

# What Is Consciousness?

## Review of *The Science of Consciousness* by Max Velmans (ed.)

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Max Velmans is very clear about what a scientific understanding of consciousness must be:

Thus, to understand what consciousness is, we need to understand what causes it, what its function(s) may be, how it relates to nonconscious processing in the brain and so on (p. 3).

After pointing to structural features of this new book (section 1) I try to highlight its contribution to the different questions raised by this quotation (sections 2, 3, 4) and then signal some difficulties I had when reading the book and questions I have after reading it (section 5). In the final section (section 6) I give a snapshot of the book.

## 1. Structural Features

This book is organised into nine chapters in the following order: An introduction to the science of consciousness (Velmans); Perception without awareness of what is perceived, learning without awareness of what is learned (Kihlstrom); On consciousness in relation to memory and learning (Gardiner); Cognitive views of consciousness. What are the facts? How can we explain them? (Baars & McGovern); Neural processes in the production of conscious experience (Libet); Dissociable aspects of conscious experience (Young); Somatic consequences of consciousness (Sheikh, Kunzendorf & Sheikh); The placebo effect (Wall); What and where are conscious experiences? (Velmans).

The chapters consist of original papers, including psychological, neuropsychological and clinical reviews. Although the clarity of the book is worthy of note, the integration of clinical reviews is a further distinctive feature. For example, a major reference book for cognitive psychologists interested in consciousness, *Varieties of Memory and Consciousness* (Roediger & Craik, 1989) integrated cognitive, neurocognitive and developmental reviews; no clinical reviews were included. Does this feature reflect the possible use of new methods or theories concerning consciousness? Although the clinical reviews included provide interesting material by showing mind-body interactions (Sheikh et al., Wall), by highlighting the need for and practical consequences of a better understanding of the consciousness-brain relationship, this integration reflects more a change in the sense of the word 'consciousness' than the possible use of new methods and models.

Indeed, the word 'conscious' can be used to mean different things: intentionality of retrieval, focal-attentive processing, monitoring, self-consciousness, and so on. In this book, the great majority of papers reflect the sense 'awareness' rather than 'intentionality of retrieval' (cf. Roediger & Craik, 1989) .

## **2. What (and Where) Consciousness Is**

In the final chapter (chapter 9), dealing with this very issue, Velmans mentions that classical dualists and reductionists disagree about what consciousness is, but generally agree about where it is (somewhere in the brain), in so far as it can be located at all. The reflexive model is then introduced (Velmans, 1990) in order to suggest that experiences are where we experience them to be, a position which is distinct from both dualism (experiences have no location in space) and reductionism (experiences are in the brain). As Velmans argues (chapter 1 and 9), definitions need not be final for research to begin. It is enough that definitions be sufficiently similar for different investigators to be able to agree that they are investigating the same thing. For Velmans, consciousness means awareness (sometimes phenomenological consciousness). Although most of the chapters seem consistently to be dealing with the same meaning of consciousness (awareness), investigators differ somewhat with respect to what consciousness is.

For some contributors (Velmans, Gardiner, Baars & McGovern, Kihlstrom, Wall), consciousness is the product--or the by-product--of information processing. In this case,

the question of the location of consciousness is not of primary interest. Typically, Baars and McGovern consider, on the basis of the Global Workspace theory (Baars, 1988) that consciousness is a distributed property in the brain.

On the other hand, for those who discuss consciousness as a function of brain activity (Libet, Young) the question arises as to where consciousness is. A comparison of the two chapters by Libet and Young shows that there is no necessary relationship between arguing that consciousness is the product of brain activity and searching for the location of consciousness in the brain, a point too often neglected in my opinion.

