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The Experimental Use of Introspection in the Scientific Study of Pain and its Integration with Third-Person Methodologies: The Experiential-Phenomenological Approach

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1. Introduction

Understanding the nature of pain depends, at least partly, on recognizing its subjectivity (thus, its first-person epistemology). This in turn requires using a first-person experiential method in addition to third-person experimental approaches to study it. This paper is an attempt to spell out what the former approach is and how it can be integrated with the latter. We start our discussion by examining some foundational issues raised by the use of introspection. We argue that such a first-person method in the scientific study of pain (as in the study of any experience) is in fact indispensable by demonstrating that it has in fact been consistently used in conjunction with conventional third-person methodologies, and this for good reasons. We show that, contrary to what appears to be a widespread opinion, there is absolutely no reason to think that the use of such a first-person approach is scientifically and methodologically suspect. We distinguish between two uses of introspective methods in scientific experiments: one draws on the subjects' introspective reports where any investigator has equal and objective access. The other is where the investigator becomes a subject of his own study and draws on the introspection of his own experiences. We give examples using and/or approximating both strategies that include studies of second pain summation and its relationship to neural activities, and brain imaging-psychophysical studies wherein sensory and affective qualities of pain are correlated with cerebral cortical activity. We explain what we call the experiential or phenomenological approach that has its origins in the work of Price and Barrell (1980). This approach capitalizes on the scientific prospects and benefits of using the introspection of the investigator. We distinguish between its vertical and horizontal applications. Finally, we conclude that integrating such an approach to standard third-person methodologies can only help us in having a fuller understanding of pain and of conscious experience in general.

2. Foundational framework and some preliminaries

Understandably, there has been resistance, among psychologists and neuroscientists, against self-consciously using introspective (first-person) methods in their scientific studies. For it has been thought self-evident that the deliverances of introspection are not intersubjectively accessible, hence verifiable, and what is not intersubjectively verifiable cannot be the subject matter of science because science is in the business of studying objective reality. The objectivity of science consists, at a minimum, in the intersubjective availability of its subject matter, in that no one is epistemically privileged with regard to gathering evidence about the object of the study. Thus, no one has any special epistemic authority over evidence that others cannot in principle enjoy. But it is claimed that the objects of introspection (in the most general sense of what is being

introspected) are essentially subjective in just this sense: necessarily it is accessible only to the person who does the introspecting. What I introspect is not, indeed cannot, even in principle, be epistemically available to any one else, at least not in the way available to me. I occupy a uniquely privileged position with respect to the contents of my mind that no one else can occupy. And, this, it is claimed, renders introspection scientifically dubious.

This distrust, of course, is not solely directed upon the method of access in question, i.e., introspection, but arises also with respect to what is thus being accessed, i.e., the objects of introspection. The intuition is that anything that can be accessed *only* through introspection cannot be a proper object of science. For if the introspected contents were physical, it would seem to be objectively available to anyone at least in principle. But if they are not physical, then they can only be the kinds of things that find their place in a Cartesian dualist framework. Hence we had the behaviorist reaction in the first part of the twentieth century to the previously dominant psychology based on classical introspection (Titchener, 1908). Behaviorism can be seen as a response to this kind of worry: if the contents of mind can only be accessed via introspection, then these contents cannot be part of the natural world that is equally accessible (and, in principle, in the same way) to anyone who wishes to study it. Thus, if there is to be a *science* of psychology, the subject matter of study had better be objectively available. This is why psychology was defined by behaviorists as the science of *behavior* (conceived as response to environmental stimuli).

Although behaviorism is now dead — at least, as an explicitly promoted psychological doctrine — the basic dilemma that had led to it is still with us, and continues to trouble scientists who wish to study the human phenomenal mind. The revival of cognitivism (or, mentalism in general) in psychology after behaviorism was primarily due to the fact that we were able to figure out a way to study the cognitive mind as an intermediary between stimuli and behavior by using third-person methods without exclusively relying on subjects' verbal behavior. The ontological status of the cognitive states implicated or reported were kosher because they could be modeled as states of information processing systems or as computational states defined over mental representations realized in the brain. What made them kosher, of course, was our ability to see how they could turn out to be objectively accessible brain structures, which in turn made verbal reports — at least in controlled experimental situations — relatively reliable first-person expressions of objective facts. It was, in other words, our ability to see how the objects of introspection as implicated in verbal reports (and as indicated in non-verbal behavior — button pressing, etc.) could turn out to be facts that are in principle objectively, i.e. intersubjectively, accessible. Thus introspection was in principle dispensable, and its proper place was the context of discovery — not the context of justification. Conversely, once we were able to see how the objects of introspection could be part of nature, there was no reason to shy away from introspection. Indeed, the subjects' verbal reports about their own cognitive states have routinely been taken as evidence for the cognitive models postulated.

But, of course, this mentalistic turn was a revolution only in our understanding of the *cognitive* mind. Hence its scope was restricted to *cognitive* psychology, which is, largely (and very roughly), the study of belief fixation for the guidance of action on the basis of perception which employs computationally structured mental representations. Functionalism replaced behaviorism and restored the reality and causal efficacy of the cognitive mind. Nothing comparable, however, has happened in our scientific understanding of conscious experience: the *experiential* or *phenomenal* mind seems as mysterious as ever.[1]

[1] Block (1995) marks the distinction by claiming that although we are now in a position to scientifically penetrate the *access*-consciousness, which is causally, functionally, computationally, or otherwise

Understanding conscious experience poses serious problems for scientists working in the relevant fields. Although these problems are general for any theorist who studies perceptual phenomena, the situation that the pain scientist finds himself in is unique for a number of reasons. First, pain, unlike most conscious experiential states such as visual, auditory, tactile experiences, have an immediate affective and emotional aspect to it, which underlies its intimate personal as well as clinical urgency. Second, most other experiences are predominantly (some say, exhaustively) representational. Having such perceptual experiences is important to us insofar as they carry information about our immediate environment. Thus, in such cases our immediate interest and attention are not focused on the experiences themselves, but rather on their objects, i.e., what they represent, and how they represent what they do. Similarly, the perception scientist can, for the most part, focus his attention on the scientific study of how information about the environment is extracted from the impinging stimuli and processed in a way that results in the recognition of the distal stimuli responsible for the proximal ones. Theorizing about this process, as we know from our best extant theories, does not heavily involve making significant assumptions about the conscious nature of experiences and their phenomenal characteristics that the subjects undergoing such perceptual processes have conscious access to.

Not so with pain and with its scientific study. Even though pain is an experience which may plausibly be taken to represent tissue damage, or at least, potential damage, our immediate concern is, in the first instance, the experience itself, i.e., the pain, and not what the experience might be representing — if it does represent anything. Notice that pain here is not the object of our perceptual experience, but rather, it is the experience itself (Aydede, 2001). And, of course, this experience may in turn have a perceptual object itself, that is, be the perception of some potential bodily damage. This fact makes immediately clear why the pain scientist is in a peculiar and difficult situation with respect to the subject matter of his study (Aydede and Güzeldere, 2002). A vision scientist doesn't have to discuss and often avoids discussing conscious visual experiences and their qualities as they are consciously available to the subject having the experience. This is because she can do her job quite well by focusing attention on how the computational processes result in reconstructing the distal scene and make it available to the conceptual system. No visual scientists would comfortably claim that the subject matter of their study is the visual experience as *consciously* revealed to the agent having the experience.

