activity. This neural system correlates with the phenomenal experience of V in so far as it correlates with the 'phenomenal report' (actionV) regarded as the expression of the perception of V. But there is a match in content only insofar as the observer defines the representational content of the neural activity according to how *he* describes the visual situation, and the representational content of the experience according to the same description. The phenomenal report doesn't seem necessary to define the representational content of the neural system only because it is assumed to be identical with the content of the phenomenal experience of the observer confronted to the same visual situation. The difference between actionV and actionH reveals a difference between the perception of situationV and situationH; but what difference? Can't we imagine that, as happens in Lutz et al.,

different (speaking) subjects would give different phenomenal reports of their experience? The experiment treats the phenomenal experience of M as a functional state, specified on the basis of the *effect* of certain stimulation, '*input*'; but then, it contradicts the common recognition of the recognitional character of phenomenal description.

Treating the phenomenal experience as functional, with an input (which yields the representational content) specified by the observer, is ignoring the perspectival aspect of perceptual experience. Perceptual activity involves the whole body, as situated somewhere, in a particular relation with its environment: "the perceptual experience as of a vertical line will represent the line as against a background and as occupying a certain position in egocentric space, as occupying a certain spatial relation to *you*, the embodied perceiver." (Noë and Thompson, 2004: 12) If the representational content of a neural system is to be the same as the perceptual experience it correlates with, then it should integrate the perceptual relation of the perceiver with this environment. What is at stake is the very notion of representational content and what is challenged is the underlying assumption about neural activity as a detector of features of the environment determined independently of the conditions of perception.

This assumption casts some light on how a phenomenal description (of the experience-of-heat) could be regarded as reducible to both a statistical mechanical description of an external object and a neural description of the activity of the brain. The external object and the neural activity are indeed meant to have a property in common. The neural activity as we saw is said to have a representational content, meant to be the property of an external object. The neural system is viewed as an instrument of detection and computation of the properties of external objects: “the senses show the brain, otherwise blind, how things stand, ‘out there’, both in the external world and in its own distal body”. (Akins, 1996: 342) For instance, in the case of peripheral thermoreception, according to the physicalist picture, “like miniature biological thermometers, the receptors record the temperature of their immediate surround, its ups and downs (...) The receptors, we think, must react with a unique signal, one that correlates with a particular temperature state.” (*ibid.*, 342) The picture says that there must be a strict correlation between the temperature and the reaction of the receptors. But it is not *empirically* possible to make sense of the activity of the thermo-system in these terms. For instance in extreme temperatures, high or low, the system reacts identically; so what does it ‘say’ about the world? ‘That must stop!’ They are pain

receptors. For the middle zone of temperature, what happens with thermo-receptors depends on many things that have no place in a scientific description of what happens outside. For instance, how the system reacts depends on its initial state: imagine one hand in water at 10°C the other in water at 30°C and then both in water at 40°C. The thermo-system reacts differently in the two hands, while the state of the world, in scientific terms, is the same: 40°C. Moreover what happens with the thermo-receptors is different at the moment of the encounter with the new medium and after a while, although the scientific description of this medium mentions no change. It is different also in different parts of the body, and it depends furthermore on how far the temperature is from the painful extremes. Accordingly, one can hardly make sense of what the thermo-system is doing in terms of the scientific description of the objects encountered; but it makes perfect sense in terms of perspective of the perceiver on the world: the world is perceived from a certain state of the body and in terms of what matters to the body. And if one wants to ascribe a representational content, for that reason, it is not to the world scientifically described that one should turn, but to the perceiver.

Paradoxically the case of 'heat' may have, finally, an analogical relevance regarding the relation between phenomenal and neural descriptions. Not for a reduction, since if the concept of heat has been reduced it is as a physical concept; but for an articulation, as happens with the phenomenal concepts related to the sensation-of-heat and the physical concept of temperature. This is, in fact, the core of the conception defended by Varela (1997) of the naturalization of experience (Bitbol 2002; Peschard 2004): that of a scientific study of phenomenal experience aiming to bring together phenomenal reports and neural descriptions in an interactive and dynamical practice where each of them acts as an equal constraint on the other, thereby acquiring more differentiation.

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<sup>1</sup>The notion of direct introspectibility, as Kind (2001) aptly insists, doesn't imply other epistemic notions such as 'infallibility', 'incorrigibility' or 'indubitability'.

<sup>2</sup> We thank the editor for his helpful comments and for inciting us to develop this point.

<sup>3</sup> L.Stevenson (2000: 284): "There is a wide, roughly Aristotelian, sense of the term 'experience' (or 'mental states') in which experiences can be ascribed to all creatures capable of sensation, emotional arousal, unconceptualized perception, and perception-guided activity. But we can distinguished a narrower, more distinctively Kantian use of 'experience' (his term was *Erfahrung*) which is distinctive of human beings. This involves the subject being able to apply concepts to represent states of affairs, to make perceptual judgment, and to evaluate the justification for such judgments."

<sup>4</sup>Contrary to a conception of 'qualia' as what in the "phenomenal character [of conscious experience] outruns representational content."  
(Block, 1996: 20)

<sup>5</sup> Hence the physical description of an object, of water, may change, ascribing it new physical properties, without the phenomenal

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description of the perceptual experience of water, and its representational content, being different.

<sup>6</sup> The conception of scientific measurement as perspectival representation is developed, e.g., in (Giere 2006)

<sup>7</sup> To the extent that language is embedded in forms of life that involve cultural and biological common normalizing constraints.

<sup>8</sup> Which is why the concepts of colors have such an ambiguous status between phenomenal and objective; 'looking red' has a flexibility similar to 'feeling warm' but 'being red' involves normal conditions, contrary to 'being warm'.

<sup>9</sup> For instance Newtonian mechanics is an asymptotic limit of relativistic mechanics (for  $1/c \rightarrow 0$ ), ray optics of wave optics (for  $\lambda \rightarrow 0$ ) (Hooker, 2004: 437-438)

<sup>10</sup> E.g., the thermodynamic limit requires infinite numbers of molecules, large volumes, random motion, condition of ergodicity.

<sup>11</sup> E.g. in Gibbs version of statistical mechanics the analogs to thermodynamic functions are mean values of statistical parameters; the value of the temperature is given by the mean value of molecular kinetic energy.

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<sup>12</sup> A similar claim concerning pitch and oscillatory frequency is criticized by (Crooks, 2002)

<sup>13</sup>See (Metzinger (ed.), 2000)

<sup>14</sup>See also (Peschard, 2004: 400-403)

<sup>15</sup>For detailed comments see, e.g., (Chalmers, 2000) and (Noë and Thompson, 2004)