Libet discusses the role neural processes have in the production of conscious experience. Again, consciousness is treated as awareness: "only introspective report by the subject can have primary validity as an operational measure of a subjective experience" (p. 47). However, the focus of his review is on the usefulness of PET and MRI technologies for measuring consciousness and in the neural conditions which are adequate to support conscious experience. Positron emission tomography (PET) and magnetic resonance imaging (MRI) allow one to study changes in uptake and turnover of metabolic and pharmacological agents. Libet convincingly argues that these tools can, at best, tell us where in the brain activities have changed. Neither the identification of neuronal activity patterns that may be uniquely involved or the causal relationship between brain activity and conscious experience can be examined with PET or MRI. Electrophysiological techniques are then reviewed. In order to identify specific kinds of neuronal activities that elicit a conscious experience, Libet seems to favour event-related potentials (ERPs) recorded in response to a sensory signal, which "do provide some direct correlates of conscious experience" (p. 102). Why is Libet so interested in ERP techniques? On the basis of his own research, Libet explains that the early components of ERPs represent neural responses that are a direct function of the stimulus parameters. They vary with changes in stimulus intensity, repetition, area, etc. The latter components of ERPs (beginning at 150ms after the signal) vary considerably with cognitive processes (e.g., subjects' attention) and the identification of essential components has not been successful.

Young also considers consciousness to be the product of brain activity. However, it will be seen that he places more emphasis on the indirect nature of this relationship. This review differs from Libet's chapter in two ways at least. First, there are different forms of consciousness: among other distinctions, phenomenal consciousness vs. access consciousness, direct experience vs. reflexive consciousness. Young points to these different forms of consciousness in order to suggest that there are different aspects which will need to be accounted for in different ways. Consciousness is not a unitary phenomenon. Second, and perhaps more important, consciousness cannot be caused by any neuronal activity:

Wakefulness and arousal are influenced by the brain reticular formation, and especially noradrenergic neurons and the locus coeruleus. . . . Such facts make it abundantly clear that consciousness is a product of brain activity. However, we also know that consciousness is not a direct result of any neuronal activity, because there are plenty of things the neurons in

our central nervous systems do of which we are not aware, like adjusting the size of the eye's pupil (p. 119).

Young develops the idea that consciousness is not a direct result of any neuronal activity. Three arguments towards this assertion are given. (1) Even for the cerebral cortex, neuronal activity is not in itself sufficient to produce consciousness. (2) The transition from consciousness is, in neural terms, more than simply a change from neuronal inactivity to neuronal activity. It is as much a change in what the neurons are doing. Here, Young explains that studies of the brain's electrical activity indicate that when we are in deep sleep, cortical neurons still do something, but that 'something' is different from what they do when we are awake. (3) One can find changes that selectively affect different aspects of consciousness. For example, Young refers to severe impairment of access consciousness in amnesiacs whose phenomenal consciousness is less impaired as revealed by indirect tests of memory. Also, impairments of consciousness can be restricted to certain types of content (movement, colour, face recognition, etc.). His review focusses on developing this third argument and describing its implications.

For authors who discuss the idea that consciousness is the product of brain activity, we have just seen that there is no necessity to locate consciousness in the brain. Also we considered the answers they provide to our second question: what causes consciousness? Only the cognitive accounts of consciousness will now be discussed.

### **3. What Causes Consciousness?**

Of primary interest here are the chapters of authors who consider that consciousness is the product of information processing. These chapters indicate to the reader major problems for cognitive psychologists. These problems can sometimes be found in reviews of attention, working memory and automaticity, and are related to the question "what causes consciousness?". For example, Baars and McGovern indicate that recent important cognitive theories simply solve this problem as it has generally been solved for years in the cognitive literature: by appealing to an executive system which processes output from specialized modules, without spelling out in detail the abilities of the executive system or buffer. This type of difficulty is noticed by Baars and McGovern when they examine recent cognitive theories dealing with consciousness.

In order to understand what causes consciousness, one may use the experimental method, for example by contrasting conscious and unconscious processes across numerous experimental domains. The cases of information processing without consciousness which authors have chosen to discuss are often based on the implicit memory and implicit learning literature. Even if this literature does support the suggestion (Velmans, 1991, this book) that consciousness follows information processing rather than entering into it, one may feel that the definition of the mechanism by which information processing produces consciousness has not been sufficiently developed.