The pain scientist, on the other hand, has no choice but to identify the subject matter of his study with the conscious experience, namely, pain — and its qualities and dimensions.[2] It is this

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physically, explainable, no one has any idea about how to scientifically study the *phenomenal* consciousness, which is not explainable at all in similar terms. Similarly, Chalmers (1996) thinks that the *psychological* (functional/intentional) aspects of the mind are in principle amenable to scientific treatment, but the "hard problem," on his view, is the explanation of conscious experience, the phenomenal mind, which resists scientific understanding. Indeed for Chalmers, the phenomenal aspects of the mind are not physical at all, and that is the reason why phenomenal consciousness cannot be naturalized or physically explained. See Güzeldere and Aydede (1997) for a criticism of the access vs. phenomenal consciousness distinction.

[2] The "official" definition of 'pain' recognized by the International Association for the Study of Pain (IASP) goes like this:

> **Pain**: An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage. *Note*: Pain is always subjective. Each individual learns the application of the word through experiences related to injury in early life... Unpleasant abnormal experiences (dysaesthesia) may also be pain but are not necessarily so because, subjectively, they may not have the usual sensory qualities of pain. Many people report pain in the

fact that generates the peculiarity of the situation that the pain scientist finds himself in. It is also a difficult situation due to the reasons given above in the opening paragraphs. For conscious experiences seem accessible only through introspection, from an essentially first-person perspective. And to say that pain scientists study *pain* is to say that they study a phenomenon accessible only through introspection, which is to say that they study a phenomenon that is not intersubjectively available. This has the odd *prima facie* consequence that the science of pain is not really scientific!

This is not the case, of course, because the pain scientist takes himself to study a perfectly objective phenomenon, the *brain activity* associated or correlated with pain (or, as some would like to put it, the brain activity that causally generates the pain). This approach is objective, and all the standard empirical methods and conventional scientific procedures apply. This does, however, seem to commit the pain scientist to some sort of metaphysical dualism, according to which, even though pain phenomena may lawfully depend on brain activity, they are nonetheless ontologically distinct (non-physical, psychic) phenomena accessible only through the special epistemic faculty of introspection. Not only that, but it also makes the pain scientist vulnerable to the charge that he is making a false advertisement when he claims to scientifically study pain; for it appears that this is not what he does. What he does, if we take the observation just made seriously, is to study the physical correlates of pain but not the pain itself: pain experience, being an essentially subjective phenomenon, cannot be studied scientifically — or so it seems. This is, more or less, the *intuitive framework* which reflects the uneasy relation that exists between pain and its scientific study.[3] The modern pain scientist has always felt the tension that this peculiarity of his subject matter has imposed on him.

But is this tension unavoidable? We think not. In fact, we think that the modern science of pain is in the unique position of providing a paradigm for scientifically studying the conscious experience *per se* (i.e., taking the experience as the explanandum). First, let us start by clarifying a common mistake that might have been created by the above description of what pain scientists actually do study.

Let us take, for a moment (to be rejected later), the intuitive framework at its face value and assume that some form of metaphysical dualism is true, say, epiphenomenalism — a version of property dualism which takes all and only the physical events to be causally efficacious. This would include the nomological causation of conscious experiences and their phenomenal qualities, i.e. qualia, which are themselves causally impotent (on this view, qualia are "nomological danglers," Feigl 1967). We suspect that many pain scientists might, at least implicitly or half-consciously, be assuming some such metaphysical doctrine — as we said, this is, after all, the intuitive framework naturally suggested by the very nature of the subject matter of study and by the demands of being scientific. Taken at face value, this framework, however, does not in fact imply that the subject matter of pain science is solely the brain activity. On the contrary, it *implies* that it is the brain activity *as related to pain phenomena* (you have to put the emphasis in the right place!). And the latter is a form of subjective experience. It follows immediately that insofar as

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> absence of tissue damage or any likely pathological cause; usually this happens for psychological reasons. There is no way to distinguish their experience from that due to tissue damage if we take the subjective report. If they regard their experience as pain and if they report it in the same ways as pain caused by tissue damage, it should be accepted as pain. This definition avoids tying pain to the stimulus… (IASP, *Pain*, 1986: 250)

For critical discussions of this definition, see Price (1988, 1999), Aydede and Güzeldere (2002)

[3] This uneasy relation does not exist only for pain, but arises in all other intransitive bodily sensations (itches, tickles, etc.) and their scientific study.

pain science is in the business of discovering the brain mechanisms *underlying pain experiences* accessible only through introspection, pain science is in fact irremediably committed to using first-person methods. This necessarily includes introspection along with whatever third-person methodologies are required to do brain science. In other words, if your scientific interest in the brain reflects an interest in knowing about the seat of *mental* activity, then you cannot avoid introspection. Since you want to know which experience types or qualia are produced by which brain activity: there is no telling if you do not know, at a minimum, when certain experiences occur and what their qualities are. And knowing *that* is to engage in introspection.

Indeed, apart from vexing issues about dualism, if we look at the history of scientific pain research, we find precisely this, namely, that introspection has been used extensively. Psychophysical studies of pain, for instance (as with psychophysical studies of any experience type conducted on humans), routinely take the subjects' reports (verbal or otherwise) to indicate the occurrence of sensations. In other words, psychophysics routinely relies on the introspection of the subjects. Here, relying on introspection has literally no alternatives: psychophysics *is* the scientific study of the lawful relations between stimulus properties and sensations. But we find the same thing if we look at the electrical and chemical stimulation experiments conducted on humans. Recording from single cells via microelectrodes similarly relies sometimes on introspective reports of patients in uncovering the relations among stimuli, brain activity, and sensory phenomena.[4] It is true, most of these more intrusive types of experiments were done on animals. But insofar as we take the findings as indicating something about the *psychology* of animals, we do that indirectly by relying on what the similar structures underlying human experiences reveal. Conversely, we take the findings of such experiments on animals as indirect evidence for the human case, which waits to be confirmed directly on the basis of introspection. This confirmation would occur whenever experimenting on humans becomes possible or whenever an occasion involving a patient with central nervous system damage arises that allows the scientist to study the case that would otherwise be impossible to study experimentally. In all these studies, introspection plays an indispensable role — directly or indirectly. What is more striking, however, is that with the recent advance of brain imaging techniques, we can now study, directly and with an unprecedented and increasing accuracy, the complex relationships that exist among stimuli, brain activity, and sensations in conscious subjects. This is largely the result of the fact that they can introspect and report their introspections in real time. We will give examples of each of these below.

So, it is simply not true that a successful science of pain can or should dispense with first-person methods, with introspection. For the sake of convenience, we have so far assumed — with what seems to be suggested by the intuitive framework anyway — that epiphenomenalism is true and that pain scientists seek to discover, among other things, lawful correlations between brain activity and experiences, essentially implicating introspection. (Of course, this conclusion can, *mutatis mutandis*, be generalized to brain science at large and all types of conscious experience.) We have shown that this assumption is consistent with the actual historical practice in pain research.