Gardiner examines the direction in which research on implicit memory and learning tasks seems to be heading. The chapter gives a clear picture of the interests and limits of two methods that have been proposed in order to deal with subject's state of awareness in putative tests of implicit memory: the retrieval intentionality criterion (Schacter, Bowers & Booker, 1989; see note <1>) and the process dissociation procedure (Jacoby, 1991). These methods, falling into the category of third-person accounts of consciousness, are criticized, and experiential measures of consciousness are proposed in order to supplement third-person accounts.

Kihlstrom's paper provides a contrast with Gardiner's emphasis on experiential criteria. Kihlstrom contends that "...the evidence favouring unconscious procedural learning is not as compelling as evidence that the subjects' performance is mediated by consciously accessible declarative knowledge structures" (p. 38). In implicit learning studies, subjects can perform quite well in several experimental situations in which the complex rules used were unknown or even unpredictable, without being able to communicate verbally the knowledge gained. This result was initially thought to reflect the superiority of an unconscious learning process in comparison to a conscious one when the situation is complex. But this conclusion resulted from a weakness in the first person method used (often a questionnaire). Indeed, subjects were simply asked the wrong questions about their knowledge: if subjects in implicit learning experiments on artificial grammar learning do not have conscious access to the complex finite-state grammar, they do have conscious access to a portion of the knowledge gained, and this partial knowledge is enough to explain their performance (Dienes, Broadbent & Berry, 1991; Dulany, Carlson & Dewey, 1984, 1985; Matthews et al., 1989; Perruchet & Pacteau, 1990, 1991). Consequently, there is no need to infer an 'omniscient' unconscious which is superior to conscious processing when the situation is complex. What appears to be a problem of overconfidence in deciding with experiential criteria that information has been processed unconsciously is then decomposed by Kihlstrom by means of the analysis of Shanks and St. John (1994). They identify two failures of experimenters investigating implicit learning: most demonstrations of implicit learning do not meet the information criterion (they fail to show that the information the experimenter is looking for in the awareness test is indeed the information responsible for performance changes), and they also do not meet the sensitivity criterion (they fail to show that the awareness test is sensitive to all the relevant conscious knowledge). For Kihlstrom, studies in implicit learning have provided an example of a first major problem psychologists have encountered in their dealings with the psychological unconscious: the problem of an omniscient unconscious. Evidence for a second major problem psychologists have encountered in dealing with the unconscious is also discussed: the problem encountered by those who limit the unconscious to the unattended and unprocessed. The same review (Shanks & St. John, 1994) is used by Kihlstrom because it provides evidence for this second problem, which consists in limiting the unconscious to the non-processed, despite the fact that subliminal perception studies and anesthesia studies suggest a processing--probably essentially perceptual processing--of environmental events. The impact of these two major problems is highlighted by results in the fields of implicit learning, anaesthesia and subliminal perception. Kihlstrom offers a third approach and outlines a plausible assumption: unconscious perception--perception without awareness of what is perceived--can occur,

but it is almost certainly limited to what can be accomplished with elementary, automatic processes.

At least from the point of view of a cognitive psychologist, Kihlstrom's review makes a very important point which should be developed in any scientific analysis of consciousness: a scientific approach to consciousness should be firmly grounded in the cognitive literature on automaticity. It is rather clear that 'what causes automaticity' forms at least part of any answer to 'what causes consciousness'.

## **4. What Are the Functions of Consciousness?**

Concerning this question, the book reflects an important debate between some of the contributors in another context several years ago. The epiphenomenalism proposed by Velmans in a target paper (Velmans, 1991) --the claim that consciousness has no functional role--has been critically discussed (see for example the comments by Baars and Block appearing along with the target article), but this epiphenomenalism was restricted to third-person accounts. When replying to Baars and other commentators who considered that he was supporting epiphenomenalism, Velmans (1991) indicated that although there exists substantial evidence in support of epiphenomenalism, this evidence appears from a third- person, external observer perspective. He added that things look different from a first-person perspective, and that this difference is "an apparent paradox any theory of mind must offer to resolve" (p. 713). So the treatment in the book of the question of the function(s) of consciousness is consistent at least with those parts of the book which emphasise first-person accounts of consciousness.

In their chapter, Baars and McGovern compare the ways consciousness is treated within several cognitive models, including Johnson-Laird's Operating System model (Johnson-Laird, 1988), Schacter's Dissociable Conscious Experience model (DICE) (Schacter, 1990), Shallice's Information Processing Model of Consciousness (Shallice, 1988), and Baars' Global Workspace theory (GW) (Baars, 1988). Among the selected models, two (Schacter's model, Shallice's model) are clearly inconsistent with epiphenomenalism, even if epiphenomenalism should be restricted to third-person accounts. In these models, the primary function of consciousness is to mediate voluntary action under the control of an executive. Schacter's model (DICE) gives consciousness an information processing role in integrating the output of specialised modules and transmitting them to an executive system. The picture is similar (although more complex) in Shallice's information processing model of consciousness. Here the output of specialized processors is not only integrated by the supervisory system but is also integrated with control systems other than the supervisory. Moreover, at the end of their chapter, Baars and McGovern outline eight functions of consciousness: definitional and context-setting, adaptation and learning, prioritizing and access control, recruitment and control of mental and physical actions, decision-making and executive, error detection and editing, reflection and self-monitoring, and optimizing the trade-off between organization and flexibility. All of this is surprising given Velmans' views as expressed in 1991: although

the book could have been expected to consider the major idea that consciousness has no causal role in information processing, it turns out that consciousness has a causal role in information processing in the models referred to. Defining the functions of consciousness is not surprising if consciousness has a functional role when viewed from first-person perspectives. It is even consistent with the general emphasis the book seems to place on first-person perspectives. But one may note that the question of the functions of consciousness is here being addressed using cognitive models which are third-person descriptions. As a result, the relevance of the question of the functions of consciousness in this book <2> is not clear for the reader who had been convinced by Velmans' (1991) argument that (all) third-person accounts support epiphenomenalism.

More generally, the emphasis in the book on first-person perspectives can be questioned in a number of ways: the epiphenomenalism consistent with third-person accounts is perhaps not developed enough, the coordination between first- and third-person methods could have been discussed by considering a difference between the two types of methods, and the cognitive models reviewed should sometimes use third- rather than first-person accounts. In addition, third-person accounts have traditionally provided information directly relevant for different subproblems discussed in this book: how capacity limitations may be conceived, to what extent dissociations do or do not indicate the operation of functionally independent systems or processes. Finally, when they suggest which processes mediate conscious experience, third-person accounts also contribute to the answer some authors have provided to the first of the four questions outlined at the beginning of the book and used for structuring this review. I will now discuss these issues, grouping my remarks in five points.

## 5. Some Remarks and Questions

I shall submit remarks and questions related to some difficulties I had as a student of the cognitive approach to consciousness when reading this book. First, two important ideas (Velmans, 1991; this book) exposed in the introduction are not well reflected by the contributions. Second, and related, the critical attitude towards third-person methodologies generally adopted in the book is not entirely convincing because the relative benefits of first-person and third-person methods differ as a function of the type of events (conscious, unconscious events) that studies want to assess. Here I will return to a chapter (Gardiner) which is representative of the sort of critical attitude towards third-person measures we can find in this book: the need to supplement third-person accounts with first-person accounts of consciousness. I have previously indicated that both the interests and limits of third-person methods of consciousness are clearly indicated in this chapter. Consequently, I hope it will be clear that I do not think that this (or any other) chapter denies the value of a third-person approach; what I am discussing is the emphasis the book places on first-person approaches. Third, the presentation of cognitive theories of consciousness (e.g., Baars & McGovern), which reflect a modularity + independence approach to consciousness, raises an important logical problem concerning the status dissociations may have. Fourth, I wonder if the cognitive literature has been sufficiently

covered with respect to the limitations of consciousness, and consequently, fifth, I wonder if a processing explanation of consciousness has been sufficiently developed.