But being consistent is one thing and being demanded by it is another. Although introspection and first-person methodologies in general may be necessary for pain science, this does not in fact logically commit the pain scientist to any form of metaphysical dualism — or so

[4] Experiments involving single cell recordings or recordings from a population of cells were usually designed to find out the *connectivity patterns* among nerves or nerve bundles. For this purpose, correlations with sensations were not essential and not sought after.

we would like to argue. As we have seen, when it comes to conscious experience and its qualities, it is difficult to make sense of how they can be physical in nature. This is bolstered by the intuition that introspection seems to be the *only* available method of access to qualia, and that if qualia were physical in nature, this should not be so: they should in principle be epistemically accessible to anyone in the same way — at least in principle, if not in practice. The idea that something can be physical but not epistemically accessible to any one in the same way, even in principle, strikes all of us as odd. So we are naturally *tempted* by this to adopt a dualist position. On the other hand, epiphenomenalism about qualia, the only tenable form of dualism in our opinion, is no less bizarre, and being scientists/naturalists, dualism strikes most of us as profligate, and given the traditional scientific commitment to physicalist objectivism and its methods, intellectually offensive. This is the tension or dilemma confronting the pain scientist. So, what to do?

The solution is to replace metaphysical dualism with epistemological dualism while preserving metaphysical physicalist monism. However, it is not clear how or whether this can be done successfully, although present efforts in this direction seem quite promising.[5] Although we will not pursue this line in any detail here, we would like to briefly point out the outlines of the fundamental idea. Introspection is a way — apparently the only way — of coming to know about our experiences and their qualities directly. As such, it is an *epistemological* activity, albeit an essentially first-person activity. However, strictly speaking, what we get at through introspection may, for all we know and appearances to the contrary, be completely physical in nature. It may be that what the brain scientist gets at through third-person methodologies turn out to be *identical* with what we get at through introspection, namely brain activity of the relevant sort. There are not two fundamentally distinct but correlated sorts of activity here, one physical and the other irreducibly psychic or phenomenal.[6] Rather, there is only one kind: the brain activity with all and only physical properties. So a scientifically respectable monism is preserved. But given the kind of cognitive organisms we are, it is essential that we have a way of getting at some of our own experiential activity directly and immediately. Indeed, such an access should be expected whenever one is dealing with epistemologically sophisticated intentional organisms such as ourselves that have to informationally interact with their environment in real time. The epistemological advantages of knowing the perceptual sources of information flowing into the central conceptual repertoire of the organism to fix its behavioral strategies are quite clear: such organisms will be able to deal with their environment (including, social environment) far more successfully than those without introspective capabilities (Armstrong, 1968). So perhaps

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[5] Treating subjectivity as merely an epistemological phenomenon lacking any anti-physicalist metaphysical implications has been in the rise since the early 1990's. Among such physicalists are Loar (1990/1997), Papineau (1993), Sturgeon (1994), Pereboom (1994), Lycan (1996), Hill (1997), Levine (1993, 2001), Tye (1995, 1999), Perry (2001), Aydede and Güzeldere (2005, forthcoming). Those who argue against physicalism on the basis of subjectivity and phenomenal character of conscious experience include Kripke (1970/1980), Nagel (1974), Jackson (1982, 1986), and Chalmers (1996).

[6] The well-known Frege puzzles in the philosophy of language concern a similar phenomenon. One can know that Mark Twain is clever without knowing that Samuel Clemens is clever, even though what makes both true is precisely the same state of affairs. There are no separate states of affairs or facts here, but only one fact that can be expressed either by saying 'I know that Mark Twain is clever' or by saying 'I know that Samuel Clemens is clever.' I may even know one and the same fact without realizing that I do: I may think that there are two facts here if I do not know that Mark Twain is Samuel Clemens. Similarly, the idea in the main text is that there are two very different ways of representing one and the same phenomenon, say, pain: one under its scientific description, the other introspectively.

introspection gives us a way of accessing certain of our own brain activity in a direct and immediate way without telling us what the complex physical properties of such brain activity are — those properties that would be revealed by a third-person scientific inquiry. As an analogy, think of our visual color detection, we are capable of recognizing instances of red, of discriminating them from other colors, all the while not having the slightest clue about what the nature of the physical surface properties are that we are thus picking out or visually responding to. Color *science* tells us what those surface properties are. Suppose they are, say, certain triplets of surface spectral reflectances. Our visual system, then, responds to such physically complex properties as spectral reflectances without giving us any information about their complex internal structure in any usable form: we perceive colors as simples. Analogously, it may be that introspection manages to convey information to us about our own brain activity underlying/realizing experiences without revealing to us what complex physical features of this activity are that we are directly and immediately responding to.

This is all speculative. However, at least it gives the flavor of a way of dealing with the above dilemma.[7] It is attractive precisely because, if it works, it saves the scientists from both the epistemological Scylla of being essentially committed to a first-person methodology (which is to be found nowhere in science but in psychology) and the metaphysical Charybdis of dualism. Scientists can have their cake and eat it too, in short. Most importantly this approach would legitimatize the indispensable role of introspection in the scientific study of pain by showing how it is in fact complementary to third-person methodologies within a fully naturalistic framework. There would remain no mystery about why the brute correlations discovered (or, to be discovered — see below) by the scientist hold between what the first-person and third-person methods of access get at: for they are access to one and the same phenomenon, namely brain activity.

To wrap up, the indispensability of introspection, and first-person methods in general, in the scientific study of pain naturally suggest that some form of dualism is correct about the phenomenal mind. We take this dualism to be an epistemological one, which consists in the different forms of access to one and the same phenomena, namely, to the brain activity realizing pain experiences.[8] Metaphysical dualism certainly entails epistemological dualism. But endorsing epistemological dualism leaves the option of accepting metaphysical dualism wide open. Thus, assuming that we can make philosophical sense of epistemological dualism within a physicalistic monism in the way suggested above and the intellectual costliness of metaphysical dualism in a scientific approach, we tentatively endorse physicalism and thus reject metaphysical dualism.[9] This meshes well with efforts to legitimize first-person methods within a scientific framework: it

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[7] For an extensive and detailed elaboration of this kind of approach to experience and introspection, see Aydede and Güzeldere (2005, forthcoming).

[8] We haven't distinguished between claims of identity of the physical with the mental, on the one hand, and the claims of metaphysical supervenience of the mental on the physical, on the other. The terminology of 'realization,' 'implementation,' etc. usually indicates that a supervenience claim is being made. Identity is stronger than supervenience in that the latter is a claim about one way entailment: if the mental is only metaphysically supervenient on the physical then more than one physical kind or different kinds of brain activity can realize or implement a given mental kind. For sensation types like pain it is more likely that a form of type-identity claim is true, so we will operate under this assumption, but nothing crucially depends on this for what follows. The reader may make the necessary changes in the text if supervenience strikes one as more plausible.

[9] One of us, DDP, hasn't decided yet whether he agrees or disagrees with physicalistic monism but he unquestionably accepts epistemological dualism. Any potential disagreement between DDP and MA about this doesn't effect the main position of this paper.

makes subjectivity metaphysically, and thus scientifically, kosher. Moreover, this solution, if it works, makes it possible to objectively study the subjectivity of conscious experience itself.

3. Two ways in which introspection is used in scientific experiments

So far we have indiscriminately talked about introspection and a first-person methodology in general as if it had a unified use in scientific practice. Neither have we talked about what introspection involves, or what kind of activity it is. However, attempting to answer the latter question would go beyond the scope of the present paper. Suffice it to say that there are basically two kinds of proposals conceiving introspection either as a form of inner sense (the higher-order perceptual model — HOP — or simply, the perceptual model),[10] or as a form of higher-order thought (HOT, or the conceptual model).[11] For the purposes of this paper, we would like to operate with an intuitive notion of introspection, which simply takes introspection to be some kind of inner perception eventually yielding conceptually articulated knowledge about one's own experiences and their qualities. In other words, introspection can incorporate elements from both perceptual and conceptual (HOT) models.[12] But nothing crucial will depend on this in what follows. We would like to expand on the former question in the remainder of this paper, detailing extensively the methodological and practical ramifications of the distinctions proposed.