(1) I was much interested in two ideas previously developed by Velmans (1991) and I looked for them in this book, mostly in vain. The first idea is that introspective access, or consciousness of the results of cerebral processing, must not be confused with the operation of that processing. What enters awareness follows the processing to which awareness is related and cannot therefore enter into it. This applies to all information processing stages, whether the information is simple or complex, familiar or novel, whether the processing is data driven, conceptually driven or a combination of the two. As shown by the presentation of the Baars and McGovern article, which strongly militates against epiphenomenalism, perhaps this position is not developed enough in the book. The second important idea is that information processing models view the brain from an external observer's third-person perspective, which cannot encompass the subject's first-person perspective. These two perspectives appear to be complementary and mutually irreducible. This second point is important because it is in tension with the idea of a science of consciousness: science usually redescribes the way the world seems to us from our first-person perspective in the objective terms of a third-person perspective. Again, between chapters 1 and 9, I had some difficulty in finding many arguments which were consistent with this proposition in the different contributions. The chapter by Gardiner is perhaps the only one which provides clear references to such a co-ordination. I will briefly return to an example of co-ordination in the following paragraph.

(2) Now, and this is related, let us re-examine the book's critical attitude toward third-person perspective methodologies. With respect to previous books (e.g. Roediger & Craik, 1989), I feel this book generally argues for supplementing third-person methods with first-person methods. I am not entirely convinced that this attitude is justified, because the relative benefits of first-person and third-person methods differ as a function of the type of events (conscious, unconscious events) that studies want to assess. Two additional observations are also worth making: the two sorts of methods can sometimes be associated; and considering the models discussed in the book, in some cases it might even be more logical to use third-person methods.

Gardiner criticizes two important methods that pertain to third-person perspective methodologies: the retrieval intentionality criterion (Schacter et al., 1989, explained above in the first section), and the process dissociation procedure (Jacoby, 1991), in which cognitive control in retrieval is measured by alternately placing subjects in inclusion and exclusion conditions during a word stem completion task. For some word stems, subjects are instructed to complete the stem with words from the study list (or with any words that come to mind if they cannot). This is the inclusion condition. For other stems, subjects are instructed to not complete the stem with studied words but to complete the stem in order to form a word which has not been studied. This is the exclusion condition. Inclusion and exclusion conditions give two probabilities of completing a word stem with a studied word, and these two probabilities reflect cognitive control in retrieval: if the probability of retrieving a studied word when 'trying to' is the



same as the probability of retrieving a studied word when 'not trying to', then cognitive control is null. The process dissociation procedure is a second example of third-person methods. It is important to note that the use of third-person methods does not contradict the assumption that first-person methodologies are the best indicator of one's awareness. Rather it contradicts the assumption that unconscious events can be adequately assessed with first-person methods. After all, the literature on implicit learning has given us clear examples over the years of the difficulty of identifying "unconscious" states on the basis of experiential measures (see Kihlstrom, chapter two). The essence of my remark is the following: unconscious states are best assessed with third-person methods, as shown by the rationale behind the retrieval intentionality criterion and the process dissociation procedure. In addition, one may note (as does Gardiner) that third- and first-person methods can sometimes be associated. For example, conceptual manipulations at study (e.g., read versus generated words) are known to affect subsequent explicit but not implicit retrieval (a third-person method). But they are also known to affect "remember" but not "know" responses (Gardiner, 1988), a first-person method in which subjects indicate when recognizing a word whether or not they can consciously recollect its prior occurrence in the study list. More generally, it is not clear to what extent the book's emphasis on first-person methods could be fully connected, for the moment, to current cognitive theories dealing with consciousness. For example, rather than dealing with awareness generally, the DICE model Schacter has put forward in recent years deals specifically with intentionality of retrieval and awareness. In other descriptions of the DICE model (Schacter, 1989) it can be seen that the phenomenal awareness of remembering or 'recollective experience' is distinct from the deliberate or intentional initiation of retrieval, and it is the latter activity which is assigned to an executive system distinct from the Conscious Awareness System or CAS (see Schacter, 1989, pp. 373-374), not awareness. In fact, in DICE, intentional initiation of retrieval is handled by the executive system and only those activated representations that gain access to CAS can be used by the executive system and thus influence voluntary activities. Consequently, I wonder why DICE is discussed (Baars & McGovern) in this book which argues against third-person methods: since intentionality of retrieval is crucial in DICE, mediating as it does the relationship between awareness and responses, the use of third-person methods such as the retrieval intentionality criterion would be consistent with the suggestion being made here that first-person and third-person methods each have their place in studying aspects of consciousness.

(3) Do dissociations reflect the operation of functionally independent processes or systems? In order to outline a potential logical difficulty with dissociations, I refer again to the paper by Baars and McGovern, one of the most integrative reviews. The description of Schacter's model (DICE), which assumes the independence of several modules, is followed by two major observations which are intended to support a basic idea of DICE, that the processes that mediate conscious identification and recognition (i.e., phenomenal awareness) should be distinguished from modular systems that operate on perceptual, linguistic, and other kinds of information. First, failures of awareness in neuropsychological cases are often restricted to the domain of impairment. The fact that amnesiac patients do not necessarily have problems reading words, while alexic individuals do not necessarily have memory problems, is the first argument. Second,

Baars and McGovern point out that numerous examples are known of patients with neuropsychological deficits who have implicit knowledge without having deliberate, conscious access to that knowledge. But do these findings "...suggest an architecture in which various sources of knowledge function somewhat separately..." (p. 83)? This idea seems to rely on the logic of functional dissociation. More precisely, the form of functional dissociation used here to argue for independence is a double dissociation: variable A affects task 1 but not task 2 and variable 2 affects task 2 but not task 1. However, a number of papers have shown the weakness of this logic in the area of memory (Dunn & Kirsner, 1988; several papers in Roediger & Craik, 1989; Ostergaard & Jernigan, 1993). Dunn and Kirsner (1988) have made clear the point that dissociation by itself is sufficient neither to exclude the possibility that levels of performance in two conditions depend upon the same resource of information, nor, if it is granted that two processes are operative, to show that each selectively affects performance on only one condition. All that may be concluded with any certainty from measurement of performance on two conditions (tasks, populations) is that they depend either upon the operation of more than one process or upon more than one source of information.

(4) Has consciousness limited capacity? Baars and McGovern point out that many philosophers and psychologists have noted limitations on conscious awareness: in each conscious moment we tend to be conscious of only a single internally consistent thing (object, intention); also, the number of items currently rehearsed in working memory is limited. Here, the cognitive literature could have been considered in more detail. How are the limitations on conscious awareness conceived? This important question is addressed by the GW theory, but the reader cannot easily evaluate why a segregation principle is used in the theory in order to explain what enters awareness. Many theories of conscious limitations have been proposed and they fall into (at least) two categories: segregation models, as in the GW theory, but also processing explanations. Processing explanations have it that the 'capacity limit' varies as people organise incoming information, as automaticity or experience develop. If the 'capacity limit' is known to be a function of the subject's knowledge, it is not clear to what extent a segregation model can explain a (putative) limit on consciousness. Stated more clearly, consciousness may not be limited for cognitive accounts (Hirst, 1996). I have reached a similar conclusion elsewhere (Terrier, 1998) in my efforts to identify a variable that explains (i.e., a variable that could be responsible both for the production and the absence of) several dissociation phenomena. This brings us to the question of which process or processes mediate conscious experience.