In a typical psychophysical experiment done on adult humans, part of the data the investigator collects consists of verbal reports of his subjects following a previously determined set of rules and questions. It is assumed that what the subjects report are the dependent variables to be measured by manipulating the independent variables, usually stimulus parameters. In this kind of experimental paradigm, the data collected are considered objective from the perspective of the investigator in that any other investigator can easily have access to the same set of data in two distinct ways. He can check out the results of the other investigator himself or he can replicate the experiment either on the same set of subjects or on others. This is typical of a third-person approach. There is no question about the investigator's engaging in introspection himself. However, that part of the data set that consists of verbal reports of subjects is typically taken to indicate the occurrences of sensory states and their qualities.

Here it is important to be clear about how the investigator takes this "indication" relation. The most plausible thing to say is that the subjects' reports *express* or *describe* what goes on in their mind or sensorium. In other words, they come to directly observe/believe that such and such sensations are occurring to them and they *express* these observations/beliefs by *verbally reporting* them as instructed.[13] But how do they form these observations/beliefs? The obvious answer is that they form them on the basis of introspection, i.e. directly noticing what is in their experience and expressing those contents through words or magnitude judgments. In other words, implicitly (or, explicitly depending on the experimental design) the subjects are instructed to notice what is

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[10] Locke (1693), Armstrong (1968), Lycan (1996), Lormand (1996).

[11] Rosenthal (1997, 2001). Among the proponents of HOT, some like Dretske (1995) and Shoemaker (1994) take introspection to be inferential, i.e., not direct and immediate.

[12] See Aydede and Güzeldere (2005, forthcoming) for more details about a general account of introspection of experiences along these lines. See Aydede (in prep.) for an account of introspection of bodily sensations including pain.

[13] Here, we use 'belief' in the standard philosophical sense as that cognitive state (like knowledge) that underlies the assent one makes to a descriptive statement. Our use here is not the ordinary layman's use in the sense of having an opinion which reflects one's biases prejudices, etc.

in their experience and report whether a sensory state of a certain type is occurring to them and what its intensities or qualities are.

Of course, if the investigator has behaviorist inclinations, the interpretation of the "indication" relation will likely be different. The verbal reports will be taken to be pieces of mere behavior that are not semantically relevant, but whose features are interpreted as the dependent variables controlled directly by stimuli (instead of *expressing* the occurrence of internal dependent variables, i.e., sensations). There is another option that such a behavioristically inclined investigator may take. She may interpret the verbal reports as indicating the occurrence of certain types of brain states correlated with stimulus properties while being silent as to whether the occurrence of these brain states are identical or correlated with sensory/mental states. Here the notion of indication is *natural indication* (as opposed to semantic one) in the sense in which smoke indicates fire.

Behaviorism has failed partly because it has prohibited the postulation of mental states mediating stimuli and behavioral responses. Indeed, it did not allow for postulating *any* intermediary as a theoretically significant parameter, be it mental or physical (brain states). We take this failure seriously, and feel justified, along with most psychologists we believe, in engaging in realist mentalistic talk and in making mentalistic hypotheses within a naturalistic framework. We, therefore, take the most plausible interpretation of what the subjects are doing in such experiments, namely that they are reporting their introspective observations about their own sensations and their qualities — just as we said above.

If this is right, then this is one sense in which introspection is indispensable in pain science, and neuropsychology in general. Interestingly, while most researchers in the field take this sort of use of introspection as perfectly objective and acceptable, they nevertheless have doubts about the legitimacy of using introspection in a more direct way, namely, by becoming subjects themselves. We have already touched upon some of the reasons of why that is the case, and tried to deflect the worries. Our point here, however, is that there is no *principled* methodological difference between investigators' drawing on subjects' introspective reports (which is indispensable anyway) and drawing on their own — if the context of the latter is properly understood and some potential methodological pitfalls are preempted. As we said in the beginning, we will propose an experimental paradigm where both kinds of introspection are used in a complementary fashion, and argue that this paradigm is superior to the one that licenses *only* the subjects' (≠investigators) introspective reports as legitimate. We call this approach the *experiential* or *phenomenological* approach.[14]

4. Studies of pain

4.1. Studies of "first" and "second" pain from a first person perspective

We can start by asking whether there exists any precedent for scientific investigators observing and analyzing their own experiences of pain. There have been both phenomenological and psychophysical studies of pain in which at least some of the investigators were subjects in their own experiments. As an example for discussion, several studies throughout the last century sought to characterize the subjective experience of "first" and "second" pain by having the

[14] This approach has some close affinities with the approach of Varela and his colleagues (Varela et al 1991; Varela 1996), which is sometimes called 'neurophenomenology' for reasons that will become clearer as we proceed. See Flanagan (1991), and Aydede and Güzeldere (2002) for a defense of similar approaches.

investigators conduct experiments on themselves. First and second pain results from a sudden noxious stimulus to a distal part of the body, such as the hand or foot. The 0.5 to 1.5 second delay between the two pains occurs as a result of the fact that nerve impulses in C axons travel much slower (0.5 to 1.5 meters/sec) than those in thinly myelinated A axons (6–30 meters/sec). The first study utilized a paradigm wherein two investigators independently mapped the body regions wherein they experienced first and second pain in response to brief intense electrical shock (Lewis and Pochin, 1938). They did so prior to knowing the results of the other investigator. The body maps of both Lewis and Pochin were nearly identical, thereby providing convergent confirmation of their results. Both maps showed that first and second pain could be perceived near the elbow but not the lower trunk even though both sites were about the same distance from the brain. The reason for this difference only became known later, when impulse conduction velocities of peripheral and central pain-related nerve cells became characterized. C fibers that supply the trunk have a short conduction distance to the spinal cord, whereas C fibers that supply the skin near the elbow have a long conduction distance. Once both "trunk" and "elbow" C fibers reach the spinal cord, they synapse on nerve cells that have fast-conducting axons. As a result of differences in peripheral conduction distance and time, first and second pain can be discriminated at the elbow but not the trunk.

A study by Landau and Bishop (1953) similarly used themselves as investigator-participants to determine the qualities of pain related to selective stimulation of peripheral nociceptors supplied by A and C-axons. Their study was much more experiential-phenomenological than that of Lewis and Pochin. Using standard stimuli, they attempted as much as possible to simply notice the qualities and intensities of first and second pain prior to reflecting on the causes or interpretations of these two types of pain. Both investigators observed that first pain was sharp or stinging, well localized, and brief, whereas second pain was diffuse, less well localized, and had qualities of dullness, aching, throbbing, or burning. The latter quality was prevalent when skin C nociceptors were selectively stimulated. Second pain was longer lasting than first pain and was accompanied by a feeling of unpleasantness that differed from that of first pain. The distinct unpleasantness of second pain was associated with a sense of vagueness and poor localizability and with its dull, diffuse, and long lasting sensory qualities. Both Landau and Bishop independently observed these sensory and affective qualities through passively noticing their own direct experience.

There are three important points to be made about these first two studies. First, they arrived at very straightforward observations about the experiential nature of specific types of pain and even made cogent inferences concerning their mechanisms. Second, the observations have since been incorporated into our body of knowledge of pain and have been replicated in several studies using more conventional experimental designs and methods drawing on other subjects' first-person access to their own experiences. Finally and most critically, the results were obtained through investigators introspecting their own experiences of pain and other sensations.