(5) Which process or processes mediate conscious experience? Because the objective of the book was (partially) to review cognitive studies, I was interested when reading the book to discover which cognitive variable or variables have structured the investigation of the topics considered usual in the study of consciousness in cognitive psychology: automaticity, implicit learning, and implicit memory. I have searched for this characterization and have been unable to find it. As previously noted, contributors differ in their proposals. For some, consciousness is the product of information processing--but the processing operations are not fully discussed. Even for those who argue that consciousness is the product of brain activity, it appears that consciousness should also be

defined in cognitive terms (see Young, chapter 6). I think that there are arguments for both but that there is a lack of definition of the processing operations that produce consciousness. Because I have recently been working in this area, I suggest the following idea (Terrier, 1998): a common mechanism can be detected which is responsible for what has been called implicit versus explicit learning, implicit versus explicit memory, and automatic versus controlled processing. In each case, consistency of mental operations over time can be shown to be the explanatory factor: this factor is responsible for both the production and the non production of dissociation. Consequently, a simple but substantially empirically motivated suggestion could be elaborated on the basis of cognitive psychology: does consistency of mental operations over time lead to consciousness?

## 6. A Snapshot

To sum up, in this new book, consciousness is (mostly) awareness, and awareness is either a product of brain activity or the result of information processing. For some, awareness is caused by brain activity: special neuronal populations (Libet) or a change in what neurones are doing (Young). For others, consciousness is caused by the integration by an executive system of information processing streams (Baars & McGovern). In this case, the primary function of consciousness is to mediate voluntary action under the control of a unified executive system. However, one can assume that consciousness mediates different cognitive activities without necessarily locating consciousness in a unified executive system (Baars & McGovern illustrate this). The boundary between conscious and unconscious events cannot be easily determined, as shown by the highly specific nature of neuropsychological impairments (Young) and the different methodological problems researchers have faced in contrasting conscious and unconscious events (Kihlstrom). Finally, clinical phenomena which represent other classes of mind-body interactions (Sheikh et al., Wall) should also be considered.

The book is clearly organised for the multidisciplinary audience of students of consciousness. One may feel (as I sometimes do) that empirical arguments are not always illustrated or spelled out enough, because a concise style has been chosen for this book. However, provided the reader has access to the given bibliographical resources, in order to understand the important debates the book reflects (e.g. third- versus first-person methods), there is no doubt that Max Velmans has edited an interesting resource which can be used as a textbook.

## Notes

<1> Ten years ago, considering several difficulties in attempting to evaluate whether or not a subject is 'aware' of a prior episode during performance of an implicit test of

memory, Schacter, Bowers and Booker (1989) argued that it was preferable to distinguish between explicit and implicit memory in terms of intentional vs. unintentional retrieval processes--rather than in terms of the presence or absence of conscious recollective experience--because we can develop rigorous criteria for making the former, but not the latter, distinction. A two component empirical test for making this distinction was put forward: the retrieval intentionality criterion. First, cues provided to subjects during implicit and explicit tests should be the same, and only test instructions should vary. Second, an experimental manipulation should be identified that selectively affects performance on one of these tasks and not the other. Once researchers have identified an experimental paradigm that satisfies both of these conditions, they can begin to use the data generated to make inferences about the nature of implicit versus explicit memory.

<2> I recognize that this observation primarily applies to the chapter under discussion. However, since this chapter is basically the only one which deals with the question of the functions of consciousness, I feel that the observation made about the chapter can be taken as a conclusion for the book without too much distortion. This strategy is the one I have tried to follow in examining to what extent the reader can find the answer(s) in the book to the questions outlined in the introduction.

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## References

Baars, B.J. (1988). *A cognitive theory of consciousness*. New York: Cambridge University Press.

Baars, B.J. (1994). A thoroughly empirical approach to consciousness [80 paragraphs]. *PSYCHE* [on-line journal], 1(6). URL: <http://psyche.cs.monash.edu.au/v1/psyche-1-06-baars.html>

Dienes, Z., Broadbent, D.E., & Berry, D.C. (1991). Implicit and explicit knowledge bases in artificial grammar learning. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 17, 875-887.

Dulany, D.E., Carlson, R.A., & Dewey, G.I. (1984). A case of syntactical learning and judgment: How conscious and how abstract? *Journal of Experimental Psychology: General*, 113, 541-555.