Some studies have combined experiential and psychophysical methods.[15] Subjects of these studies included one of the present authors (DDP) as well as those who were unfamiliar with first and second pain or the hypotheses of the study. The result of these studies replicated and extended the observations of Landau and Bishop. First, the investigators experienced the same kind of sensory and affective qualities reported by them and thereby replicated their observations. Furthermore, untrained subjects also reported them without our provocation or suggestion that such qualities existed. Thus, knowledge of first and second pain is both first- and third-person.

[15] Barrell and Price (1975); Price *et al.* (1972, 1977, 1994).

This knowledge was then extended in psychophysical experiments wherein subjects reported on and separately rated the intensities of first and second pain. Using series of four computer-driven heat pulses (2.5 sec duration, peak temperature 52^0 C) or four 5–9 mA electrical shocks, subjects' mean ratings of first pain were not statistically different throughout each series (Price *et al.*, 1977, 1994). Unlike first pain, second pain progressively increased in mean intensity and duration throughout a series of shocks or heat pulses when the inter-stimulus interval was less than three seconds but not when it was five seconds. All of these results also were confirmed in direct experience. In the case of one of the present authors that addressed the question (DDP), second pain did indeed become stronger, more diffuse, and more unpleasant with repeated heat pulses or repeated electrical shocks.

4.2. Psychophysical-neural parallels of first and second pain

We now turn to studies where direct comparisons can be made between the types of psychophysical data just described and neural activity at different levels of the nervous system, including the human nervous system.[16] When the same types of heat pulses or electrical shocks described above are applied to the skin of monkeys, individual neurons within the spinal cord dorsal horn respond with a double response (i.e., two sets of impulse discharges). The earlier of the two is related to synaptic input from A-nociceptors and the delayed response is related to synaptic input from C nociceptors. Similar to first and second pain, the first response does not significantly change throughout a series of heat pulses, whereas the second delayed response increases progressively both in magnitude and duration. Similar to second pain, temporal summation of the delayed neural response was observed when the inter-stimulus interval was 3 seconds or less but not five seconds. Moreover, this summation must occur within the spinal cord dorsal horn, because similar experiments conducted on peripheral A and C nociceptors show that their responses do not increase with stimulus repetition (Price *et al.*, 1977). Thus, temporal summation of second pain depends on mechanisms of the central nervous system (i.e., dorsal horn neurons) not changes in peripheral receptors.

These psychophysical-neural parallels have been confirmed not only in the case of single neurons of the spinal cord dorsal horn but also in the case of neural imaging at the level of the somatosensory region of the cerebral cortex (Tommerdahl et al, 1996). Using a brain imaging method of intrinsic optical density measurements (OIS), Tommerdahl and colleagues imaged neural activity within the primary somatosensory cortex of anesthetized squirrel monkeys as their hands were repetitively tapped with a heated thermode. These taps reliably evoke first and second pain in human subjects. Their method of neural imaging has a high degree of both spatial and temporal resolution, measuring local cortical neural activity within 50–100 microns and sampling neural activity that has occurred within a third of a second. Heat taps produced localized activity in two regions of the primary somatosensory cortex, termed 3a and 1. When heat taps were presented at rate of once every 3 seconds, delayed neural activity within these regions occurred in response to each tap and grew progressively more intense with each successive tap. This temporal summation of this neural response paralleled human psychophysical experiences of second pain in several distinct ways. Both types of responses summate at the same rate of stimulus repetition and have a similar growth in intensity during a series of heat taps. The perceived skin area in which second pain is perceived and the area of cortical neural activity both increase with repeated heat taps.

[16] See Price (1988) and (1999) for reviews.

Since the psychophysical experiments utilized human subjects and the neurophysiological experiments utilized anesthetized monkeys, more definitive conclusions about how these patterns of neural activity relate to the conscious experience of second pain summation await future experiments in humans. But given the results so far, there is reason to think that robust correlations would be established. Furthermore, interpretations of the results of such experiments can be improved by several conditions of the experimental design. First, the subjective data and neural data should be obtained in the same subjects. Second, the neuroimaging methods should have a high level of spatial and temporal resolution. Third and finally, the subjects of such experiments should include both the investigators and subjects unfamiliar with the hypotheses. It is very clear that including investigators among the subjects in such experiments cannot fail to help interpret the data in a more accurate and detailed way. Given the results so far, and certain constraints we will describe later, there is no reason to shy away from taking the experiential-phenomenal method here (in addition to standard methods).

4.3. Relating brain activity to sensory and affective dimensions of pain

A good example of an experiment that supports the feasibility of this type of experimental strategy is that conducted by Rainville and his colleagues (Rainville *et al.*, 1997). The experiment was not about first and second pain, but about the subjective qualities of pain sensation and pain unpleasantness, and how they relate to each other. Participants of this study rated pain sensation intensity and pain unpleasantness of moderately painful immersion of the left hand in a 47^{o} C water bath. Two experimental conditions included one in which hypnotic suggestions were given to *enhance* pain unpleasantness and another in which suggestions were given to *decrease* pain unpleasantness. Suggestions also were given in both conditions to the effect that, unlike pain unpleasantness, pain sensation would not change. They found that suggestions for enhancement of unpleasantness increased magnitudes of both pain-unpleasantness ratings and neural activity in the anterior cingulate cortex (area 24) in comparison to the condition wherein suggestions for decreased unpleasantness were given. Neural activity in S-1 somatosensory cortex, like subjects' mean ratings of pain sensation intensity, were not statistically different across the two experimental conditions.

A second similarly designed study used hypnotic suggestions to modify the intensity of pain sensation. In this experiment, the suggestions were effective in producing parallel changes in ratings of pain sensation intensity and neural activity in S-1 somatosensory cortex (Hofbauer *et al.*, 2001). It is important to recognize that the stimulus intensities were exactly the same across experimental conditions that produced different subjective magnitudes of unpleasantness or pain sensation. These experiments reflect a strategy designed to identify neural structures differentially involved in two separate dimensions of pain experience. It is necessarily simplistic because sensory and affective dimensions of pain cover broad and complex experiential territories. However, this type of experiment not only clearly and essentially draws on the introspective reports of subjects used in the experiments, but also strongly suggests that adopting the experiential-phenomenal method could only help here. In particular it could help clarify, better describe, and expand the results of the specific experiments from which the results are obtained. It could only help suggest new ways of extending the experimental design in question to new experiments by formulating new hypotheses. The latter possibility is a reliable sign of the fertility and productivity of any methodology used in scientific experiments and hypothesis forming.

4.4. The significance of parallels between pain phenomenology and central neural activity

A single brief heat tap can lead to multiple pains with diverse sensory qualities, partly as a result of the frequency with which it is presented. The sensory qualities of pain depend not only on

features of the stimulus and on the transducing properties of sensory receptors but also on integrative mechanisms of the central nervous system. For example, there is nothing about the physical properties of heat taps or even the physiological characteristics of peripheral C-nociceptors that would allow someone to predict temporal summation of second pain. Yet the subjective qualities of this phenomenon can be characterized and systematically related to central neural mechanisms, including those at the highest levels of the central nervous system.

Similarly, there is nothing about the stimulus in Rainville *et al.*'s study that allows one to predict changes in the affective or sensory qualities of pain produced by the suggestions given to the subjects. Sensory and affective qualities of pain co-vary with patterns of neural activity in the central nervous system and not just the physical characteristics of stimuli. Given this high variability between the stimulus characteristics (or, features of the peripheral nervous system) and qualities of the resulting subjective experience, it is very clear that the relationships between these qualities of pain experience and neural activity can *only* be explored through careful analysis of both subjective experience and neural activity. It should by now be obvious that drawing on introspection is an indispensable condition of such an exploration.[17]

It is very important to recognize that parallels between experience and neural activity do not prove that the neural activity sufficient for a given subjective quality of pain exists within one specific brain region, such as the somatosensory cortical area (second pain) or anterior cingulate cortical area 24 (pain unpleasantness). However, activity in these regions may represent a beginning or necessary stage of processing that is required for such qualities. It is not difficult to envision how knowledge of patterns of activity in these brain regions will eventually form at least part of a coherent explanation of how patterns of brain activity entail the existence of experiences with a subjective epistemology for their possessors.

4. 5. Possibilities for a refined analysis of the relationships between pain and brain activity

Our evolving knowledge of the relationships between brain activity and experiential states such as pain depends equally on improvements in methods of analyzing neural activity and on methods of investigating human experience from a first-person perspective. Complete explanations of these relationships require an integration of experiential methods, such as phenomenology and psychophysics, and neuroscience.

As we touched upon previously, first-person experiential methods are extensively and essentially used in psychophysics. Throughout the history of psychophysical research, we see, moreover, that experiential methods and introspective observation have been constantly improved upon. Paradigms of detection, direct scaling, and differential scaling of different experiential

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[17] It is noteworthy that these findings make a strong *prima facie* case against pure representationalist theories of pain, or as philosophers sometimes put it, against externalist perceptual theories of pain, according to which the phenomenal content of a pain experience is exhausted by its external informational/representational content (e.g., Dretske 1995, 1999; Tye 1995, 1997). Such a position requires the theorist to find a feature of the stimulus or its immediate effect on the body (tissue damage or impending tissue damage) for every discernable phenomenological quality of pain as its representational content. As we have seen, however, the second pain summation phenomenon clearly does not correlate with any stimulus property or even with anything in the peripheral nervous system. This makes it hard to see what the phenomenology of second pain summation can have as its representational content. Aydede (2001) uses the affective dimension of pain in an attempt to make a case against purely representational theories of pain, but the second pain summation demonstrates that the same kind of argument can also be mounted by using sensory-discriminative qualities of pain.

dimensions have continued to improve throughout the last century.[18] Psychophysical observers can be trained to detect very small differences in sensory qualities and intensities and to differentially judge magnitudes of different dimensions or qualities of their own experience (e.g., as in the Rainville studies described above). These paradigms and response abilities can be applied not only to sensory phenomena but also to several dimensions of human experience in general including the relationships among higher order mental states (such as beliefs, desires, hopes, expectations, etc.). Thus, the well known power law in psychophysics applies not only to sensory phenomena, such as sound and pain, but to such dimensions as expectation, desire, and emotional feeling intensity (Price and Barrell, 1984). In fact, studies have directly scaled these three dimensions and found lawful interrelationships between them.[19]

Less well known, however, are extant methods for observing the contents of experience and improvements in methods of analyzing experiences. These include eastern meditative practices, phenomenology, and explicit experiential paradigms. Buddhist meditative practices offer a method for observing what one's mind is doing as it does it, to be present with one's mind. As Varela *et al.* (1991) point out, "The purpose of the mind in Buddhism is not to become absorbed but to render the mind able to be present with itself long enough to gain insight into its own nature and functioning." This method is compatible with phenomenology, the study of how phenomena are presented in our experience prior to analysis or explanation. Phenomenologists offer reflections on direct experiences that are nearly totally missing in mainstream psychology and cognitive science.[20] For example, there is relatively little emphasis within mainstream psychology on understanding the experiential structure of phenomena such as pain or emotional feelings. Consequently, there is often a lack of any search for detailed structural analyses within these kinds of experience. In fact, within the framework of a large part of psychology, experiences such as pain or anxiety are usually discussed only in relation to the possible external conditions under which they are present or to the physical processes that seem to generate them. Yet there is no search for experiential dimensions internal to these phenomena. Obviously, both the study of pain, and the conscious experience in general, might substantially benefit from an integration of improved experiential-phenomenological approaches and conventional methodologies of neuroscience. There is no reason at all that justifiably prohibits a systematic first-person approach to studying these phenomena involving the investigators themselves as subjects.

5. The experiential approach and method: The *horizontal* phase

Recognizing the limitations of traditional phenomenology and classical introspectionism, Price and Barrell (1980), and Barrell and Barrell (1975) developed an experiential approach and method for the study of human experience, one that utilizes both the basic principles of phenomenology and psychometric methods (e.g., psychophysics). This approach and method allows for the discovery of common factors or dimensions within specific types of experience such as anger, anxiety, and pain as well as for the characterization of the interrelationships among these common factors. The focus of this kind of approach is "horizontal" in that it is the interrelationships among the elements of one's total experience (broadly construed) as revealed to one's introspective consciousness that are under investigations — without an attempt to relate them to brain

[18] See Gesheider (1998) and Stevens (1975) for reviews.

[19] Price and Fields (1997), Price *et al*. (1985, 2001).

[20] Bakan (1967), Buytendyck (1961), Merleau-Ponty (1962), Husserl (1952).

structures. Later, we will sketch the second, 'vertical,' phase of this approach where experiments are designed to discover the correlations between the findings of the first phase (experiential elements and regularities) with the elements of brain activity. However, the horizontal phase can stand on its own, and we expect to find quite robust and interesting results simply by studying the elements of conscious experience.

The horizontal experiential paradigm itself consists of several stages that include (1) questioning and observing; (2) describing experiences from a first-person perspective; (3) understanding experiences through discovering common factors and their interrelationships (i.e., anxiety, pain, etc.); (4) application of quantitative methods to test generality and functional relationships between common factors. Of these four stages of research, the first three are unique in that the investigators are the subjects of their own research questions (i.e., co-investigators) and the last stage utilizes accepted psychometric methods, derived mainly from psychophysics, to test hypotheses in other human observers. The last stage is no different in principle from conventional psychological/psychophysical research. However, it is the combination of these stages that produces direct knowledge about experiential phenomena. It is a paradigm that could be directly applied to the study of consciousness in general and to pain in particular. We now turn to the explanation of each of these stages.

(1) Questioning and observing experiences

An experiential approach begins with the investigator or a group of investigators posing a general question about their experiences such as "What is it like to experience performance anxiety?" or "What is it like to experience the unpleasantness of a specific form of laboratory pain, such as immersion of the hand in a heated water bath?"[21] The question should be general, clearly understandable, and specifically directed to *how* a given phenomenon is experienced. The focus is to be on *how* we experience something rather than the specific objects of experience or the stimulus conditions in which the experience occurs. Thus, if the question concerns the experience of pain unpleasantness, we would attempt to passively notice the qualities of sensations, thoughts, and feelings that would occur during the experience as opposed to our explanation of *why* the experience occurred in the first place. This approach has historical roots in phenomenological analysis which asserts that the process of experiencing rather than the specific objects of experience leads to an understanding of the essential structure and factors within different types of experience.[22] For example, noticing how we experience performance anxiety would include our thoughts and feelings that occurred during or just before performance and not just the specific targets or "stimulus objects" of experience (e.g., the particular audience or the particular acts of performance). However, noticing *how* we experience the audience and our thoughts and feelings about our prospective performance is more likely to reveal the content of experience that is *common* across different experiences of performance anxiety (Barrell *et al.*, 1985). Most importantly, the investigators in the study are to pose the question to themselves, that is, to their own experience of the phenomenon.