Dulany, D.E., Carlson, R.A., & Dewey, G.I. (1985). On consciousness in syntactic learning and judgment: A reply to Reber, Allen, and Regan. *Journal of Experimental Psychology: General*, *114*, 25-32.

Dunn, J.C., & Kirsner, K. (1988). Discovering functionally independent processes: The principle of reversed association. *Psychological Review*, *95*, 91-101.

Gardiner, J.M. (1988). Functional aspects of recollective experience. *Memory and Cognition*, *16*, 309-313.

Hirst, W. (1996). Cognitive aspects of consciousness. In M.S. Gazzaniga (Ed.), *The cognitive neurosciences* (pp. 1307-1319). London: MIT Press.

Jacoby, L.L. (1991). A process dissociation framework: Separating automatic and intentional uses of memory. *Journal of Memory and Language*, *30*, 513-541.

Johnson-Laird, P.N. (1988). A computational analysis of consciousness. In A. Marcel and E. Bisiach (Eds.), *Consciousness in contemporary science*. Oxford: Clarendon.

Matthews, R.C., Buss, R.R., Stanley, W.B., Blanchards-Fields, F., Cho, J.R., & Druhan, B. (1989). Role of implicit and explicit processes in learning from examples: A synergistic effect. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *15*, 1083-1100.

Ostergaard, A.L., & Jernigan, T.L. (1993). Are word priming and explicit memory mediated by different brain structures? In P. Graf & M.E.J. Masson, (Eds.), *Implicit memory: New directions in cognition, development, and neuropsychology* (pp. 327-349). Hillsdale, N.J: Erlbaum.

Perruchet, P., & Pacteau, C. (1990). Synthetic grammar learning: Implicit rule abstraction or explicit fragmentary knowledge? *Journal of Experimental Psychology: General*, *119*, 264-275.

Perruchet, P., & Pacteau, C. (1991). The implicit acquisition of abstract knowledge about artificial grammar: Some methodological and conceptual issues. *Journal of Experimental Psychology: General*, *120*, 112-116.

Roediger, H.L. III, & Craik, F.I.M. (1989). *Varieties of memory and consciousness: Essays in honour of Endel Tulving*. Hillsdale, NJ: Erlbaum.

Schacter, D.L. (1989). On the relation between memory and consciousness: dissociable interactions and conscious experience. In H.L. Roediger III & F.I.M. Craik (Eds.), *Varieties of memory and consciousness: Essays in honour of Endel Tulving* (pp. 355-389). Hillsdale, NJ: Erlbaum.

Schacter, D.L. (1990). Toward a cognitive neuropsychology of awareness: implicit knowledge and agnosia. *Journal of Clinical and Experimental Neuropsychology*, *12*, 155-178.

Schacter, D.L., Bowers, J., & Booker, J. (1989). Intention, awareness, and implicit memory: The retrieval intentionality criterion. In S. Lewandowsky, J.C., Dunn & K. Kirsner (Eds.), *Implicit memory: Theoretical issues*, pp. 47-65. Hillsdale, N.J: Erlbaum.

Shallice, T.R. (1988). Information-processing models of consciousness: possibilities and problems. In A.J. Marcel and E. Bisiach (Eds.), *Consciousness in contemporary science*. Oxford: Clarendon.

Shanks, D.R., & St. John, M.F. (1994). Characteristics of dissociable human learning systems. *Behavioral and Brain Sciences*, *17*, 367-447.

Terrier, P. (1998). Re-examining the role of consistency: The cornerstone, not simply an important factor. *PSYCHE* [online journal], *4*(5). URL: <http://psyche.cs.monash.edu.au/v4/psyche-4-05-terrier.html>

Velmans, M. (1990). Consciousness, brain, and the physical world. *Philosophical Psychology*, *3*, 77-99.

Velmans, M. (1991). Is human information processing conscious? Commentaries and author's response. *Behavioral and Brain Science*, *14*, 651-726.