Once a question is formed, the investigators can assume a particular stance toward the subject of interest in order to gain information about it. The stance consists of passive attention, simply noticing whatever is happening in one's experience.[23] It is simply "being *with*" the experience and includes an intermittent attention to whatever is occurring or has just occurred

[21] See Barrell and Barrell (1975), Van Kaam (1959), Price and Barrell (1980).

[22] See Husserl (1952), Merleau-Ponty (1962), VanKaam (1959).

[23] See Perls *et al.* (1951), Barrell and Barrell (1975), Price and Barrell (1980).

without a strong hard focus and without explanation or judgment of the experience itself. This process is similar to locating an object in one's peripheral visual field, rather than in its focal region. In this respect it is a form of introspection different than the one promoted by classical introspectionists who insisted on active attention to one's experiential elements, which often resulted in the disappearance of or changing the elements thus attended.[24] In our paradigm, one simply just allows oneself to notice occasionally whatever is going on in experience without interpretation or judgment. This requires acceptance of whatever is happening. Once acceptance occurs, we are more willing to look at the processes of experience impartially. Otherwise, we tend to experience through the filters of our own biases. Passive attending is not interpretative or judgmental nor, as we said, a form of classical introspectionism. Rather, it occurs in a present-oriented context, that is, either in the present or a "reliving" of past situations. However, since it is often difficult to attend passively exactly at the same moment one is experiencing a phenomenon, this form of attention often consists of immediate retrospective attention to what has just occurred in experience. This form of observation has been used in certain forms of psychotherapy, particularly gestalt therapy (Perls *et al.*, 1951), and yet is also consistent with underlying principles of phenomenology.[25]

(2) Describing experiences

Once we develop the ability to passively attend and notice how we experience a given phenomenon, such as anxiety or a specific type of laboratory pain, we can also develop a method and style of describing these experiences. The experiential method contains a way of reporting experience that is consistent with the principles of phenomenology in that it requires reports of observers to be first person present tense accounts. Thus, the report refers to immediate experience and is written in the first person present tense, since even reports of previous experiences can result from "reliving" those situations. A (necessarily simplistic) experiential report of a few moments of a specific type of experimental pain serves to exemplify this type of account:

> *My (DDP) hand was immersed in a 47^0 C water bath (Pierre Rainville at al.'s 1997 experiment) when the following experience occurred:*
> Intense burning and throbbing in my hand. Feel bothered by this and slightly annoyed. Is it going to get stronger? Feeling of concern. Hope my hand isn't going to be scalded.

This type of report can be generated from an immediate retrospective reliving of this experience, but is more likely to be distorted if it were obtained long after it occurred. With continued "snapshots" of experiences such as this, one would begin to observe commonly experienced types of thoughts, sensations, and emotional feelings that characterize the experience of a specific type of pain in a particular individual.

(3) First-person understanding of experiences

With continued reliving or direct experiences of pain in a given experimental or clinical situation, one would find commonly experienced factors.[26] Thus, thoughts and feelings such as "Is it going to get stronger? Feeling of concern. I hope my hand isn't going to be scalded" might be

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[24] See Boring (1957), Titchener (1908,1924).

[25] See Husserl (1952), Merleau-Ponty (1962), Van Kaam (1959), Varela *et al.* (1991).

[26] See Price and Barrell (1980), Van Kaam (1959).

characterized by the statement "I think and feel a concern for future consequences related to this pain." This expression more concisely describes the sense of what is experienced. Part of the process of so-called "phenomenological reduction" consists in an attempt to capture experiences in this more concise way.[27] Similarly, the statement "Feel bothered by this and slightly annoyed" could in this way be reduced to the expression that "I have a feeling of intrusion related to this pain." This process represents a distillation of the sensations and their general significance that are present in an individual's experience during a specific type of experimental pain. This type of account can be a starting point for understanding experiences as described below.

Thus, following several experiential descriptions of what is present in several situations in which the phenomenon (e.g., pain) takes place, we then become interested in understanding the factors that make up this type of experience. We begin this process by analyzing our data in such a way as to determine what is present in *all* situations in which this phenomenon occurs. The aim of this analysis is to identify the *common factors* (or what phenomenologists call structural invariants) of experience, an aim of structural phenomenology.[28] At this time, we must be careful to reflect in such a way that no preconceptions are brought in for the purpose of interpretation. The assumption is that the answers to our question can be directly identified within the data. We are to reflect on the data, continuing to ask, "What is present in my experience during the situations wherein I am feeling pain during immersion of the hand in this experiment?," "Which of these common elements or factors are necessary or sufficient for this experience?" Both *definitional* hypotheses and *functional* hypotheses can be generated from this type of reflection. Definitional hypotheses posit the experiential factors that are commonly present during a type of phenomenon, such as pain from a heated water bath, and functional hypotheses are statements about their interrelationships.

To use our analysis of pain as an example, we can formulate the following definitional hypothesis on the basis of this analysis. Experiential factors that are present in my experience of this form of pain include (i) an intense burning throbbing sensation in the hand, (ii) an experienced intrusion or threat *associated with this sensation*, and (iii) a feeling of unpleasantness *associated with this felt intrusion or threat*. The sense of intrusion can apply simply to the present without concern for future threat or it can also include the latter. The experiential example given above contains both factors. When the factors of intrusion or threat are present, they are accompanied by a felt sense, one that is normally experienced as a state of the body.[29] This felt sense constitutes the pain-unpleasantness. As Gendlin (1962) has pointed out, the felt sense of an emotional feeling is its key feature: it seems to reflect the physical and biological state of the body in the same way that the experience of thirst and hunger reflect biological states.[30] For example, the felt intrusion and threat during pain seems to *about* the experienced integrity of the self, body, and consciousness that is implicitly there in experience prior to explanation (i.e., the experience carries the information without this information being necessarily conceptualized and thus made conscious *to* the subject-investigator as such prior to its becoming the target of introspection). We

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[27] See Van Kaam (1959), Price and Barrell (1980).

[28] See Merleau-Ponty (1962), Van Kaam (1959).

[29] Note that it is not necessary for one's experience simply to *have* this felt sense of unpleasantness that it be experienced *as* threatening or intrusive, in that one need not have the conceptual resources to characterize one's experience as such. The claim here is that the experience is threatening and intrusive when and only when it is unpleasant — although it will also, as a matter of fact, be normally conceived as such by the passive introspection of subject-investigators who have the relevant conceptual resources.

[30] See Damasio (1994, 1999), Price (2000).

could also formulate hypotheses that are about the functional relationships between these three factors. For example, felt unpleasantness should increase as a function of experienced intrusion or threat. Experienced intrusion, in turn, should increase as a function of the intensity of burning, throbbing sensation.

Once factors for a given type of experience are agreed upon by a group of subject-investigators, the investigators can formulate *functional* hypotheses about the interactions between them. To do so, the investigators can utilize several specific experiences in which a factor, such as the perceived degree of intrusion or threat varies in magnitude from one specific experience to another. The relative magnitude of pain-unpleasantness may then be observed to increase in relationship to the degree of experienced intrusion or threat. The end result of this analysis are quantitative and qualitative expressions of how the experiential factors relate to each other, that is, the generation of functional hypotheses.

An aim of our experiential method is to generate qualitative descriptions of given kinds of experience, descriptions that express phenomena as they reveal themselves to the experiencing person. They are to be agreed upon and well understood by all those capable of having the experiences in question. Each final phenomenological-experiential account of a kind of experience (e.g., pain) is to contain precise explicit statements about what is essential for a kind of experience, omitting particulars. Important differences exist between our method and similar approaches used by others (Van Kaam, 1959). For one, the experiential method requires the investigators themselves rather than other participants to produce the descriptions. Another difference is that our method more exactly specifies the mode of observing and questioning. A third difference is that our method includes a strategy of determining the necessary and sufficient factors for the type of experience in question. Finally, it allows the investigators to discover the functional relationships of common factors of given kinds of experience. Thus, the experiential method can generate both *definitional* and *functional* hypotheses that can be subjected to quantitative methods of testing.

(4) Application of quantitative methods

Both definitional and functional hypotheses can be tested with accepted psychometric methods in conventional psychological experiments. These methods and experiments would be similar in principle to those already used, particularly in psychophysical studies. They would involve controlled observations of ratings of experiential dimensions by participants that are commonly used in experimental psychology (e.g., undergraduate college students). The participants of the experiments would *not* be the investigators and would not have knowledge of the hypotheses of the study. Thus, the last stage of the horizontal experiential paradigm would involve a third-person epistemology (from the investigators' perspective) but one that is complementary to the first-person exploration of stages 1–3 described above. Thus, in the example of experimental heat pain cited above, psychophysical observers would rate not only pain sensation intensity and pain unpleasantness, but also their experienced intrusion and concern for future consequences. They could also rate other experiential factors, such as anxiety and annoyance. Further experiments involve experimental manipulations of specific dimensions of experience to directly test functional hypotheses. What is unique to this horizontal phenomenological approach, in strong contrast with traditional psychological methods, is the conceptual shift in which the independent variable becomes the experiential dimension to be manipulated as opposed to the external conditions used to produce changes in the experiential dimension. A manipulation of a given dimension, such as perceived intrusion or perceived threat, can be achieved by a variety of manipulations, and the consistent functional interaction between the manipulated dimension and the hypothesized

dependent dimension provides a test of the functional relation between the two experiential dimensions.

6. Interfacing subjective experience and neural activity: The *vertical* phase of the experiential approach

Although the results obtained from the studies following the horizontal phase of the experiential paradigm would have intrinsic scientific value of their own, the real significance of these results would emerge when they are integrated with neuroscience. This is the vertical phase where an attempt to correlate the results of the first phase with brain activity is made. There is an important sense in which the horizontal phase is designed with an eye to present the phenomenal structure of specific types of experience and its elements in such a clear and precise way as to make them ready to be "hooked up" to the structural elements of the neural activity underlying/realizing those experiences. In other words, the combination of the horizontal and vertical phases would give us (if anything would) the long sought after mind-brain correlations, and thus prepare the way for explaining mind-brain relationship within a metaphysically monistic framework while preserving the subjectivity of the mental.

To illustrate more vividly the potential of such a two-phase approach, let us reconsider a hypothetical experiment that would be an extension and refinement of the one conducted by Rainville *et al.* (1997) described above. This kind of imaging study could be interfaced with the horizontal experiential paradigm described above to provide a much more elaborate characterization of both subjective experience and patterns of neural activity that co-vary with the different and subtle sub-dimensions of pain unpleasantness. Investigator-participants could identify these sub-dimensions using the first-person experiential approach described above (the horizontal phase). These sub-dimensions might include, for example, factors such as perceived intrusiveness and concern with future harm. Subjects of neural imaging experiments could then rate these sub-dimensions under different experimental conditions designed to generate variation in their magnitudes and/or to selectively modulate their magnitudes, as in the case of Rainville *et al.* (1997). Patterns of cerebral cortical activity that co-vary with different subjective dimensions of pain could then be identified. Each investigator would make two types of observations. The first would be an observation of the different sensory, cognitive, and affective, qualities of pain from his or her embodied perspective. The second would be an observation of the spatio-temporal map of brain activity associated with this subjective experience. Furthermore, it may be possible to nearly simultaneously observe changes in both subjective experience and patterns of brain activity. Once a reliable correspondence is established between a dimension of experience and specific neural activity by using first and third person approaches, one needs to test between-subject variations in this correspondence.

7. Conclusion

The demonstration that similar experiential descriptions between individuals are associated with similar patterns and levels of critical brain processes would support the view that we share qualia. Indeed, under naturalistic assumptions, such results would make a strong — albeit non-demonstrative — case for the claim that there is a looser but perfectly legitimate sense in which qualia are intersubjectively accessible to all those who share, to close enough approximation, the neural hardware (perhaps even including some higher animals).[31]

[31] For intriguing remarks to similar effect, see Feigl (1967), and Nagel (1974).

In practice, of course, we do assume that we share qualia. We assume that our experiences instantiate identical or similar phenomenal qualities, and in this sense and in this sense only, qualia are intersubjectively accessible and thus objective, insofar as we have independent third-person ways of confirming their occurrences in others — which we do. Both the horizontal and vertical phases of the experiential method proceed on these assumptions (as do, as a matter of fact, all the other conventional psychophysical and brain imaging experiments conducted on subjects and their introspective reports). But once the confirming results come in (if they do) we can use a bootstrapping strategy to argue that our initial assumptions were justified. Indeed, this is how most scientific enterprises usually go. You start with certain assumptions, and on the basis of the success of your results, which usually depends on the explanatory power of the model that would confirm the empirical data if it were correct, you then turn back and claim that your assumptions were/are justified.

The kind of questions that are usually asked by philosophers might then be empirically addressed. For example, are there lawlike correlations between the elements of subjective experiences and patterns of brain activity? Philosophers and scientists alike have usually assumed that the answer to this question is affirmative. But of course, if so, it seems an empirical matter to find out by doing science. If the results are as expected or assumed, then this can be taken as giving strong support for the metaphysical supervenience of the mental on the physical — if, as we mentioned before, philosophical sense can be made for the naturalistic claim that subjective conscious experience can be identical to objective brain activity. So far we have tentatively assumed that the naturalistic claim *does* make philosophical sense. However, if it turns out that naturalism about consciousness cannot be sustained philosophically, we would certainly be surprised and quite puzzled for reasons given in the beginning sections of the paper; but very little would be lost in terms of the value of our methodological proposals.[32] For the two-phase experiential paradigm we have proposed can still be carried out on dualistic assumptions. We would then be asking questions not about metaphysical supervenience but only about natural or nomological supervenience where experiential elements are only (inexplicably) correlated with specific types of neural activity — if they are.

There are also questions of more neuroscientific nature. For example, does the encoding of a specific pain quality occur in multiple brain areas simultaneously or in just one place? And if it occurs only in one place, how do other brain areas access that encoded representation in a way that would explain the unified nature of the subjective experience in question (the binding problem)? Presently, these questions would be viewed to be difficult (perhaps, even impossible) to answer by many neuroscientists. Answering these would of course rely on more technologies than just brain imaging techniques. However, increasing improvements both in neuroscience technology and in methods for investigating human experience could lead to the conditions that could initiate a satisfactory inquiry into a *complete* understanding of consciousness — perhaps using pain as a model due to its peculiar status as mentioned in the beginning.

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[32] Even though systematic and pervasive failure of finding out mind-brain correlations could contribute to giving up naturalism, what we have in mind here is rather the failure of philosophical arguments for naturalism.

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